NATIONAL CONSERVATION LANDS

Grand Staircase-Escalante National Monument

ANALYSIS OF THE MANAGEMENT SITUATION

August 2022



U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

Our Mission

The Bureau of Land Management's mission is to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations.

NATIONAL CONSERVATION LANDS

Mission

Conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations.

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2015 and 2016 GSENM Artists in Residence,
Grand Staircase-Escalante National Monument

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

	Full Phrase
ACEC	area of critical environmental concern
AIM	Assessment, Inventory, and Monitoring
AMS	analysis of the management situation
ATV	all-terrain vehicle
AUM	animal unit month
BLM	Bureau of Land Management
BMP	best management practice
BP	before present
°C	degrees Celsius
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
"the church"	the Church of Jesus Christ of Latter-day Saints
CO_2e	carbon dioxide equivalent
DOI	Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
EPA	US Environmental Protection Agency
ERMA	extensive recreation management area
ESA	Endangered Species Act of 1973
°F	degrees Fahrenheit
FAR	functioning at-risk
FLPMA	Federal Land Policy and Management Act of 1976
GHG	greenhouse gas
GIS	Geographic Information System
Glen Canyon	Glen Canyon National Recreation Area
GSENM	Grand Staircase-Escalante National Monument
HUC	hydrologic unit code
IM	instruction memorandum
IPCC	Intergovernmental Panel on Climate Change
ISA	instant study area
KEPA	Kanab-Escalante Planning Area
LUA	land use authorization
MMP	monument management plan
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NLCS	National Landscape Conservation System
NOI	notice of intent

NPS	National Park Service
NRCS	Natural Resources Conservation Service
NSHT	National Scenic Historic Trail
OHV	off-highway vehicle
ONA	outstanding natural area
OSNHT	Old Spanish National Historic Trail
PAC	protected activity center
PFC	proper functioning condition
PFYC	potential fossil yield classification
PILT	payment in lieu of taxes
PL	public law
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PSD	prevention of significant deterioration
RMA	recreation management area
RMP	resource management plan
RMIS	recreation management information system
RMZ	recreation management zone
RNA	research natural area
ROD	record of decision
ROW	right-of-way
SGMA	sage-grouse management area
SITLA	School and Institutional Trust Lands Administration
SQRU	scenic quality rating unit
SRMA	special recreation management area
SRP	special recreation permit
TDS	total dissolved solids
TMDL	total maximum daily load
UDAQ	Utah Division of Air Quality
UDWR	Utah Division of Wildlife Resources
US	United States
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTV	utility-task vehicle
VOC	volatile organic compound
VRI	visual resources inventory
VRM	visual resource management
WPA	Works Progress Administration
WSA	wilderness study area
WSR	wild and scenic river

Chapter 1. Introduction

On October 8, 2021, Presidential Proclamation 10286 restored the boundaries and conditions of the Grand Staircase-Escalante National Monument (GSENM) that were in place prior to December 4, 2017, when Presidential Proclamation 9682 divided GSENM into multiple units. The goal of Proclamation 10286 is to ensure that the exceptional and inimitable landscape of GSENM, filled with an unparalleled diversity of resources, will be properly protected and will continue to provide the living laboratory that has produced so many dramatic discoveries in the first quarter century of its existence (**Appendix A**).

Proclamation 10286 also mandates that the Bureau of Land Management (BLM) create a new management plan for the entirety of GSENM. The BLM Paria River District Office is now preparing this analysis of the management situation (AMS) in response to updates to GSENM's the planning area boundary and in preparation for developing the new management plan for GSENM.

1.1 What is an Analysis of the Management Situation?

Prior to preparing a resource management plan (RMP), the BLM must analyze the available inventory data and other information to characterize the resource area profile, portray the existing management situation, and identify management opportunities to respond to identified issues. In preparing this AMS, the BLM can analyze available data and information to determine the degree to which an area can respond to the RMP's identified purpose and need relevant to the issues identified in the planning criteria. The AMS also provides the basis for formulating reasonable alternatives.

This AMS provides a brief description of the resource conditions within the planning area and how these resources are currently being managed. It will serve as a baseline for the development of the alternatives in the environmental impact statement (EIS) associated with the RMP. This document represents an early component of the planning process and is not a comprehensive, detail-oriented document for various resources. It is intended to provide a summary of existing management practices, including direction from existing plans and agency policy, local resources, and social and economic conditions.

1.2 Development of Planning Criteria

Planning criteria consist of management concerns and the associated issues that provide the groundwork for the effects analysis associated with the planning process. The preliminary management concerns and analytical frameworks for addressing preliminary issues is presented in Chapter 6. The BLM land use planning regulations state that the "estimation of effects shall be guided by the planning criteria and procedures implementing the National Environmental Policy Act" (NEPA) (43 Code of Federal Regulations [CFR] 1610.4-6). As such, the planning criteria presented in the AMS establish an early framework the BLM will use to analyze issues in the NEPA document.

1.3 Planning Process and Schedule

The BLM planning process, explained in 43 CFR 1600, BLM Manual 1601, and BLM Land Use Planning Handbook (H-1601-1), falls within the framework of the NEPA environmental analysis and decision-making process described in the Council on Environmental Quality (CEQ) regulations of 40 CFR 1500–1508, the Department of the Interior (DOI) NEPA Manual (516 DM 1-7), and the BLM NEPA Handbook H1790-1. **Table 1-1** shows an initial schedule of milestones, a part of the BLM's NEPA planning process, starting with the publication of the notice of intent (NOI).

Table 1-1
Milestone Schedule

Milestone	Tentative Date
Publication of the NOI	July 29, 2022
Publication of the AMS	Summer 2022
Public scoping and alternatives development	Summer/Fall 2022
Development of draft RMP/EIS	Fall/Winter 2022–Early 2023
Publication of draft RMP/EIS and public comment period	Spring 2023
Proposed RMP/Final EIS	Spring 2023–Late 2023
Protest resolution period	Late 2023
Approved RMP and record of decision (ROD)	Spring 2024

Chapter 2. Planning Area and Existing Management

2.1 History of GSENM

GSENM was established to protect one of the last large-scale, unspoiled natural landscapes in the lower 48 states, for the purposes of scientific investigations. Utah has long contained extensive roadless and previously unmapped areas, and GSENM is no exception. However, the roadlessness and lack of mapping in GSENM are changing due to increases in visitation and use.

On September 18, 1996, President Clinton signed Proclamation 6920, which established GSENM and emphasized the diverse and intact physical, biological, and historical resources that provide for a science-focused national monument. This was the first time a national monument was established under the purview of the BLM. Additionally, establishing such a BLM unit for scientific purposes was—and is—unique. A monument management plan (MMP) for GSENM was completed in 2000. During the initial years after the proclamation, GSENM had a large annual budget to support coordination of a science program that worked with other entities such as universities. Over the years, this support and staffing levels were reduced.

On December 4, 2017, President Trump issued Proclamation 9682, which reduced the GSENM's boundaries by approximately 50 percent. It also opened the lands excluded from GSENM, identified as the Kanab-Escalante Planning Area (KEPA), to entry, location, selection, sale or other disposition under the public land laws; disposition under all laws relating to mineral and geothermal leasing; and location, entry, and patent under the mining laws. New RMPs were completed in 2020 for both retained and newly excluded GSENM lands (see **Figure 2-1**).

On October 8, 2021, President Biden signed Proclamation 10286, which restored the GSENM boundaries and conditions that were in place prior to December 4, 2017. Proclamation 10286 declares that the entire landscape reserved by the proclamation is "an object of historic and scientific interest in need of protection." Proclamation 10286 also states that, if without specific protections afforded under the Antiquities Act, the objects identified in Proclamations 10286 and 6920 are not adequately protected by the boundaries established in Proclamation 9682.

Presidential Proclamation 10286 directs that GSENM be restored "to its size and boundaries as they existed prior to December 4, 2017" to ensure "that this exceptional inimitable landscape filled with an unparalleled diversity of resources will be properly protected and will continue to provide the living laboratory that has produced so many dramatic discoveries…." Furthermore, such protection will preserve GSENM's "cultural, prehistoric, and historic legacy and maintain its diverse array of natural and scientific resources, ensuring that these values remain for the benefits of all Americans. Reservation of these lands will preserve the living laboratory within the monument boundaries that will facilitate significant scientific discoveries for years to come" (**Appendix A**).

Figure 2-1 National Monument Boundary Changes

National Monument boundary

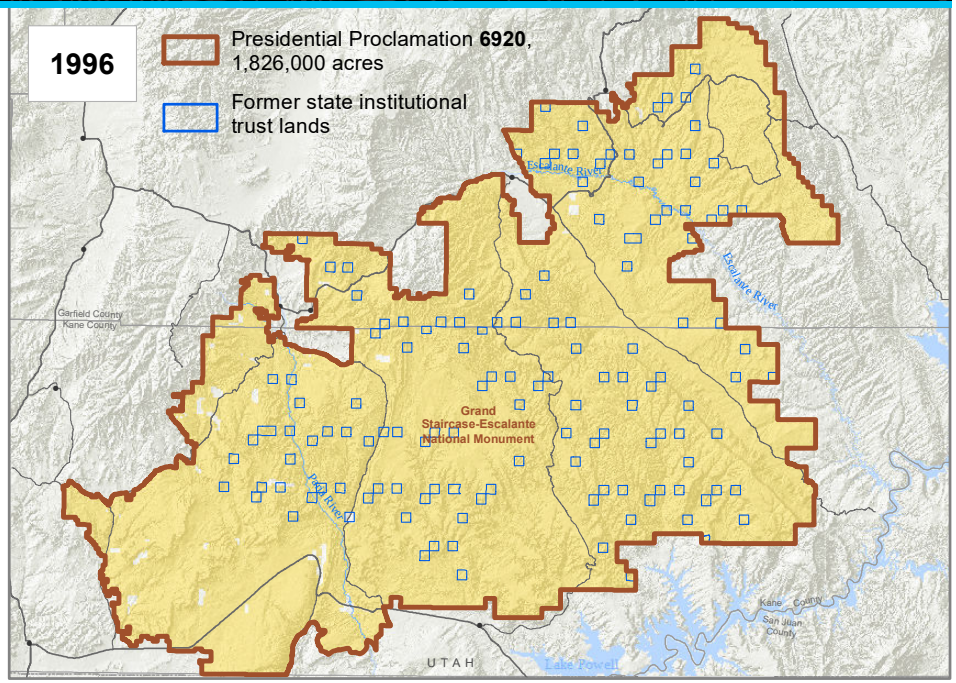
Bureau of Land Management surface administration

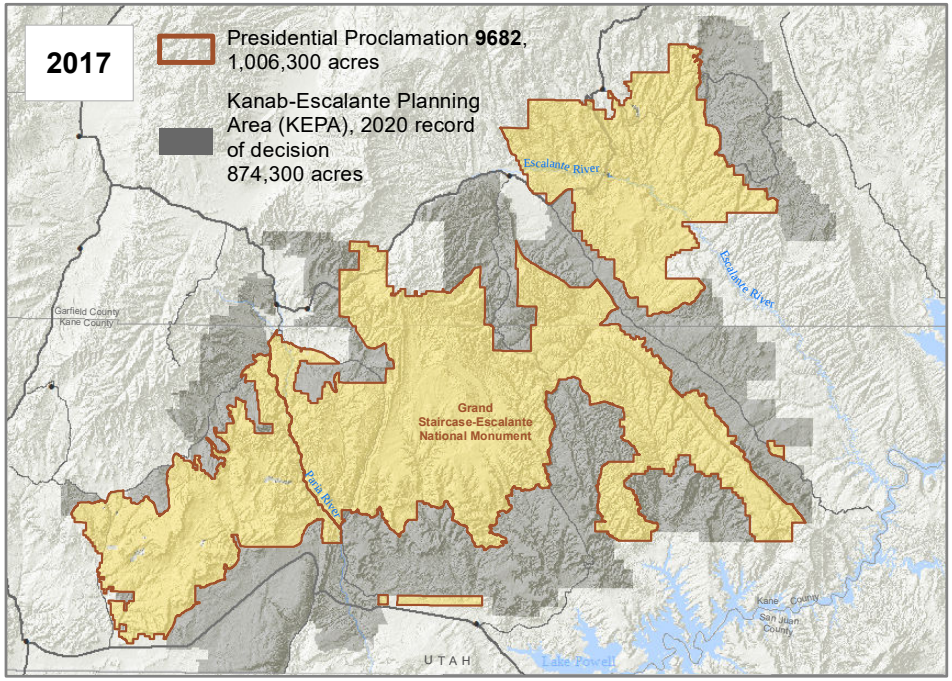
0 10
Miles

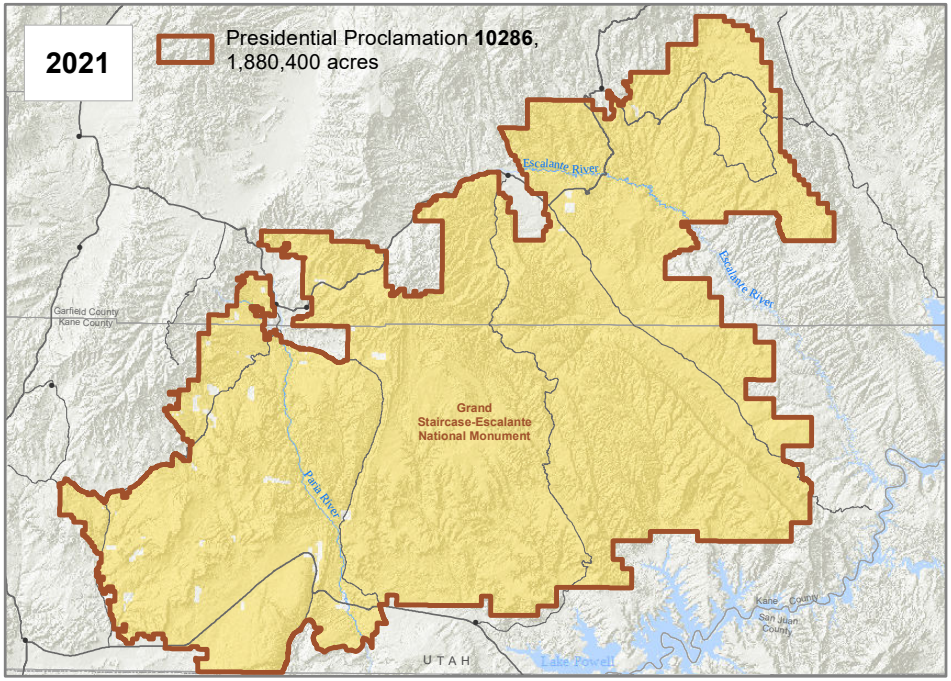
The 1996 monument boundary reflects the boundary that existed prior to December 4, 2017. The 1996 boundary underwent modifications after the initial Proclamation 6920 and now exists because of Proclamation 10286.



August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_1intro_Change
NAD 1983 UTM 12
US Department of the Interior Bureau of Land Management
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.







2.2 PLANNING AREA AND DECISION AREA

The planning area is the region within which the BLM will make decisions during a planning effort. A planning area boundary includes all lands regardless of jurisdiction; however, the BLM will only make decisions for the decision area, which is limited to lands managed by the BLM. For the purposes of this document, the planning area refers to the entire area outlined in **Figure 2-2**. Surface ownership within the planning area is detailed in **Table 2-1**.

Table 2-1
Surface Ownership in the Planning Area

Surface Ownership	Acres
BLM (surface decision area)	1,865,600
Private	14,800
Planning area total	1,880,400

Source: BLM Geographic Information System (GIS) 2022

Of the approximately 1,880,400 acres of land within the planning area, the RMP will make decisions for approximately 1.87 million acres of public land administered by the BLM. This is known as the decision area (**Figure 2-2**). The decision area does not include state, municipal, or private lands. With respect to livestock grazing, certain allotments administered by GSENM cross over into the BLM Kanab and Arizona Strip Field Offices, as well as Glen Canyon National Recreation Area (Glen Canyon).

GSENM is near or adjacent to areas of national and international significance, including Bryce Canyon National Park, Zion National Park, the North Rim of the Grand Canyon, Glen Canyon, Pipe Spring National Monument, Cedar Breaks National Monument, Grand Canyon-Parashant and Vermilion Cliffs National Monuments, Kodachrome Basin State Park, Escalante Petrified Forest State Park, and Coral Pink Sand Dunes State Park. Small communities are located on the perimeter of GSENM and their economies are intertwined with livestock grazing and the recreational opportunities that exist both at GSENM and the surrounding attractions that draw local, national, and international visitors.

2.3 EXISTING MANAGEMENT

Management of GSENM must be consistent with Proclamation 10286 and is currently guided by the following existing BLM land use plans:

- GSENM Management Plan ROD (BLM 2020a)
- KEPA Management Plan ROD (BLM 2020b)

However, as articulated in a memorandum outlining interim management direction for the restored GSENM (USDOI 2021), all uses and activities authorized in GSENM must be consistent with Proclamation 10286. As such, prior to adopting a new RMP for GSENM, the BLM may allow discretionary activities only if it determines that: (1) the decision conforms to the applicable 2020 resource management plan, and (2) the decision is consistent with the protection of GSENM objects and values. In making the latter determination, the BLM should consider whether the activity would have been permitted under the 2000 MMP.

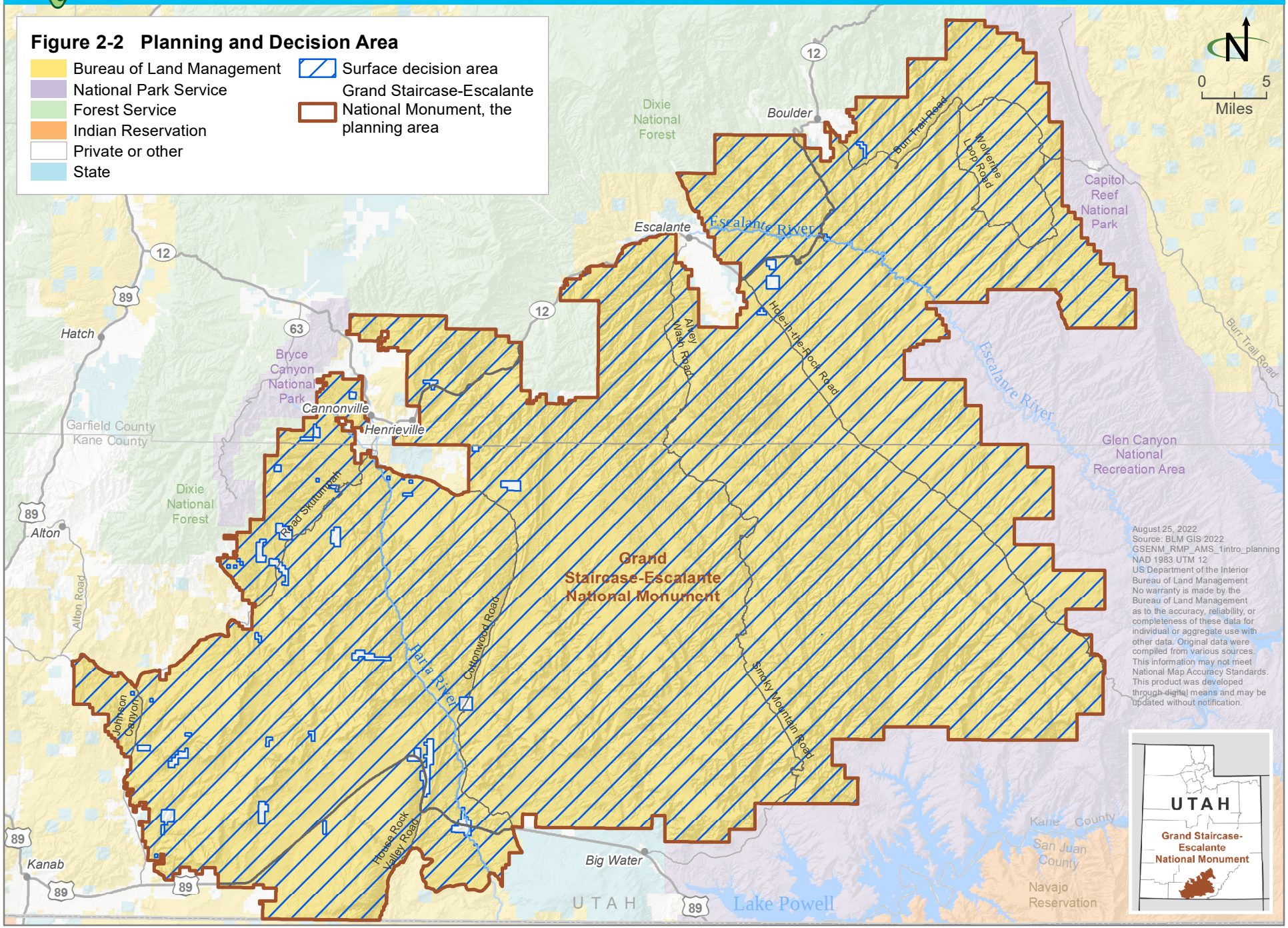


Figure 2-2 Planning and Decision Area
Bureau of Land Management
National Park Service
Forest Service
Indian Reservation
Private or other
State
Surface decision area
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Escalante
Escalante River
Hatch
Bryce Canyon National Park
Cannonville
Henrieville
Garfield County
Kane County
Dixie National Forest
Alton
Kanab
Big Water
Capitol Reef National Park
Glen Canyon National Recreation Area
Lake Powell
Navajo Reservation
San Juan County
Kane County
Burr Trail Road
Wolverine Loop Road
Hole-in-the-Rock Road
Alvey Wash Road
Smoky Mountain Road
Cottonwood Road
Johnson Canyon
Alton Road
Paria River
House Rock Valley Road
Grand Staircase-Escalante National Monument
August 25, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_1intro_planning
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.
UTAH
Grand Staircase-Escalante National Monument

Chapter 3. Regulatory Framework

The foundations of public land management are in the mandates and authorities provided in laws and regulations. Executive orders, instruction memoranda (IM), information bulletins, manuals, handbooks, and other policy and guiding direction implement and interpret the authorities provided under those laws and regulations. These sources of federal policy direct the BLM concerning management of public lands and resources. The BLM's planning process, as described in 43 CFR 1600, is authorized and mandated through two important laws, the Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701 *et* seq.) and NEPA.

FLPMA declares the policy of the United States concerning the management of federally owned land administered by the BLM. FLPMA provides that the BLM "shall manage the public lands under principles of multiple use and sustained yield … except that where a tract of such public land has been dedicated to specific uses according to any other provisions of law it shall be managed in accordance with such law" (43 USC 1732(a)). Proclamation 10286—in accordance with the Antiquities Act of 1906—dedicated the lands in GSENM to specific uses by designating the national monument and reserving the entirety of the lands in the restored boundary of GSENM as the smallest area compatible with the protection of its objects and values. Further, GSENM is a component of the National Landscape Conservation System (NLCS), which was established "to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations" and therefore the BLM is required to manage GSENM "in a manner that protects the values for which the components of the system were designated" (16 USC 7202). Therefore, any discretionary uses in GSENM that are not consistent with the protection of its objects and values cannot be permitted. Additionally, any BLM decisions regarding discretionary uses in GSENM must conform to the BLM's approved land use plan.

The BLM develops and updates its land use plans through a planning and NEPA process that includes public involvement. (43 USC 1712(a)) FLPMA also directs the BLM, when completing a planning process, to coordinate with other federal departments and agencies, state and local governments, and Tribal Nations, to seek to promote consistency among land use plans across jurisdictions.

In NEPA, Congress directs "all agencies of the Federal Government…[to]…utilize a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment" (42 USC 4332(A)). The BLM is preparing an EIS concurrent with the RMP to examine a range of alternatives, including a no-action alternative, to resolve the issues in question. Alternatives should represent complete but different means of satisfying the identified purpose and need of the EIS and of resolving the issues. The RMP/EIS is being prepared using the best available information. Other federal laws, regulations, and policies, as well as applicable state, local, and other applicable regulatory frameworks, are identified below.

Further, the BLM plans to collaborate with other federal, state, and local agencies, and governmental entities throughout the RMP process. Opportunities for coordination with other agencies will be sought throughout the RMP and EIS development process. Project phases where state and local governments,

other federal agencies, and Native American tribal government involvement could prove most helpful include scoping, alternatives development, impacts analysis, and public and agency comment periods.

3.1 FEDERAL LAWS

In addition to the planning-specific federal laws listed above, the BLM planning decisions must comply with other federal laws:

- Clean Air Act, as amended (42 USC 7418, *et seq.*)—Authorizes regulations to limit emissions from both stationary (industrial) sources and mobile sources.
- Clean Water Act, as amended (33 USC 23, *et seq.*)—Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
- Endangered Species Act of 1973, as amended (ESA) (16 USC 1531-1544)—Designed to protect critically imperiled species from extinction as a "consequence of economic growth and development untempered by adequate concern and conservation."
- Omnibus Public Land Management Act of 2009 (16 USC 7201, *et seq.*) – Established the NLCS "to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations," (16 USC 7202(a)) including national monuments like GSENM and requires that the lands within NLCS units shall be managed "in a manner that protects the values for which the components of the system were designated." (16 USC 7202(c)(2))
- American Indian Religious Freedom Act of 1978 (42 USC 1996, *et seq.*)— Protects the rights of Native Americans to exercise their traditional religions by ensuring access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.
- National Trails System Act of 1968 (Public Law [PL] No. 90-543), as amended—Calls for establishing trails in both urban and rural settings for people of all ages, interests, skills, and physical abilities. Promotes the enjoyment and appreciation of trails while encouraging greater public access. It also establishes four classes of trails: national scenic trails, national historic trails, national recreation trails, and side and connecting trails.
- Farm Bill of 2018 (PL No. 115-334)—Governs an array of agricultural and food programs, providing an opportunity for policymakers to comprehensively and periodically address agricultural and food issues; this bill typically is renewed about every 5 years.
- Archaeological Resources Protection Act of 1979, as amended (16 USC 470, *et seq.*)—Governs the excavation of archeological sites on federal and Native American lands in the United States, and the removal and disposition of archeological collections from those sites.
- Healthy Forests Restoration Act of 2003 (PL No. 108-148)—Empowers the Secretaries of Agriculture and the Interior to expedite projects designed to reduce hazardous fuels buildups and to restore healthy forest conditions on federal forest lands.
- International Migratory Bird Treaty Act of 1918 (16 USC 703–711)—Implements four international conservation treaties that the US entered into with Canada in 1916, Mexico in 1936, Japan in 1972, and Russia in 1976 to ensure the sustainability of populations of all protected migratory bird species.

- John D. Dingell, Jr., Conservation, Management, and Recreation Act (PL No. 116-9)—Addresses land conveyances, exchanges, acquisitions, withdrawals, and transfers; national parks, monuments, memorials, wilderness areas, wild and scenic rivers, historic and heritage sites, and other conservation and recreation areas; wildlife conservation; the release of certain federal reversionary land interests; boundary adjustments; the Denali National Park and Preserve natural gas pipeline; fees for medical services in National Park System units; funding for the Land and Water Conservation Fund; recreational activities on federal or nonfederal lands; and federal reclamation projects.
- National Historic Preservation Act (NHPA), as amended (16 USC 470, *et seq.*)—Intends to preserve US historic and archeological sites; it creates the National Register of Historic Places, the list of National Historic Landmarks, and the State Historic Preservation Offices.
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001, *et seq.*)—Enacted to outline a requirement and process for museums and federal agencies to return certain Native American cultural items (including human remains) to lineal descendants, culturally affiliated Tribal Nations, or Native Hawaiian organizations.
- Paleontological Resources Preservation Act: Title VI, subtitle D of the 2009 Omnibus Public Land Management Act (16 USC 7202, *et seq.*)—Important for fossil resource management as a stand-alone subtitle from the overall Omnibus Public Land Management Act.
- Taylor Grazing Act of 1934 (43 USC 315, *et seq.*)—Provides for the regulation of grazing on public lands (excluding Alaska) to improve rangeland conditions and to regulate their use.
- Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq.)—Enacted to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations.

3.2 RELEVANT RESOURCE PLANS, POLICIES, AND PROGRAMS

The direction provided by the various laws, regulations, policies, and documents listed below is applied to specific resources and areas by developing RMPs. These plans apply federal law, regulation, and policy at a landscape level by identifying desired outcomes, allowable uses and management actions anticipated to achieve desired outcomes.

Upon approval of the RMP, subsequent implementation decisions are put into effect by developing implementation (activity-level or project-specific) plans. An activity-level plan typically describes multiple projects in detail that will lead to on-the-ground action. Implementation decisions generally constitute the BLM's final approval, allowing on-the-ground actions to proceed. These types of decisions require appropriate site-specific planning and NEPA analysis.

Other state and federal agencies are responsible for managing or providing support for resource management within the decision area. Plans related to management of these resources are usually site-specific or resource specific in nature. The following lists identify some of the RMPs, implementation plans, and other planning or policy documents (i.e., DOI manuals and BLM manuals and handbooks) that may pertain to the decision area and the planning process. These are not meant to be exhaustive lists.

3.2.1 Activity Plans

- Programmatic Noxious Weed and Invasive Plant Management Environmental Assessment (EA), 2015

- Paria Canyon-Vermilion Cliffs Wilderness, Wilderness Management Plan, 1986 (revised 2021)
- Scenic Byway 12 Corridor Management Plan, 2001
- Fire Management Plan, 2005
- Communication Site Plan: TV Hill, 2002
- Kanab/Escalante Rangeland Program Summary, 1981
- Kanab/Escalante Rangeland Program Summary Update, 1984
- Kanab/Escalante Rangeland Program Summary Update, 1987

3.2.2 Wildlife/Habitat Plans

- Paria Habitat Area Habitat Management Plan, year unknown
- East Zion Habitat Management Plan, 1982
- Marysvale-Circleville Habitat Area Habitat Management Plan, 1978
- Garfield Habitat Management Plan, 1985
- Paunsaugunt Habitat Management Plan, 1982

3.2.3 Species Recovery Plans and Conservation Agreements

- Mexican Spotted Owl Recovery Plan, 1995 (revised 2012)
- Northern States Bald Eagle Recovery Plan, 1983
- American Peregrine Falcon Recovery Plan, 1984
- Utah Prairie Dog (*Cynomys parvidens*) Final Revised Recovery Plan, 2012
- Recovery Plan Amendments for 20 Southwest Species, 2019
- Welsh's Milkweed Recovery Plan, 1992
- Silver Pincushion Cactus Recovery Plan, 1986
- Autumn Buttercup Recovery Plan, 1991
- Amendment to the 2009 Conservation Agreement and Strategy for the Coral Pink Sand Dunes Tiger Beetle (*Cicindela albissima*), 2013
- Range-Wide Conservation Agreement for Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker, 2004
- Utah Conservation and Management Plan for Three Fish Species in Utah Addressing needs for Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*), 2006
- Conservation Agreement for Colorado River Cutthroat Trout (*Oncorhynchus pleuriticus*) in the States of Colorado, Utah, and Wyoming, 2006
- Recovery Plan for the California Condor, 1996
- Final Recovery Plan for Southwestern Willow Flycatcher, 2002
- Recovery Plan for the Jones Cycladenia, 2021
- Navajo Sedge *(Carex specuicola)* Recovery Plan, 1987

- BLM Utah Greater Sage-Grouse Approved Resource Management Plan, 2019[1]

3.2.4 Other Federal Plans and Policies

- Zion National Park General Management Plan, 2001
- Bryce Canyon National Park Fire Management Plan, 2004
- Glen Canyon General Management Plan, 1979
- Old Spanish National Historic Trail Comprehensive Administrative Strategy 2017

3.2.5 Selected DOI and BLM Policies

- DOI Departmental Manual Part 516, Chapter 11, contains NEPA guidance for the BLM
- BLM Manual 6100—National Landscape Conservation System Management Manual
- BLM Manual 6220—National Monuments, National Conservation Areas, and Similar Designations
- BLM Manual 6320—Considering Lands with Wilderness Characteristics in the BLM Land Use Planning Process
- BLM Manual 6330—Management of Wilderness Study Areas
- BLM Manual 6400—Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning, and Management
- BLM Manual 1780—Tribal Relations
- BLM Manual 8100—Foundations for Managing Cultural Resources
- BLM Supplement H-8110 – Utah, Cultural Resource Fieldwork Guidelines and Standards
- BLM Handbook H-1790-1 provides NEPA guidance
- BLM Handbook H-1601-1 contains land use planning guidance

3.2.6 Watershed Plans

- Upper Sevier Watershed Management Plan, 2004

3.3 Relevant State and Local Plans, Policies, and Programs

3.3.1 State Plans

State of Utah regulations that may be germane to the planning process include:

- Utah Code, Title 63: Chapter 4, Part 4, Planning—Describes the duties of the planning coordinator and office.
- Utah Code, Title 63: Chapter 8, State of Utah RMP for Federal Lands—Establishes the Utah Grazing Agricultural Commodity Zones, including the Escalante Region Grazing Zone, to preserve and protect the agricultural livestock industry and its history, culture, customs, and economic value from ongoing threats; it maximizes efficient and responsible restoration,

[1] The BLM amended or revised land use plans in 2014 and 2015 in the California, Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, and Wyoming (2015 Sage-Grouse Plan Amendments) to provide for greater sage-grouse conservation on public lands. Subsequently, the BLM amended several of those plans in 2019 in California, Colorado, Idaho, Nevada, Oregon, Utah, and Wyoming (2019 Sage-Grouse Plan Amendments). On October 16, 2019, the United States District Court for the District of Idaho preliminarily enjoined the BLM from implementing the 2019 Sage-Grouse Plan Amendments (Case No. 1:16-CV- 83-BLW).

reclamation, preservation, enhancement, and development of forage and watering resources for grazing and wildlife practices and affected natural, historical, and cultural activities.

- Utah Code, Title 79: Chapter 3, Natural Resources Utah Geological Survey, Part 5 Paleontology—Contains a provision for the state database that the BLM supports and uses for management of GSENM fossils.
- The State of Utah Natural Resources Division and Division of Parks and Recreation Outdoor Recreation Plan, 2019—Provides an overview of statewide recreation supply and needs based on a survey of recreational professionals throughout Utah and a statewide residents' survey; information and guidance provided by the plan should help entities make more informed decisions regarding expenditures of scarce outdoor recreation acquisition and development dollars in Utah.
- Utah's Water Resources: Planning for the Future, 2004—Emphasizes the importance of careful planning and wise management in meeting future water needs. It estimates Utah's available water supply, makes projections of water needs, explores how these needs will most efficiently be met, and discusses other important values, including water quality and the environment. It also guides water planners and managers to meet the many water challenges facing Utah.
- State watershed, wildlife, and wildfire plans:
  - Paria River Watershed Water Quality Plan, 2005
  - Escalante River Watershed Water Quality Plan, 2005
  - Southwest Utah Regional Wildfire Protection Plan, 2007
  - Utah Division of Wildlife Resources (UDWR) Statewide Management Plan for Mule Deer, 2014
  - UDWR Statewide Bighorn Management Plan, 2018
  - UDWR Migration Action Plan, 2018
  - Deer Unit Management Plan, 2010
  - Deer Herd Unit #24 (Mount Dutton) Management Plan, 2020
  - Deer Herd Unit #27 (Paunsaugunt) Management Plan, 2020
  - Deer Herd Unit #28 (Panguitch Lake) Management Plan, 2020
  - Deer Herd Unit #29 (Zion) Management Plan, 2020
  - Elk Herd Unit #24 (Mount Dutton) Management Plan, 2016
  - Elk Herd Unit #27 (Paunsaugunt) Management Plan, 2016
  - Elk Herd Unit #28 (Panguitch Lake) Management Plan, 2016
  - Elk Herd Unit #29 (Zion) Management Plan, 2016
  - Pronghorn Herd Unit #24/27 (Mount Dutton/Paunsaugunt) Management Plan, year unknown
  - Utah Cougar Management Plan V.3, 2015
  - Utah Black Bear Management Plan, 2000
  - Strategic Management Plan for Chukar Partridge, 2003
  - Conservation Plan for Greater Sage-Grouse in Utah, 2019
  - Utah Wildlife Action Plan, 2015

  - Elk Unit Management Plan, undated
  - Pronghorn Management Plan, 2009
- Coral Pink Sand Dunes State Park General Management Plan, 2005

3.3.2 County Plans

The planning area encompasses approximately 1,880,400 acres in portions of Kane and Garfield Counties. County plans, policies, and programs that may be germane to the planning effort are:

- Garfield County General Management Plan (adopted November 8, 2007, revised in 2018)—Designed to guide the county in developing enforceable and effective plans for physical development of the county; provides a general philosophy regarding the future pattern of land uses in Garfield County.
- Kane County General Plan (adopted 2017)—Outlines goals and policies for unincorporated land use, transportation and access management, conservation of natural resources, protection against natural- and human-caused hazards, provision of public services, preservation of historic resources, development of the economic base, accommodation of affordable housing, and partnering with federal and state land management agencies.
- Kane County RMP (adopted 2018)—Developed to address the present and future needs of the county, including the growth and development of all or any part of the county's unincorporated portions.
- Scenic Byway 12 Corridor Management Plan, 2001—Guides management of this critical road corridor; it recommends consolidating the ideas of those who live along Scenic Byway 12, communicate concerns, facilitate conflict, avoid redundancy, initiate byway pride, and strive to protect valuable resources.

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Chapter 4. Purpose and Need

Purposes and needs serve to frame the issues identification, alternatives development, and effects analyses. Proclamation 10286 directs the BLM to "prepare and maintain a new management plan for the entire monument" for the specific purposes of "protecting and restoring the objects identified [in Proclamation 10286] and in Proclamation 6920" (**Appendix A**).

The RMP's purpose is to provide a management framework, including goals, objectives, and management direction, to guide monument management, consistent with the protection of GSENM objects and values and the management direction provided in Proclamation 10286.

The following purposes are set forward in Presidential Proclamations 10286 and 6920 or have been identified based on key present and historical GSENM management challenges. Planning for these purposes and their desired outcomes will be crucial for development of an RMP that provides direction for addressing critical current and future management challenges.

1. *Protect and restore the entirety of GSENM's large, remote, rugged, and markedly impenetrable landscapes, including the extraordinary landscapes dark skies, natural soundscapes, and rich mosaic of objects of natural, historical, and scientific interest.*

   This topic focuses on protection of GSENM as a whole.

   Needs and challenges: The immense scale and unspoiled naturalness of GSENM serves as a foundation for the rest of GSENM objects and values, including the diversity of ecotypes, as well as the diversity of geological and paleontological resources, vegetation, and wildlife. Through the latter half of the 20th century, Utah's large extent of unspoiled natural, roadless areas was unique in the lower 48 states, ultimately providing for Proclamation 6920. GSENM visitation has increased steadily since its designation, mostly because of recreational use. In addition to rising visitation, Utah has had the fastest growing population in the US in the last decade (18.4%). In 2021, Utah's growth was 1.7% while the national population growth was 0.1%. These increases in human presence pose diverse challenges to preserving resources (for example, adverse vegetation and soil impacts, loss of potential for human solitude, adverse effects on certain wildlife species, increases in noise). Effects to resources tend to be incremental, and gradual degradation of resources over time can easily occur almost unnoticed without either adequate management sidebars or overall management goals and objectives for the landscape. To retain the unique value of a largely unspoiled, natural landscape, the planning process must consider how to guard against incremental degradation due to ongoing uses.

2. *Emphasize GSENM as a living, outdoor laboratory for diverse and significant research and discovery related to GSENM's varied resources, objects, and values.*

   This topic focuses on enacting a science emphasis for GSENM.

   Needs and challenges: The proclamation that originally designated GSENM in 1996 explains, "[e]ven today, this unspoiled natural area remains a frontier, a quality that greatly enhances the monument's value for scientific study." However, the circumstances surrounding and within

GSENM have changed substantially in the past 25 years. There are substantial management challenges regarding how to maintain the unspoiled naturalness essential to GSENM's purposes of science. Given the intensification of anthropogenic change in the world, undisturbed and unaltered natural areas on the geographic scale of GSENM are increasingly essential, rare, and hard to maintain. Accordingly, GSENM is equally important for scientific understanding of the past and for understanding changes and trends that allow us to appropriately plan for and understand the future.

3. *Protect and restore GSENM's biological resources, including five life zones, a variety of habitats, and multiple eco-regions. Due largely to its remoteness and substantial variation in elevation and topography, GSENM contains unique and isolated plant communities, various floristic communities, and relic and endemic plants, unique species of invertebrates, and a biodiversity of bees, and diverse amphibians, birds, and mammals, including mountain lion and desert bighorn sheep.*

   This topic focuses on broadscale, interdependent management of biological resources, including species, habitats, and ecosystems.

   Needs and challenges: Management of living individuals, populations, habitats, and interconnected communities and ecosystems must address a spectrum of needs and challenges. GSENM supports a range of ecotypes, as well as remnant, relic, and refugia populations, across the landscape's substantial ranges of elevation and large geographic extent. Further, climate change and drought are pushing ecological conditions outside of the historic range of variability, affecting the function and resilience of vegetation and, in turn, habitat and species. A key component of this planning effort will be identifying appropriate management for changing ecotypes, populations, and habitats.

4. *Protect cultural and historic resources in GSENM and ensure Tribal Nations' ability to access and use traditionally sacred places and landscapes. These objects and values include traditional cultural places and uses considered sacred to modern Tribal Nations with ancestral and/or historical ties to GSENM lands, as well as a high density of archeological sites spanning the Paleoarchaic, Archaic, Formative (Ancestral Puebloan and Fremont), Ethnohistoric (Ancestral Paiute), and the post-Contact Historic periods. These objects and values also include numerous historic routes and trails including Powell expedition routes and Mormon pioneer trails, historic inscriptions, ghost towns, cowboy line camps and historic townsites.*

   This topic focuses on the protection, management, and education/appreciation of cultural and historic resources, including Tribal, public and scientific uses of cultural resources.

   Needs and challenges: Protection and management of cultural and historic resources often requires substantial work, such as survey/inventories, monitoring, stabilization, and public outreach/education activities. The RMP planning process should clarify how to select and prioritize such activities, as well as consider collaboration with outside entities and consultation with Tribal Nations that could support understanding, protection, and management of cultural and historic resources.

5. *Protect GSENM's varied and rich geology, extraordinary visual landscapes with numerous unique areas and features, and abundant, world-class paleontological resources.*

   This topic focuses on protection, scientific use, and visual enjoyment of paleontological and geologic resources.

   Needs and challenges: Extensive scenic exploration can be accessed via paved roads, which serve as main arteries through GSENM. Paved roads are augmented by several maintained, unpaved roads and some lesser dirt roads. Scenic geology itself, and the opportunity for visual appreciation, is relatively easy to preserve, while other uses of these resources, for example scientific study, will require more consideration during planning to provide for appropriate access, use, and protection. This is especially important in view of the scientific purposes of GSENM.

6. *Protect the opportunity to experience a remote landscape rich with opportunities for adventure and self-discovery. While protecting GSENM objects and values, provide a diversity of world-class outdoor recreation opportunities such as hiking, backpacking, hunting, canyoneering, mountain biking, and horseback riding associated with a substantial, regional socioeconomic sector. Effectively serve visitors with diverse emphases, as well as provide basic facilities, such as trailheads and restrooms, to ensure human health and safety.*

   This topic focuses on sustainable recreation management given challenges due to rising visitation of GSENM's remote, fragile landscape.

   Needs and challenges: Most visitation to GSENM is recreational. While not identified as an object in need of protection, Proclamation 10286 acknowledges the world class recreational opportunities in GSENM that support a travel and tourism sector that is a source of economic opportunity for the region. However, high and increasing levels of recreational visitation are a top management challenge, and appropriate management of recreational use is a central concern to be addressed by the RMP. Large numbers of visitors can degrade visitor experience, raise human safety and health issues (such as related to human waste), and may harm objects and values, including ecologically sensitive areas and species. A key component of this planning effort will be identifying appropriate management that will protect GSENM's objects and values amid rapidly rising visitation levels.

7. *Manage discretionary uses in GSENM in the context of protecting objects and values. GSENM lands have long-served a variety of uses and purposes by Tribal Nations and their ancestors as well as by European settlers and their descendants.*

   This topic focuses on identifying sustainable and appropriate uses within the context of protecting GSENM objects and values.

   Needs and challenges: Since designation of GSENM in 1996, controversy and disputes have existed among stakeholders regarding BLM's discretionary uses, particularly since, as noted above, the designation of GSENM as a national monument requires the BLM to protect the objects and values within its boundary. Stakeholder interests span the spectrum from supporting a wide variety of activities and uses to promoting strong preservation interests. Establishing

management that best protects GSENM's objects and values while considering other compatible uses is vital in this planning process.

Chapter 5. Planning Area Profile

This chapter of the AMS documents the current conditions, trends, and forecasts for resources, resource uses, existing nondiscretionary designations, and social and economic conditions in GSENM that are relevant to the purpose and need and the planning issues identified by the BLM. Unless otherwise noted, allocations are based on the 2020 Approved RMPs for GSENM and KEPA.

5.1 Terrestrial Habitat and Vegetation Resilience and Conservation (Large-scale and Local Ecotypes)

5.1.1 Current Conditions

Terrestrial Vegetation

Terrestrial vegetation includes plant species not associated with rivers, creeks, lakes, springs, wetlands, or other surface or shallow subsurface water. Most decision area vegetation is terrestrial. Terrestrial vegetation provides an enormous variety of functions in an ecosystem and provides uses for humans and a variety of wildlife species. Healthy and diverse terrestrial vegetation provides ecosystem benefits, including stabilizing soils, preventing erosion, using carbon dioxide, releasing oxygen, increasing species diversity, providing habitat and food for animals, and providing resources for human use.

Ecosystems reflect complex sets of interactions between diverse components, including plants; animals; soil; water; air; geography; climate; disturbance regimes, such as fire; and humans. Influences exerted on one component affect other components in the system. Vegetation management affects other BLM management, including that of wildlife habitat, noxious and invasive vegetation, rangeland health, soils, recreational uses, and more. For example, management of healthy woodlands has effects on other resources and values (for example, wildlife and personal woodlands use). Management of noxious and invasive vegetation is central to ecosystem health, with effects on many resources; conversely, noxious and invasive vegetation is affected by management of wildfires and livestock grazing.

Currently, due to past and ongoing climate-related factors, as well as fire suppression and livestock grazing, there are areas of high fuel loads across broad, remote landscapes. These fuel loads pose management challenges in terms of the method (for example, prescribed fire) and outcomes (for example, the potential for noxious and invasive infestations), as well as management of human safety during wildfire response. Many BLM land management policies are directed toward managing for healthy vegetation communities that support resistant and resilient ecological systems.

Existing Vegetation Type

The LANDFIRE existing vegetation type product represents the current (through 2016) distribution of terrestrial ecological systems (LANDFIRE 2022). LANDFIRE defines terrestrial ecological systems as groups of plant community types that tend to co-occur throughout landscapes with similar ecological processes, substrates, and/or environmental gradients. Acres of LANDFIRE existing vegetation types in the decision area are summarized in **Table 5-1**. Additionally, **Figure 5-1, Appendix B** displays the 12 dominant vegetation types found in the decision area. In **Figure 5-1**, vegetation types comprising less than 10,000 acres are combined into the "other" vegetation category for display purposes. Detailed descriptions of the ecological systems are available in NatureServe's International Ecological Classification Standard (NatureServe 2009).

Table 5-1
LANDFIRE Existing Vegetation Types in the Decision Area

Existing Vegetation Type	Extent (Acres)[1]
Colorado Plateau Pinyon-Juniper Woodland	506,400
Colorado Plateau Pinyon-Juniper Shrubland	347,600
Colorado Plateau Mixed Bedrock Canyon and Tableland	314,800
Colorado Plateau Blackbrush-Mormon-tea Shrubland	306,500
Inter-Mountain Basins Big Sagebrush Shrubland	130,400
Inter-Mountain Basins Semi-Desert Shrub-Steppe	55,100
Inter-Mountain Basins Mixed Salt Desert Scrub	41,000
Inter-Mountain Basins Shale Badland	31,400
Southern Colorado Plateau Sand Shrubland	30,200
Inter-Mountain Basins Mat Saltbush Shrubland	17,400
Rocky Mountain Lower Montane-Foothill Shrubland	14,100
Great Basin and Intermountain Ruderal Shrubland	13,800
Inter-Mountain Basins Active and Stabilized Dune	9,400
Colorado Plateau Mixed Low Sagebrush Shrubland	7,300
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	6,400
Rocky Mountain Cliff Canyon and Massive Bedrock	5,900
Developed-Roads	4,600
Inter-Mountain Basins Greasewood Flat	3,900
Inter-Mountain Basins Montane Sagebrush Steppe	2,800
Inter-Mountain Basins Semi-Desert Grassland	2,800
Western Cool Temperate Urban Shrubland	2,400
Western Cool Temperate Pasture and Hayland	2,200
Southern Rocky Mountain Ponderosa Pine Woodland	1,600
Great Basin and Intermountain Introduced Annual Grassland	1,300
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,200
Great Basin and Intermountain Introduced Annual and Biennial Forbland	1,000
Rocky Mountain Lower Montane-Foothill Riparian Woodland	800
Great Basin and Intermountain Introduced Perennial Grassland and Forbland	700
Western Cool Temperate Urban Herbaceous	600
Interior West Ruderal Riparian Scrub	500
Western Cool Temperate Urban Evergreen Forest	400
Rocky Mountain Lower Montane-Foothill Riparian Shrubland	100
Western Cool Temperate Developed Shrubland	100
Interior Western North American Temperate Ruderal Grassland	100
Quarries-Strip Mines-Gravel Pits-Well and Wind Pads	100
Western Cool Temperate Close Grown Crop	100
Developed-Low Intensity	100
Interior Western North American Temperate Ruderal Shrubland	100
North American Arid West Emergent Marsh	100
Interior West Ruderal Riparian Forest	100
Rocky Mountain Subalpine-Montane Mesic Meadow	100
Interior Western North American Temperate Ruderal Shrubland	100

Existing Vegetation Type	Extent (Acres)[1]
North American Arid West Emergent Marsh	100
Interior West Ruderal Riparian Forest	100
Rocky Mountain Subalpine-Montane Mesic Meadow	100
Other[2]	100
Total	**1,865,600**

Source: BLM GIS 2022

[1] Rounded to the nearest 100 acres

[2] There are 23 additional LANDFIRE Existing Vegetation Types totaling approximately 100 acres throughout GSENM.

Ecological Site Groups

Ecological site groups are generalized groupings of US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) ecological sites. Ecological site groups incorporate additional context and information about how landscapes may respond to management. Nauman et al. (2022) generalized the ecological site concepts based on unifying underlying soil geomorphology and climate patterns to delineate ecological site groups in the Upper Colorado River region. The ecological site groups and their extent in the decision area are summarized in **Table 5-2** and shown in **Figure 5-2, Appendix B**. Ecological site groups have been delineated using a variety of data and information, including all ecological site descriptions (ecological sites based on NRCS Soil Survey vector polygons) in GSENM. Development of ecological site groups uses multivariate statistical techniques to test and optimize decisions made to define new ecological site groups, based on climate, soil, and geomorphic properties (Nauman et al. 2022). This process was completed and described in detail in A Quantitative Soil-Geomorphic Framework for Developing and Mapping Ecological Site Groups (Nauman et al. 2022). Because of the scientific approach and degree of quantification to create these ecological site groups, and the nuance of information they provide, the BLM anticipates using them as a basis for developing the RMP. The ecological site groups and their extent in the decision area are summarized in **Table 5-2** and shown in **Figure 5-2, Appendix B**.

Table 5-2
Ecological Site Groups in the Decision Area

Ecological Site Group[1]	Extent (Acres)[2]
Arid Warm Sandy and Loamy Uplands	377,700
Arid Warm Shallow	305,500
Arid Warm Very Shallow	289,100
Semiarid Warm Shallow and Deep Rocky	252,100
Semiarid Warm Sandy and Loamy Uplands	187,900
Semiarid Warm Very Shallow	78,100
Arid Warm Breaks	70,100
Outcrops	62,900
Semiarid Warm Finer Uplands	53,500
Arid Warm Deep Rocky	47,100
Semiarid Warm Breaks	31,000
Arid Warm Finer and Clay Uplands	26,100
Arid Warm Saline Uplands	21,800
Semiarid Warm Sandy and Loamy Uplands	18,200
Arid Warm Sandy Bottoms	18,100
Arid Warm Saline Hills	11,300
Arid Warm Saline Bottoms and Bottoms	6,000

Ecological Site Group[1]	Extent (Acres)[2]
Semiarid Warm Sandy Bottoms and Bottoms	5,500
Arid Warm Gypsum	4,600
Riparian	3,400
Semiarid Cool Shallow	3,000
Semiarid Warm Saline Hills	2,400
Semiarid Cool Deep Rocky	2,000
Semiarid Warm Saline Uplands	1,700
Semiarid Warm Saline Bottoms	1,600
Semiarid Cool Very Shallow	700
Semiarid Cool Breaks	600
Semiarid Cool Saline Sandy Loamy and Finer Uplands	500
Semiarid Warm Clay Uplands	300
Semiarid Warm Gypsum	200
Semiarid Cool Clay Uplands	<100
Semiarid Cool Bottoms	<100
Semiarid Cool Sandy Bottoms	<100

Source: Nauman et al. 2022; BLM GIS 2022.

[1] For a crosswalk of ecological sites to ecological site groups, see the supplementary materials in Nauman et al. 2022.

[2] Rounded to the nearest 100 acres

A brief introduction to ecological site groups and their utility is provided here to indicate one important approach that is being used as a foundation for assessing vegetation conditions in GSENM. Ecological site groups integrate soil geomorphic units with climate information. **Table 5-3** provides Table A.2 from Nauman et al. (2022) and provides general soil geomorphic unit descriptions. Table A.2 contains brief narratives for individual soil geomorphic units that relate to ecological site group designations. Soil geomorphic units encompass topographic mediation of moisture, soil salinity, soil depth, slope, rock content, and soil texture (Nauman et al. 2022). When combined with climatic factors, these units make up the 32 ecological site groups in GSENM.

The 32 ecological site groups have a naming convention using soil geomorphic units with their respective climate zones derived from an aridity index and maximum temperature of the hottest month (Nauman et al. 2022). The "Arid Warm" climate zone was defined as having an aridity index of less than 0.144 and a maximum temperature of the warmest month greater than 77.04 degrees Fahrenheit (°F) (25.02 degrees Celsius [°C]). The "Semiarid Warm" climate zone has an aridity index greater than 0.144 and a maximum temperature of the warmest month greater than 77.04°F (25.02°C). The third zone, which was labeled as "Semiarid Cool," has an aridity index greater than 0.144 and a maximum temperature of the warmest month less than 77.04°F (25.02°C; Nauman et al. 2022).

Ecological site groups can be analyzed in different ways to inform land managers of certain expected and potential resource conditions (for example, the mean reference production for forbs, grasses, shrubs, and trees within all mapped ecological site groups throughout GSENM; see **Table 5-4**). The data presentation in **Table 5-4** is adapted from Table 4 in Nauman et al. 2022.

Table 5-3
Geomorphic Unit Descriptions Adapted from Nauman et al. 2022[1]

Soil Geomorphic Unit	Soil-Landform Setting Key	Dominant Plant Communities	Notable State and Transition Model Features
Outcrops	Areas dominated by bedrock outcrops (equal to or greater than 75 percent) with only small pockets of soil that may support vegetation.	Very low productivity areas with vegetation sparse and spread out in pockets or fissures. Outcrops with more fractured bedrock can support more vegetation.	Not applicable
Riparian	Variety of soils in floodplains or areas with perennial plant or trees with available water tables or surface water.	Dominated by obligate riparian vegetation (for example, *Salix* spp., *Populus* spp., *Carex* spp., etc.) and usually very high production.	Aridification, gullying, or channelization can cause these sites to irreversibly revert to bottoms or uplands.
Saline Bottoms	Gently sloping, low-lying areas that receive excess moisture beyond ambient precipitation (run-on or subsurface moisture). Most have ephemeral washes and streams (not perennial). Soils are influenced by salts and have subsurface* soil electrical conductivity greater than 4 decisiemens per meter (saturated paste).	Higher productivity than other saline groups. Alkali sacaton and black greasewood are common dominant species. Generally more grass-dominated when in a reference state.	Gullying or channelization can lead to alternative states or cause these sites to irreversibly revert to uplands. Salts also make them less resilient to surface disturbance. Greasewood and other shrubs often increase in alternative states.
Sandy Bottoms	Other gently sloping, low-lying areas that receive excess moisture beyond ambient precipitation (run-on or subsurface moisture). Most have ephemeral washes and streams (not perennial). Soils are sandier, averaging greater than 50 percent sand and less than 27 percent clay in both surface** and subsurface horizons.	Diverse shrubs and C4*** grasses often dominate. These sites have higher productivities than upland counterparts. Can support big sage in semiarid climate zones (aridity index equal to or greater than 0.144).	Often more prone to bare ground exposure and associated wind erosion. Can become an aeolian sand source for downwind dunes. Also highly prone to loss of perennial species.
Bottoms	Other gently sloping, low-lying areas that receive excess moisture beyond ambient precipitation (run-on or subsurface moisture). Most have ephemeral washes and streams (not perennial).	Dominated by grasses and shrubs associated with run-in landscape settings (higher surface or groundwater available). Basin big sage can dominate. These sites have higher productivities.	Gullying or channelization can cause state transition or even irreversible reversion to uplands. Woody encroachment is also commonly observed in these areas.
Gypsum	Upland**** areas with soils averaging greater than 5 percent gypsum in the surface or greater than 10 percent gypsum in the subsurface, but with a surface sodium adsorption ratio less than 8. These areas are often hilly badlands but can also be more gentle terrain.	Sub-shrublands with limited grasses dominated by C4 species and low overall productivities. The species composition is determined by gypsum tolerance. They often have very high biological soil crust cover.	Favor biological soil crust development. Have the least number of documented alternative states, indicating a high resistance to state change. Limited annual and shrub invasions have been observed.

Soil Geomorphic Unit	Soil-Landform Setting Key	Dominant Plant Communities	Notable State and Transition Model Features
Saline Hills	Other upland areas that are highly salt limited (often sodic), erosion features common, often dissected badland hillslopes. These soils include surface sodium adsorption ratios greater than 7 and/or average electrical conductivity greater than 4 decisiemens per meter in surface or average electrical conductivity greater than 8 decisiemens per meter in subsurface.	Mat, Castle Valley, and Gardner's saltbush often dominate with associated salt-tolerant species. Low productivity with even grass and shrub production in reference communities.	Erosion prone, especially with disturbance that exposes bare ground. Can lose perennial grasses and increase in shrub dominance. Often invaded by annuals (for example, cheatgrass, *Salsola* spp., and *Halogeton glomeratus*).
Saline Uplands	Other uplands with moderate salt limitations, including average surface ec greater than 1.5 decisiemens per meter or average subsurface electrical conductivity greater than 2.	Salt-tolerant grasslands with moderate salt-tolerant shrub component (for example, shadscale and low sage). Moderate to moderately low productivity.	Less susceptible to herbaceous and woody invasion as well as erosion and bare ground than similar soil geomorphic units with more or less salinity.
Breaks	Other uplands on steep slopes (greater than 35 percent) and rocky soils with greater than 40 percent (by volume) rock content in surface soil horizons.	Very low productivity areas that favor woody species or resilient forbs. Vegetation is often sparse and limited by unstable slopes, poor water retention, and high rock content.	Particularly susceptible to cheatgrass and other annual invasions. Few other alternative state issues observed.
Very Shallow	Other uplands with soils less than 12 inches (30 centimeters) depth until a bedrock contact. Sites are often rocky and rugged.	Generally low production with an even mix of trees (above a certain aridity level), shrubs, and grasses. Blackbrush can dominate in drier areas.	Drought prone and susceptible to annual invasion. Can have bare ground states, erosion issues, and perennial loss of both grass and woody species.
Shallow	Other uplands with soils less than 22 inches (55 centimeters) to a bedrock contact.	Commonly low to moderately productive pinyon-juniper woodlands, but also supports substantial grass and shrub components that vary in relative abundance by climate. Blackbrush can dominate in drier areas.	Drought prone and susceptible to annual invasion. More woody encroachment than Very Shallow. Bare ground, biocrust loss, eroded, and perennial loss states possible.
Deep Rocky	Other uplands with soils that average greater than 30 percent rock fragments by volume in either surface or subsurface horizons. Often rugged topography but can be high-energy alluvial deposits. These soils also tend to have high calcium carbonate contents.	Exhibit a wide variety of dominant grasses, shrubs, and trees, including blackbrush, big sagebrush, and juniper at lower elevations. Generally moderate to moderately high production. Species composition is generally very mixed among species and functional groups.	High propensity for herbaceous invasion, moderate for woody encroachment. Resistant to erosional states, but moderately susceptible to bare ground and perennial loss states

Soil Geomorphic Unit	Soil-Landform Setting Key	Dominant Plant Communities	Notable State and Transition Model Features
Clay Uplands	Other uplands with average surface clay greater than 30 percent or subsurface clay averaging greater than 35 percent. These sites often exhibit vertic (shrink/swell) properties.	Productive savannas and grasslands often dominated by grasses more adapted to shrink-swell soils. However, big sage can dominate these areas in wetter climates.	Moderate water erosion, herbaceous invasion, and bare ground state risk. Common loss of perennial grasses and woody encroachment.
Sandy Uplands	Other uplands with very sandy eolian and alluvial deposits that average greater than 75 percent sand in both surface and subsurface horizons. These soils are generally quite young and low in carbonates (less than 10 percent, but usually less than 5).	Productive savannas and grasslands with substantial shrub component (primarily four-wing saltbush, but with some sand sage, blackbrush, *Ephedra* spp., and big sage on wetter sites). Blackbrush can dominate this group as a long-term state, but it is less common than on shallow sites or sites with calcic horizons and slightly finer textures. Dunes have been described as a reference state possibility for the driest and most exposed areas. Big sage can also dominate in wetter climates.	Drought and disturbance can cause severe wind erosion and dune mobilization. Sites with water erosion issues have also been observed. There is a high propensity for annual invasion, woody encroachment, and perennial species loss (particularly grass). There is also a moderate risk of bare ground states.
Loamy Uplands	Other uplands with surface soil textures of Sand, Loamy Sand, or Sandy Loam, but finer subsoil field textures or carbonate content higher than 10 percent.	Grasslands and savanna communities. Some areas have blackbrush communities that can dominate, but often in mosaic with grasslands as a long-term state. Big sage and other shrubs can also dominate.	Similar to Sandy Uplands, but with less risk of most alternative states and no erosional states related to water erosion documented.
Finer Uplands	Other uplands that tend to have finer loamy textures.	Savannas and shrublands with grasses; these are mostly dominated by Wyoming big sage at middle elevations, but include some sites dominated by winterfat and other shrubs.	High risk of herbaceous invasion, woody encroachment, perennial species loss, and bare ground states. Some documentation of eroded states.

Notes:
[1] This table is organized as a key with areas falling into the first class that would include them (from top to bottom). The table is designed to be read from top to bottom with upper units mutually exclusive of units lower in the table.
* Subsurface is 12–39 inches (30–100 centimeters).
** Surface is 0–12 inches (0–30 centimeters).
*** A C4 plant fixes carbon dioxide into a molecule containing four carbon atoms before initiating the Calvin-Benson cycle of photosynthesis
**** Upland refers to areas that receive no extra moisture beyond ambient precipitation.

Table 5-4
GSENM Ecological Site Group Mean Reference Production (pounds per acre) of Plant Functional Groups

Ecological Site Group	Forb	Grass	Shrub	Tree	Total Production
Arid Warm Sandy Uplands and Loamy Uplands	29	228	109	7	372
Arid Warm Shallow	16	110	130	20	275
Arid Warm Very Shallow	20	64	118	56	258
Semiarid Warm Shallow Deep Rocky	29	200	106	83	418
Semiarid Warm Very Shallow	37	79	165	45	328
Arid Warm Breaks	20	42	101	6	168
Outcrops	—	—	—	—	—
Semiarid Warm Finer Uplands	50	315	143	31	539
Arid Warm Deep Rocky	20	172	128	20	341
Semiarid Warm Breaks	20	127	119	94	359
Arid Warm Finer Uplands and Clay Uplands	33	208	118	0	358
Arid Warm Saline Uplands	20	212	88	1	322
Semiarid Warm Sandy Uplands and Loamy Uplands	45	339	148	53	584
Arid Warm Sandy Bottoms	34	355	138	0	527
Arid Warm Saline Hills	13	123	79	2	218
Arid Warm Saline Bottoms and Bottoms	48	560	154	0	762
Arid Warm Gypsum	20	102	115	3	241
Riparian	—	—	—	—	—
Semiarid Cool Shallow	111	270	159	79	620
Semiarid Warm Saline Hills	17	111	117	0	245
Semiarid Cool Deep Rocky	51	282	139	0	472
Semiarid Warm Saline Uplands	45	242	69	29	385
Semiarid Warm Saline Bottoms	63	887	129	0	1079
Semiarid Warm Sandy Bottoms and Bottoms	66	733	170	0	970
Semiarid Cool Very Shallow	—	—	—	—	—
Semiarid Cool Breaks	—	—	—	—	—
Semiarid Cool Saline, Sandy, Loamy, and Finer Uplands	81	483	137	28	730
Semiarid Warm Clay Uplands	42	379	118	18	557
Semiarid Warm Gypsum	22	130	138	4	294
Semiarid Cool Clay Uplands	45	268	143	0	457
Semiarid Cool Bottoms	202	1236	184	3	1625
Semiarid Cool Sandy Bottoms	—	—	—	—	—

Source: Nauman et al. 2022
Notes:
Dashes indicate there are no reference production values currently available.
Values within each column are heat mapped to highlight the highest production (darkest) and lowest production (lightest).

Ecological Context

The current conditions of the GSENM landscape have been highly influenced by previous land uses and land management practices, especially since European settlement in the outlying areas. Since the 1850s, sagebrush-steppe communities, which dominated the Intermountain West, have shifted toward woodlands or invasive annual-dominated communities (Tausch et al. 1981; Miller and Wigand 1994).

This is evidenced by the level of departure from reference conditions[2] described in the ecological site descriptions (NRCS 2022), as shown by data collected for the Assessment, Inventory, and Monitoring (AIM) Strategy and Landscape Monitoring Framework (MacKinnon et al. 2011). The BLM uses AIM Strategy and Landscape Monitoring Framework data (herein referred to as "AIM data") nationally as a tool to assess natural resource conditions and trends and to determine whether rangeland health standards are being met. These data are collected from monitoring plots across the western United States.

More than 400 monitoring plots in GSENM provide data related to direct field observations of standardized indicators (Herrick et al. 2021). A subset of the AIM monitoring plots in GSENM also collected data using the Interpreting Indicators of Rangeland Health protocol as a supplement to the AIM core methods. This protocol describes the monitoring location in terms of a departure from reference conditions.

The rangeland health attribute of biotic integrity incorporates ratings of departure from reference conditions for the following nine indicators (Karl et al. 2016):

- Soil surface resistance to erosion
- Soil surface loss or degradation
- Compaction layer
- Functional and structural groups
- Plant mortality and decadence
- Litter amount
- Annual production
- Invasive plants
- Reproductive capability of perennial plants

As shown in **Table 5-5**, 65 percent of AIM plots for which rangeland health data have been collected are moderately, extremely, or entirely departed from reference conditions. Eight of the nine indicators showed moderate, extreme, or total departure at one or more of the plots with compaction layer being the exception. **Diagram 5-1** shows the geographic distribution of these sites. Although the data shown are a small subset of all AIM plots, the wide geographic representation of moderate, extreme, and total departure from reference conditions shows a broad trend across GSENM. Two main drivers of this departure have been livestock grazing and a change in fire frequency.

Twenty percent of AIM plots have biotic integrity data collected and are shown on the map (**Diagram 5-1**). AIM plots rated as moderate, moderate to extreme, and extreme to total departure from reference conditions are broadly distributed across GSENM.

[2] Reference conditions are those that occur where the biotic integrity, hydrologic function, and soil and site stability are at their potential under the natural disturbance regime (BLM 2016).

Table 5-5
Biotic Integrity Departure Ratings in the Decision Area[1] Ranked by Degree of Departure

Ecological Site Group	None to Slight and Slight to Moderate	Moderate[2]	Moderate to Extreme[3]	Extreme to Total[3]	No Data Collected	Percentage of Plots with Moderate, Extreme, or Total Departure
Semiarid Warm Saline Hills	0	0	1	1	0	100
Arid Warm Saline Uplands	0	0	0	1	3	100
Arid Warm Deep Rocky	1	0	1	1	12	75
Semiarid Warm Sandy and Loamy Uplands	5	7	0	2	38	74
Semiarid Warm Shallow Deep Rocky	5	5	2	1	51	72
Arid Warm Shallow	4	2	1	0	43	64
Arid Warm Sandy and Loamy Uplands	11	4	0	4	91	63
Arid Warm Very Shallow	4	0	2	0	30	60
Semiarid Warm Finer Uplands	4	0	0	1	16	56
Semiarid Warm Very Shallow	4	0	0	0	5	50
Arid Warm Breaks	1	0	0	0	4	50
Outcrops	1	0	0	0	2	50
Arid Warm Finer and Clay Uplands	2	0	0	0	12	50
Riparian	1	0	0	0	0	50
Total	**43**	**8**	**7**	**11**	**7**	**65**

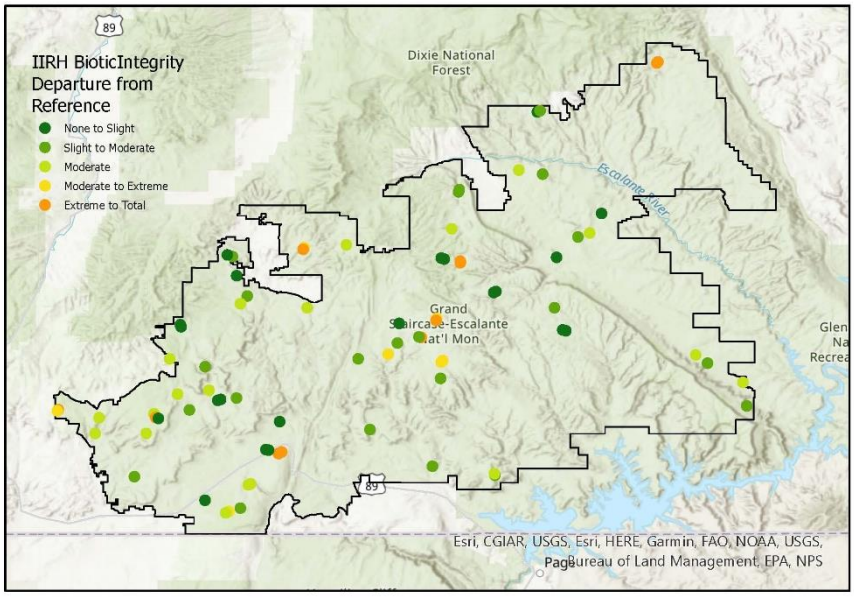
Source: BLM GIS 2022

[1] Note that only a portion of all AIM plots (80 out of 405 total plots [approximately 20 percent]) have biotic integrity data collected; as such, not all ecological site groups are included in this table. Data presented for each ecological site group represent the count of AIM plots within each departure from reference category.

[2] Moderate departure from reference conditions suggests that the attribute is "at risk" of declining in condition on the rangeland (Karl et al. 2016).

[3] Moderate-to-extreme departure or extreme-to-total departure suggests that the attribute has declined in condition on the rangeland (Karl et al. 2016).

Diagram 5-1
Biotic Integrity Ratings in the Decision Area

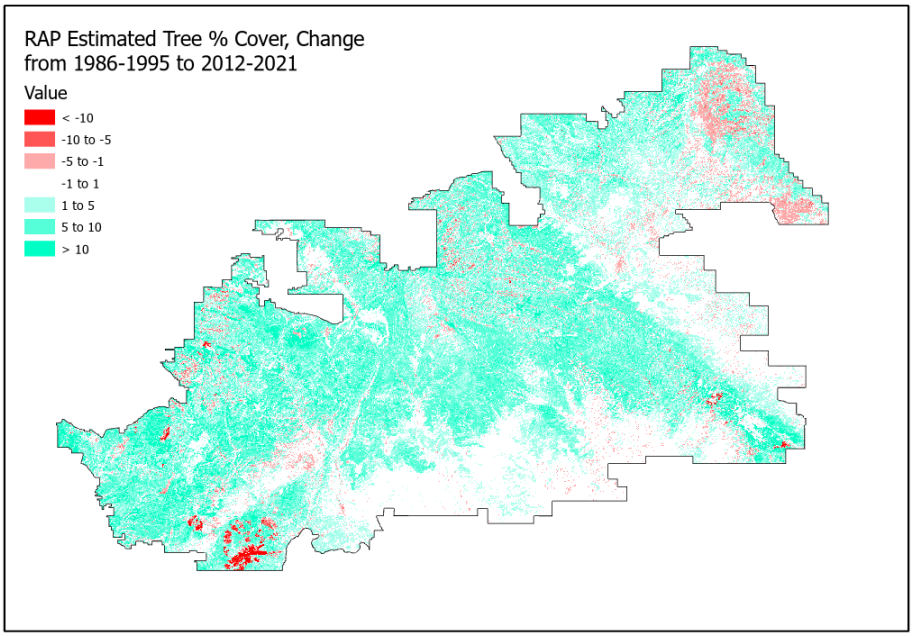


Cattle remove grasses and forbs but do not remove woody species. As a result, areas that are heavily grazed often experience an increase in woody species, such as pinyon pine and juniper. Fire suppression has also influenced the extent of woody species, as described further below. In fact, pinyon-juniper woodlands have increased substantially in both density and extent throughout the Intermountain West over the past 130 to 150 years, often invading landscapes previously dominated by sagebrush (*Artemisia* spp.) (Tausch et al. 1981; Miller and Wigand 1994).

A statewide inventory of Utah's forests estimated that 66 percent of all pinyon-juniper acres in the state are composed of trees established within the last 150 years (O'Brien 1999). Pinyon-juniper woodland expansion has been well documented in the literature (for example, Miller et al. 2008, Romme et al. 2019, and Miller et al. 2013) and is evidenced throughout GSENM by an analysis of aerial imagery. This has been documented even over the past 35 years.

Using data from the Rangeland Analysis Platform[3] (Rangeland Analysis Platform 2022), the BLM compared estimated tree cover using average values between 1986 and 1995 with estimated tree and shrub cover using average values between 2012 and 2022. **Diagram 5-2** shows the change in estimated tree cover in GSENM from 1986–1995 to 2012–2022. Green indicates an increase in the estimated cover; red indicates a reduction in the estimated cover. As shown in **Table 5-6**, below, all ecological site groups have experienced an increase in tree cover; the exception is the Semiarid Cool Clay Uplands group. All other groups, including the six groups having a sagebrush-steppe reference state, show more than a 20 percent increase in tree cover during the period analyzed.

Diagram 5-2
Change in Estimated Tree Cover in GSENM



[3] The Rangeland Analysis Platform is a remote-sensing data set that uses Landsat imagery to estimate the percent cover of coarse functional groups (annual forbs and grasses, perennial forbs and grasses, shrubs, and trees) annually. Variation is seen in the year-to-year estimates; therefore, for this analysis, the BLM used average values over a 10-year period.

Table 5-6
Change in Estimated Tree Cover within Ecological Site Groups in GSENM Ranked by Percent Change

Ecological Site Group	Estimated Tree Cover, Mean, 1986–1995	Estimated Tree Cover, Mean, 2012–2022	Percent Change in Estimated Tree Cover (%)
Arid Warm Saline Uplands	1.1	2.3	102
Arid Warm Saline Hills	0.5	1.0	100
Semiarid Warm Saline Uplands[1]	2.5	4.2	68
Arid Warm Sandy Bottoms	3.0	5.1	67
Arid Warm Sandy and Loamy Uplands[1]	4.7	7.5	59
Arid Warm Shallow	4.4	7.0	58
Semiarid Warm Saline Bottoms	5.7	9.0	58
Arid Warm Breaks	3.6	5.7	56
Arid Warm Very Shallow	4.6	7.2	56
Outcrops	3.3	5.1	56
Arid Warm Deep Rocky	6.8	10.4	52
Semiarid Warm Gypsum	1.5	2.3	49
Arid Warm Gypsum	0.7	1.0	48
Semiarid Warm Saline Hills	1.1	1.6	48
Arid Warm Saline Bottoms and Bottoms	4.1	6.1	47
Semiarid Warm Sandy Bottoms and Bottoms[1]	9.3	13.5	45
Arid Warm Finer and Clay Uplands	8.7	12.4	42
Semiarid Cool Sandy Bottoms	6.4	8.9	38
Semiarid Warm Shallow Deep Rocky	11.4	15.4	36
Semiarid Warm Breaks	11.1	14.9	35
Semiarid Warm Very Shallow	12.4	16.5	33
Semiarid Cool Saline, Sandy, Loamy, and Finer Uplands[1]	19.6	25.9	32
Riparian	9.6	12.6	31
Semiarid Warm Sandy and Loamy Uplands	14.3	18.6	30
Semiarid Cool Very Shallow	17.3	22.3	29
Semiarid Cool Bottoms	23.4	30.0	28
Semiarid Cool Shallow	17.3	22.0	27
Semiarid Warm Clay Uplands	12.2	15.4	26
Semiarid Cool Deep Rocky[1]	25.6	31.9	25
Semiarid Cool Breaks	18.4	22.9	24
Semiarid Warm Finer Uplands[1]	17.5	21.2	21
Semiarid Cool Clay Uplands	39.2	41.4	6

Source: Rangeland Analysis Platform 2022
[1] Indicates an ecological site group that has sagebrush steppe as the reference state.

Reduced fire frequency has also affected the composition of vegetation on the GSENM landscape. Prior to European settlement, periodic fires (both natural and aboriginal burning) throughout GSENM contributed to maintenance of a healthy balance of vegetation types and prevented woody fuels from accumulating to hazardous levels. After European settlement, but before grazing became regulated with the passage of the Taylor Grazing Act in 1934, the area was likely overgrazed by cattle and other forms of domestic livestock. Overgrazing in the sagebrush steppe has the potential to reduce fine fuels (grasses and forbs) needed to carry these periodic fires and consequently may have contributed to pinyon-juniper expansion and infilling. Fire suppression in recent history may also have contributed to the current conditions by removing the disturbance from fire that is essential to maintain a healthy ecosystem and to

keep fuels buildup at safe levels. This has led to vegetation that is departed from that associated with historical fire regimes.

As measured by LANDFIRE Vegetation Condition Classes (LANDFIRE 2022), which indicate the general level to which current vegetation is different from the estimated historical vegetation reference conditions, 60 percent of GSENM is moderately or highly departed from historical fire regimes. Fuel loading as a result of fire suppression has increased the susceptibility of vegetation and other resources to large-scale, catastrophic fires. This issue is compounded by the unavailability of prescribed fire as a tool in many situations (see **Section 5.9**, Fuels, Wildfire, and Prescribed Fire for a more detailed description of LANDFIRE Vegetation Condition Classes and fire management in GSENM).

Such catastrophic fires increase the potential for invasive weeds, particularly cheatgrass, to spread. When areas burn, native vegetation is destroyed, leaving burned areas susceptible to cheatgrass invasion, if seeds are present in the soil or there is a seed source in proximity. When conditions are favorable for germination, such as after fires, cheatgrass will germinate and can outcompete native vegetation (Zouhar 2003). Fine fuels are increased as cheatgrass spreads; since cheatgrass cures earlier than native vegetation, such sites become more susceptible to re-burn. The cheatgrass-fire relationship is thus a positive feedback loop for the continued spread of cheatgrass and more frequent fires.

Annual herbaceous cover in GSENM is presented in **Table 5-7** and **Diagram 5-3**, based on a model developed by Maestas et al. (2020). In GSENM, annual herbaceous cover is most often invasive annual plant species, notably cheatgrass. The model includes only rangelands and removes other cover types, such as forests, riparian areas, developed areas, and water (see Maestas et al. 2020 for a full description); as such, only approximately half of GSENM is covered by the model. Even so, the modeling results present evidence of the cover and distribution of invasive annuals across GSENM. Over 35 percent of GSENM has a 1 percent or higher percent cover of herbaceous annuals; cover greater than 1 percent of invasive annual grasses translates to higher fire frequency. Further, the Maestas et al. (2020) model may not fully capture the risk for cheatgrass to spread, since cheatgrass seeds can persist in the soil over time (Smith et al. 2008; Zouhar 2003). Additional information regarding other noxious and invasive weeds is provided in **Section 5.2**.

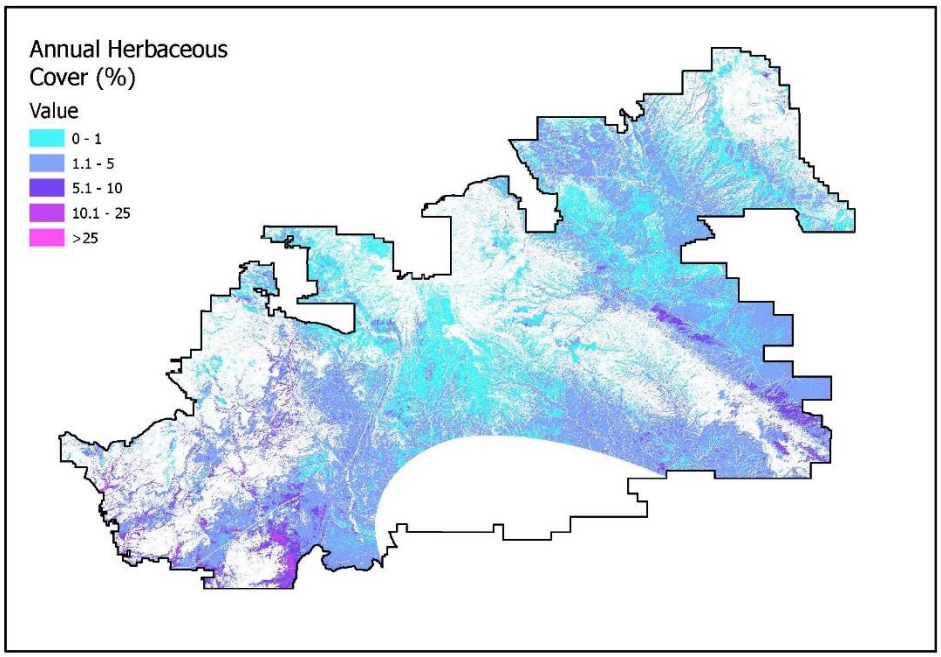
Table 5-7
Annual Herbaceous Cover in the Planning Area

Percent Cover	Acres[1]	Proportion of Decision Area (%)
0–1	288,000	15.3
1–5	592,800	31.5
5–10	62,500	3.3
10–25	8,100	0.4
>25	400	0.0
N/A (non-rangelands)	930,300	49.4

Source: Maestas et al. 2020
[1] Acres rounded to the nearest hundred

Diagram 5-3 shows the modeled annual herbaceous cover across GSENM. Annual herbaceous cover is used as a proxy for invasive annual cover. Areas above 1 percent invasive annual cover represent an increased fire risk; areas modeled with over 1 percent annual herbaceous cover are present on 35 percent of GSENM. White areas are those that were not covered by the model due to insufficient data.

Diagram 5-3
Modeled Annual Herbaceous Cover in the Decision Area



Sagebrush has been further altered by historical seedings. Across GSENM, there are areas that were treated as rangeland seedings or nonstructural range improvements from the 1960s to around 1980. Such treatments were mostly for forage production purposes related to livestock grazing. These treatments aimed to improve grass production by removing pinyon-juniper and/or reducing sagebrush densities. These treated lands are often found on sagebrush and grassland sites where there are well-developed and deep soils. These are typically found in valley bottoms, gently sloping terrain, and structural benches, or on mesa tops. A summary of treatments in GSENM over the past approximately 60 years is included in **Table 5-8** and **Figure 5-3, Appendix B**. Past treatments primarily consisted of seeding and chaining, although several small, prescribed fires, followed by drill seeding, have also occurred. Previously treated lands were seeded almost exclusively with nonnative crested wheatgrass and Russian wild rye.

Table 5-8
Past Vegetation Management in the Decision Area[1]

Management Action	1960–1980	1981–2021	Unknown Year[2]	Total
Seeding	13,700	23,500	26,300	63,500
Mechanical treatment	4,700	28,500	—	33,200
Chemical treatment	—	100	2,000	2,100
Prescribed fire	—	1,300	900	2,200
No data[2]	12,200	—	9,000	21,200

Source: BLM GIS 2022

[1] Data are not complete, as not all vegetation management actions have been mapped or digitized, particularly those completed prior to the use of GIS technology.

[2] Some management actions have been mapped, but there are no data regarding what management action was used or the year in which the action was conducted.

Since approximately 1980, the purpose of vegetation management has shifted to improvement of watershed and habitat health. Such restorations have used native or nonnative seeds, or both, depending on management guidance at the time. After 2000, subsequent to the establishment of GSENM and the approval of the MMP (BLM 1999), restorations were primarily done with native seeds.

Special Status Species

Utah is rich in native flora and is remarkable for its large numbers of endemic and rare plants, which are attributed to the state's diverse range of habitats (UDWR 1998, pp. 3, 4). Fifty percent of the rare flora in Utah are also found within the GSENM landscape. The area also supports 125 species of plants that occur only in Utah or on the Colorado Plateau (Belnap 1997). **Table 5-9** lists federally listed and BLM sensitive plant species that have been documented or have the potential to occur in GSENM.

Table 5-9
Special Status Species that Occur or Have the Potential to Occur in the Decision Area

Species	Common Name	Federal Status	BLM Status	Known or Potential to Occur
Asclepias welshii	Welsh's milkweed	Threatened	Sensitive species	Potential
Carex specuicola	Navajo sedge	Threatened	Sensitive species	Potential
Cycladenia humilis var. *jonesii*	Jones's cycladenia	Threatened	Sensitive species	Known
Physaria tumulosa	Kodachrome bladderpod	Endangered	Sensitive species	Known
Pediocactus sileri (=*Echinocactus s., Utahia s.*)	Siler pincushion cactus	Threatened	Sensitive species	Potential
Spiranthes diluvialis	Ute ladies'-tresses	Threatened	Sensitive species	Known
Astragalus ampullarius	Gumbo milkvetch	None	Sensitive species	Known
Astragalus striatiflorus	Escarpment milkvetch	None	Sensitive species	Known
Dalea flavescens var. *epica*	Hole-in-the-rock prairie-clover	None	Sensitive species	Potential
Euphorbia nephradenia	Paria spurge	None	Sensitive species	Known
Lupinus caudatus var. *cutleri*	Cutler's lupine	None	Sensitive species	Known
Oenothera murdockii	Chinle evening-primrose	None	Sensitive species	Known
Pediomelum epipsilum	Kane breadroot	None	Sensitive species	Known
Phacelia cronquistiana	Cronquist's phacelia	None	Sensitive species	Potential
Phacelia pulchella var. *atwoodii*	Atwood's pretty phacelia	None	Sensitive species	Known
Salvia columbariae var. *argillacea*	Chinle chia	None	Sensitive species	Known
Sphaeralcea grossulariifolia var. *fumariensis*	Smoky Mountain mallow	None	Sensitive species	Known
Thelypodiopsis ambigua var. *erecta*	Kanab thelypody	None	Sensitive species	Known

Sources: BLM 2018; USFWS 2022; SEINet 2022

5.1.2 Trends

To summarize what has been detailed in the current conditions section (Section 5.1.1), 1 main driver that has historically affected vegetation in the region, as well as in the planning area, is vegetation

community conversion. This has primarily been due to pinyon-juniper woodland expansion into sagebrush and other shrub-dominated communities. Community conversion has also occurred because of invasive plant spread, including the invasive annual cheatgrass (*Bromus tectorum*), and recreational use. Planning area vegetation has also been affected by wildfire, as well as mechanical treatments to improve rangeland conditions.

Pinyon-juniper woodlands have expanded over the last century into grassland and shrubland ecosystems throughout the western United States. Livestock grazing, changes in fire regimes, and climate changes drive pinyon-juniper woodland distribution. In the absence of fire (for example, due to fire suppression), pinyon-juniper woodlands have expanded and infilled into sagebrush habitats, leading to increased fuel loading and a greater potential for severe wildfire. Additionally, when pinyon-juniper woodlands expand into sagebrush-steppe habitats, they outcompete understory species for light, moisture, and nutrients. This cycle eventually results in a nearly complete loss of ecologically valuable understory vegetation species, such as sagebrush, grasses, and forbs. The altered condition has interconnected effects on soils, vegetation structure and composition, hydrologic patterns, nutrient and fire cycles, forage production, carbon storage, and plant and wildlife biodiversity. Bare ground tends to increase in tree-invaded sites, leading to soil loss due to wind and water erosion (Connelly et al. 2000; Aldrich et al. 2005; Pierson et al. 2007, 2010; Davies et al. 2011).

As described above, prior to establishment of GSENM, many historical vegetation management actions in GSENM were done to increase the value of rangeland for livestock grazing. As such, management actions typically included reducing sagebrush, pinyon-juniper, and other shrub cover and increasing the cover of perennial grasses, typically crested wheatgrass and other valuable livestock forage species. In the intervening decades since such actions were taken, many of these areas have seen no form of disturbance or maintenance, whether natural or anthropogenic. As sagebrush has reestablished, these areas have become characterized by uniform age classes, with decadent sagebrush and a reduced understory of perennial grasses and forbs.

Where seeding maintenance has occurred in historical rangeland treatments, these areas contain a more diverse age class of sagebrush, have a residual perennial grass and forb understory, and are some of the only areas in GSENM that greater sage-grouse (*Centrocercus urophasianus*) currently use. However, because these areas were originally seeded with nonnative crested wheatgrass, the native grasses and forbs are reduced. Yet, these areas more closely resemble the expected natural dominant vegetation than untreated areas. These sites are generally within LANDFIRE Vegetation Condition Class 2, or moderately departed from normal conditions (see **Section 5.9**, Fuels, Wildfire, and Prescribed Fire).

Recent vegetation management actions that have occurred in sagebrush steppe were targeted for fuels reduction and habitat improvement. Similar to the historical seeding maintenance treatments, these areas also contain a more diverse age class of sagebrush. However, unlike the historical seeding maintenance treatments, a diversity of native grasses and forbs were used, resulting in conditions that more closely resemble the expected natural dominant vegetation.

Special Status Species

A range of threats, including habitat degradation from improper livestock grazing, trampling, unauthorized or cross-country off-highway vehicle (OHV) use, weed spread, and pinyon-juniper expansion, may affect individual species in different ways. However, the threat of climate change and its

associated precipitation, wildfire, and herbivory effects may be the most significant threat faced by special status plant species. Little information is available documenting the current trends, habitat conditions, and population size of most special status plant populations throughout Utah, including BLM sensitive plants (BLM 2018). Monitoring for three federally listed plant species in the decision area indicates that trends for individual species range from relatively stable to declining.

5.1.3 Forecasts

Warming temperatures, drought, fire, and other extreme weather effects are expected to increase in frequency and will likely contribute to impacts on terrestrial vegetation and special status plants as climate change continues. The Colorado Plateau Rapid Ecological Assessment suggests that the ecoregion is expected to undergo general warming, with as much as a 3.6°F (2°C) increase by 2060 in some locations, particularly in the southern portion of the ecoregion (Bryce et al. 2012, p. 130). Average summer temperatures are expected to increase, but even greater increases are expected for the winter (Bryce et al. 2012, p. 130).

Vegetation communities expected to have the greatest exposure (that is, a higher probability for change) to climate change are shrublands, especially big sagebrush (*Artemisia tridentata*) and blackbrush (*Coleogyne ramosissima*)-Mormon tea (*Ephedra viridis*) communities; riparian vegetation; and pinyon-juniper woodland (Bryce et al. 2012, p. 155). Insects and disease will play a collateral role with the effects of climate change in altering the dominance and distribution of various vegetation species (Bryce et al. 2012, p. 155); in turn, this will alter the distribution and availability of habitat for special status species.

Temperature increases are expected to interact with water limitations to alter the vegetation community composition and distribution. In many vegetation communities, the canopy cover of perennial plants has been shown to be sensitive to temperature, whereas canopy cover of annual plants responds to cool-season precipitation (Munson et al. 2011, p. 1). Colorado Plateau Rapid Ecoregional Assessment models (Bryce et al. 2012) predict increasing temperatures in all seasons, as well as reductions in winter and summer precipitation.

Winter precipitation is critical to perennial native plants and enhances annual productivity for certain species (Bryce et al. 2012, p. 145). If both winter and summer precipitation are reduced, trees, especially pinyon pine, and grasses may be reduced (Bryce et al. 2012, p. 145; Munson et al. 2011, p. 1), while shrubs are likely to expand (Munson et al. 2011, p. 1). For tree species, drought-induced water stress has been linked to bark beetle infestations leading to die-off (Breshears et al. 2005, p. 15147).

The Colorado Plateau Rapid Ecoregional Assessment predicts the contraction of some of the drier shrublands (sagebrush in particular), savanna pinyon-juniper, and some evergreen forest by 2060, while grasses are expected to expand in the ecoregion (Bryce et al. 2012, p. 145). Within the planning area, the Rapid Ecoregional Assessment predicts a 26 percent reduction in evergreen tree savanna, such as ponderosa pine (*Pinus ponderosa*), and a 17 percent reduction in evergreen shrub savanna, such as sagebrush and saltbrush. The largest expansions are predicted in grasslands, such as those composed of sandhill muhly (*Muhlenbergia pungens*) and blue grama (*Bouteloua gracilis*), with up to a twenty-fold predicted increase. The seasonality and intensity of precipitation will be a key factor in these potential changes. If the trend is toward wetter winters or springs, the invasive grasses, such as cheatgrass, will spread and burn in the summer and fall, reinforcing their persistence over larger areas. If multiple wet

years occur, grasses may have the advantage over shrubs in establishment and survival (Bryce et al. 2012, p. 145).

5.2 NOXIOUS WEEDS AND INVASIVE NONNATIVE PLANTS

5.2.1 Current Conditions

Noxious weeds and nonnative, invasive plants disrupt or have the potential to disrupt or alter the natural ecosystem function, composition, or diversity of infested areas. These species complicate natural resource use and may interfere with management objectives.

Invasive plants are those that are not native and cause or are likely to cause harm to ecology, the economy, or human health (Executive Orders 13112 and 13751). Native plants that can become excessively abundant due to disturbance or other modification of an ecosystem are sometimes also called "invasive" (BLM Handbook H-1740-2; BLM 2008); however, these are excluded here.

Noxious weeds are designated under federal and state noxious weed acts. No federally designated noxious weeds are known to occur in the planning area. Noxious weeds in the planning area are listed under the Utah Noxious Weed Act of 2008. This act defines "noxious weed" as "any plant the commissioner determines to be especially injurious to public health, crops, livestock, land, or other property."

Weed spread is often influenced by the extent of disturbed soil and the proximity of established weed infestation to areas of disturbance. Assessing weed spread is based in part on evaluating the difference in frequency, intensity, or type of management activity or natural processes (such as wildfire) that result in significant soil disturbance. In addition, the mechanism for transporting weed seed is termed a "vector." Noxious weeds have been found in a variety of locations and habitat types, with waterways and transportation systems being the major vectors of spread. Other vectors include vehicle use, wind, wildlife, livestock, and humans. Over a 6-year study in the planning area (Stohlgren et al. 2006), researchers identified the following patterns across the landscape related to invasive plants:

- Both native and nonnative plant species thrive in rare, mesic (moist) habitats that are high in soil fertility, moisture, and foliar cover.
- Highly disturbed habitats, such as post-burn areas, have exceedingly high levels of plant invasions related to the destruction of soil crusts and local displacement of native species by invasive species.
- More common xeric (dry) habitats are high in endemic species and have considerably lower nonnative species and cover.

Table 5-10 summarizes the noxious weeds documented in the planning area.

Table 5-10
Noxious Weeds in the Planning Area

Name	Weed Class[1]
Russian knapweed (*Acroptilon repens*)	3
Hoary cress or whitetop (*Cardaria draba*)	3
Poison hemlock (*Conium maculatum*)	3
Field bindweed (*Convolvulus arvensis*)	3

Name	Weed Class[1]
Bermudagrass (*Cynodon dactylon*)	3
Quackgrass (*Elymus repens*)	3
Scotch thistle (*Onopordum acanthium*)	3
Johnsongrass (*Sorghum halepense*)	3
Tamarisk or salt cedar (*Tamarix ramosissima*)	3
Leafy spurge (*Euphorbia esula*)	2
Russian olive (*Elaeagnus angustifolia*)	4

Sources: Utah Weed Control Association 2022; BLM GIS 2022

[1] Noxious Weed Class Descriptions:

1A = Not known to exist in Utah; significant risk of invasion (none known to be present in GSENM)

1B = Limited distribution in Utah; early detection, rapid response (none known to be present in GSENM)

2 = Widely distributed in Utah; considered controllable

3 = Widely distributed in Utah; considered beyond control; control expansion

4 = Present in Utah; prevent distribution through seed law

Additional weeds on the Utah Noxious Weed List (Utah Weed Control Association 2022) have been documented in the region and have the potential to become introduced in the planning area. These are:

- Musk thistle (*Carduus nutans*); Class 3
- Diffuse knapweed (*Centaurea diffusa*); Class 2
- Yellow starthistle (*Centaurea solstitialis*); Class 2
- Spotted knapweed (*Centaurea stoebe*); Class 2
- Squarrose knapweed (*Centaurea virgata*); Class 2
- Canada thistle (*Cirsium arvense*); Class 3
- Houndstongue (*Cynoglossum officinale*); Class 3
- Dyers woad (*Isatis tinctoria*); Class 2
- Perennial pepperweed or tall whitetop (*Lepidium latifolium*); Class 3
- Dalmatian toadflax (*Linaria dalmatica*); Class 2
- Purple loosestrife (*Lythrum salicaria*); Class 2

While not listed on Utah's Noxious Weed List (Utah Weed Control Association 2022), an invasive plant species of concern and a significant change agent in the region is cheatgrass (*Bromus tectorum*). Change agents alter ecosystem processes, such as fire regimes, and have the potential to expand their distribution despite human and natural disturbances. They also have the potential to adapt and shift their range in response to climate change (Bryce et al. 2012).

The BLM has inventoried portions of the decision area to determine the extent of noxious weeds and invasive plants. In 2012, the BLM inventoried more than 4,600 acres in the Alvey Wash watershed, focusing on the invasive woody riparian species Russian olive and the noxious weed tamarisk. Other targeted species were hoary cress, Russian knapweed, and perennial pepperweed, though no infestations of these species were identified. In the inventoried area, biologists detected nearly 150 acres of Russian olive and more than 200 acres of tamarisk (Edvarchuk and Ransom 2012).

Rangeland health assessments in decision area riparian areas between 2000 and 2003 found that tamarisk (found at 68 percent of riparian sites); the invasive plant yellow sweetclover (*Melilotus officinalis*; found at 37 percent of riparian sites); and cheatgrass (found at 32 percent of riparian sites) were

common (BLM 2006). Cheatgrass was also the predominant invasive species in upland sites, found in 54 percent of sites assessed; cheatgrass was a dominant species in over 20 percent of those sites (BLM 2006). Yellow sweetclover is rare outside riparian areas.

Invasive annual grasses, such as cheatgrass, are known to increase fire frequency and alter ecosystems in western rangelands (Bradley et al. 2018). Cover greater than 1 percent of invasive annual grasses translates to a higher fire frequency. According to terrestrial BLM AIM Strategy and Landscape Monitoring Framework data from 2011 through 2021, approximately 16 percent of the monitoring plots had over 1 percent invasive annual grass cover, putting GSENM at a high risk of catastrophic fire (**Table 5-11**). The most abundant invasive annual grass is cheatgrass, which was documented in 159 out of 405 AIM and Landscape Monitoring Framework plots (39 percent) and shows a wide distribution across GSENM. Three other invasive annual grasses have been recorded in GSENM: red brome (*Bromus rubens*) at 26 plots, field brome (*Bromus arvensis*) at 1 plot, and annual wheatgrass (*Eremopyrum triticeum*) at 1 plot. The majority of the remaining invasive plant records from AIM and Landscape Monitoring Framework plots are invasive annual forbs, including Russian thistle (*Salsola tragus* at 43 plots), herbsophia (*Descurainia sophiaphia* at 17 plots), redstem filaree (*Erodium cicutarium* at 16 plots), and saltlover (*Halogeton glomeratus* at 12 plots).

Reductions in biological soil crust cover, native perennial herbaceous cover, and native species richness increase the risk of cheatgrass invasion in multiple ecosystems in the Intermountain West (Reisner et al. 2013; Root et al. 2019; Roundy et al. 2018; Shinneman and Baker 2009). In pinyon-juniper ecosystems of GSENM, biological soil crust cover is lower in sites grazed by livestock (Guenther et al. 2004; Harris et al. 2003). Livestock grazing is associated with decreased biological soil crust and perennial grass cover and increases in cheatgrass in Colorado Plateau salt deserts (Duniway et al. 2018). Across ecosystems in GSENM, nonnative species richness is higher where biological soil crusts are less well developed (Stohlgren et al. 2005). Increases in cheatgrass cover are also associated with fire (Evangelista et al. 2004; Shinneman and Baker 2009) and with vegetation management actions that reduce shrub or tree cover (Havrilla et al. 2017; Prevéy et al. 2010; Redmond et al. 2014; Roundy et al. 2018). In GSENM, livestock grazing and vegetation management are likely to increase the risk of cheatgrass invasion and to amplify the post-fire risk of invasion.

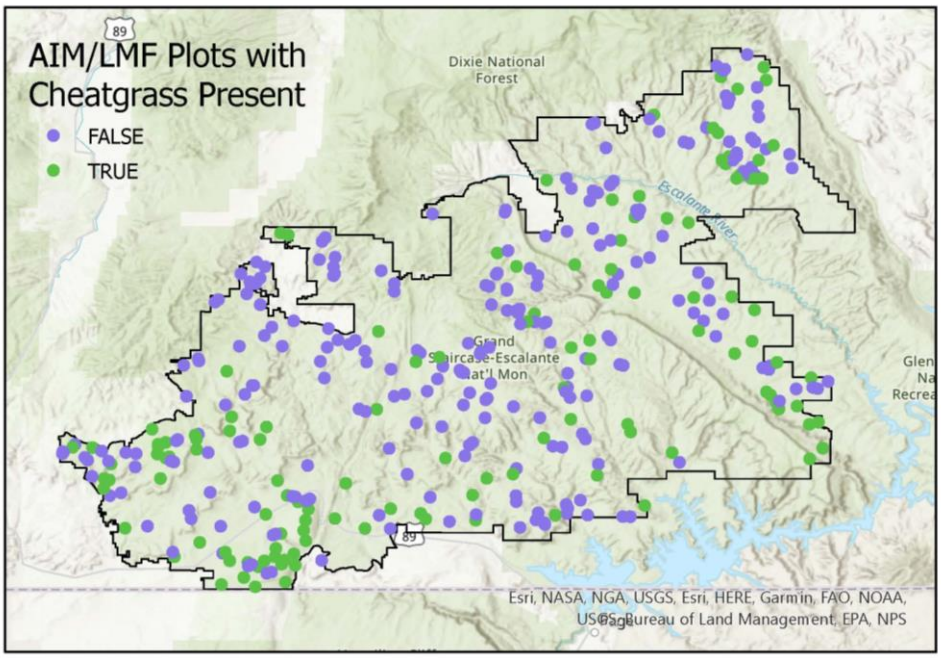
Table 5-11
Invasive Annual Grass Cover in the Decision Area

Invasive Annual Grass Cover (Percent)	Plot Count	Percentage of Plots (Not Percentage of Area)
<1	342	84.4
1–5	24	5.9
>5	39	9.6

Source: BLM GIS 2022

Diagram 5-4 shows GSENM AIM plots with cheatgrass. Green dots indicate that cheatgrass is present; 34 percent of AIM plots have documented cheatgrass.

Diagram 5-4
AIM plots with cheatgrass present in GSENM



5.2.2 Trends

As ground disturbance associated with human visitation increases in areas of known populations, the likelihood that noxious weeds and invasive plants would move into disturbed areas also increases. Other sources of potential noxious weed and invasive plant infestations are livestock grazing and routine GSENM operations, such as road maintenance, fire response, and even weed-control operations that result in ground disturbance.

Some successes have occurred in controlling certain species in specific areas; if such efforts are expanded, noxious invaders could be controlled somewhat. However, most of the decision area has not been inventoried for this type of effort to begin. Focused efforts include spot treatments of noxious weeds, preemergent herbicide application prior to seeding (targeting cheatgrass), harrowing and seeding, prescribed fire use, and follow-up seeding post-treatment.

5.2.3 Forecasts

Established weed populations will likely continue to expand, and new weed species will continue to appear in the planning area because of natural and human-caused introductions. The Colorado Plateau Rapid Ecoregional Assessment (Bryce et al. 2012) predicted an 85 percent increase in invasive species distribution within the region (which includes the decision area) by 2025. The degree to which these species spread is directly correlated to human activities, disturbances, and control efforts. Surface-disturbing activities and vehicular travel contribute to weed proliferation, although natural elements, such as climate, wind, and wildlife, will likely also continue to contribute. Range animals, such as livestock and feral and domesticated horses, will also increase the opportunities for invasive plant species to spread and become established. Noxious weeds and invasive plants will be more likely to establish in

newly disturbed areas, especially near existing populations. In some areas, control efforts will eradicate species locally.

Invasive annual species, such as cheatgrass, will continue to alter fire regimes by facilitating increases in fire frequency and size. This will occur due to increasing fine fuel loads and continuity in areas that were once fuel limited. As fires burn these areas, cheatgrass will replace native vegetation, reinforcing this feedback cycle. In the absence of appropriate management responses to fire (for example, seeding and mechanical planting), cheatgrass will dominate. Pyke et al. (2013) found that post-fire seeding alone had no effect in reducing invasive species in 67 percent of cases; however, it did reduce invasive species in 28 percent of cases studies.

While it is difficult to predict future introductions of noxious weeds and invasive species, the most likely areas for introduction are those where new disturbances occur, particularly in areas where management actions are not implemented post-disturbance. Historical evidence indicates that new weed species introduced to the planning area will establish if they are not eradicated quickly.

Control of noxious weeds and invasive plants would depend on the cost and feasibility of available treatment methods. Resource management strategies under the Programmatic Noxious Weed and Invasive Plant Management Environmental Assessment for GSENM (BLM 2015) are in place that would contribute to maintaining current levels or reducing the expansion of these species. Examples of these strategies are minimizing surface disturbance and surface-disturbing activities, reclamation of these disturbed areas, reducing traffic through infested areas, and requiring equipment to be washed prior to and after completion of work. Research continues to develop new herbicide formulations and test the effectiveness of biological agents, including pathogens, as tools to control weed species.

5.3 SOILS AND BIOLOGICAL SOILS CRUSTS

Biological soil crusts are also identified as a GSENM object, along with unusual and diverse soils. According to the Colorado Plateau Rapid Ecological Assessment, biological soil crust is a key conservation element (Bryce et al. 2012).

5.3.1 Current Conditions

Soil Characteristics

Most soils in the decision area are semiarid, young, and poorly developed. Physical, chemical, and biological soil development processes, such as rock weathering, plant material decomposition, organic matter accumulation, and nutrient cycling, proceed slowly in this environment. In many areas, natural or geological erosion rates are too fast to develop distinct, deep soil horizons. Most soils in the area range in average depth of 5 to 50 cm (Soil Survey Staff 2022). The deeper soils are formed in recent alluvium. Almost all the local soils are derived from sedimentary rock. The dominant topographic features are structural benches, mesas, valley floors, valley plains, alluvial fans, stream terraces, hills, cuestas, and mountainsides. The USDA NRCS has completed soil surveys for the BLM in the area (Soil Survey Staff 2022).

Dominant soil orders in the decision area are Aridisols, Entisols, and Mollisols; Alfiosols and Inceptisols occur less often (**Figure 5-4, Appendix B**). Aridisols are dry soils with low organic matter content; they tend to have salt accumulations due to an imbalance between evapotranspiration and precipitation. They are sparsely vegetated by drought- or salt-tolerant plants; therefore, erosion by wind and water

can be severe. Entisols are soils that have little development and are commonly largely influenced by underlying parent material. Many different parent materials contribute to Entisols' varied soil properties. They are often found in areas where soil material is not in place long enough to form distinctive horizons, or they are associated with parent materials that are highly resistant to weathering (for example, quartz). Mollisols form in semiarid to subhumid areas and are characterized by high base cation saturation and a significant accumulation of humus in the surface horizons. These mineral soils are typically formed under native grass vegetation and may be arable. In the decision area, approximately 212,800 acres are Aridisols, 89,600 acres are Alfisols, 1,445,300 acres are Entisols, and 7,000 acres are Mollisols.

Soils map units within the decision area have been correlated to specific vegetation communities that are grouped into ecological site groups, as described in **Section 5.1**, Terrestrial Habitat and Vegetation Resilience and Conservation, Current Conditions. A map of the ecological site groups is shown on **Figure 5-2, Appendix B**.

Sensitive Soils

Soils that have characteristics that make them extremely susceptible to impacts and difficult to restore or reclaim are considered sensitive soils. The Colorado Plateau Rapid Ecological Assessment (Bryce et al. 2012) and describes sensitive soils in GSENM. Approximately 1,291,000 acres of sensitive soils have been mapped in GSENM (Bryce et al. 2012). Sensitivity classes are combined and include droughty (marked by little or no precipitation or humidity), shallow, hydric (soils permanently or seasonally saturated by water), high risk of wind or water erodibility, low erosion tolerance, shallow soils, acidic soils, gypsiferous (soils containing sufficient quantities of gypsum to interfere with plant growth), desert pavement soils, saline, and high calcium carbonate (calcareous) soils. It should be noted that the Colorado Plateau Rapid Ecological Assessment combines data that are mapped at different scales and does not include data for all sensitive soils in the ecoregion.

Biological Soil Crust

Technical Reference 1730-2, Biological Soil Crusts: Ecology and Management, contains a description of the biological soil crust distribution and factors influencing species composition, ecological roles, response to natural and human actions, management techniques, and monitoring methods (DOI 2001). It also explains various ecological roles of biological soil crusts. Biological soils crusts comprise cyanobacteria, fungi, and lichen growing in a symbiotic relationship on the soil surface (Bryce et al. 2012). Late-succession crusts commonly appear dark, rough, and pinnacled, where a combination of frost-heaving and dust capture increase surface microtopography. Early succession crusts appear as a smoother, two-dimensional layer on the surface.

Biological soil crusts are an important component of ecosystems in semiarid areas and may represent up to 70 percent of the living cover (Belnap 1995). Research has shown that biological soil crusts provide important contributions to soil stabilization, hydrologic processes, nutrient cycling, and biological diversity in rangeland ecosystems (Miller 2008). Biological soil crusts have a stronger direct effect on surface soil stability than plants or mycorrhizal fungi (Chaudhary et al. 2009). Biological soil crusts are susceptible to damage by compression caused by grazing or off-road driving and can be adversely affected by fire.

Due to the importance of biological soil crusts in rangeland health, the biological soil crust integrity was also assessed in the planning area (Miller 2008). Quantitative data on the biological soil crust composition, abundance, and distribution were compared with reference areas; ratings were informed by preliminary results from a concurrent project to develop a spatial predictive model of biological soil crust cover in GSENM (Bowker et al. 2006). The study found that fine-loamy soils associated with the semidesert loam ecological site had a high potential to support biological soil crust development (Miller 2008). This ecological site corresponds to the Wyoming Big Sagebrush, Saltbush, Blackbrush, Spiny Hopsage, Black Sagebrush, Torrey's Jointfir, Utah Juniper–James' Galleta, and Utah Juniper-Pinyon ecological site types, which are present throughout the planning area.

Given the sensitivity of soils and the high biological soil crust potential of these sites, and the importance that biological soil crusts play in soil stabilization and other rangeland health factors, the functional significance for biological soil crusts in these sites is particularly high (Miller 2008). Soil crusts are useful ecological indicators of desert conditions because they are not only sensitive to disturbance but respond to disturbances in predictable and quantifiable ways (Bryce et al. 2012). Semiarid and arid landscapes with sparse vegetation and biological soil crust cover lack redundancy in function (Bryce et al. 2012). In other words, when crust is eliminated, so too are the essential functions it provides: nitrogen fixation, carbon storage, the capture of dust and airborne nutrients, moisture retention, and the provision of microsites for native plant germination. Soil crusts may take decades to recover from disturbance. Therefore, they are not good short-term indicators of the appropriateness of current management actions.

Biological soil crusts are ubiquitous within the decision area with the entire decision are exhibiting the potential. Biological soil crusts are ubiquitous within the decision area with the entire decision area exhibiting the potential for biological soil crusts. Maps of potential early and late crust abundance indicate the potential quantitative cover of biological crusts and major crust constituents (mosses, lichens, and dark cyanobacterial crusts) across the Colorado Plateau (**Figures 5-5** and **5-6, Appendix B**). Comparisons of the observed crust distribution with the potential distribution can serve as a surrogate for reference conditions.

5.3.2 Trends

Persistent wind and water erosion of soils are natural phenomena in desert ecosystems. However, human activities, including past mining, recreation, and livestock grazing, disturb the soil surface, affecting protective crusts and vascular plants and exposing underlying soils to wind and water erosion (Bryce et al. 2012). Six livestock grazing allotments did not meet Standard 1 in the 2006 rangeland health determinations. Since 2006, the BLM, in coordination with livestock grazing permittees, has made changes in the Circle Cliffs, Coyote, Mollies Nipple, Soda, Upper Paria, and Vermilion allotments, which failed to meet Standard 1 due to livestock grazing. Such changes include seeding restoration, a seasons-of-use restriction, range improvement maintenance, voluntary nonuse, and feral cattle removal. As a result of these changes, many areas that did not meet standards are now making progress toward doing so, based on recent upland assessments. See **Table 5-14** in **Section 5.4.2** for more information.

5.3.3 Forecasts

The BLM expects human activities to continue to disturb soil surfaces, thereby affecting soil surface conditions and biological soil crusts and exposing underlying soils to wind and water erosion.

5.4 RANGELAND HEALTH AND LIVESTOCK GRAZING MANAGEMENT

Presidential Proclamation 10286 speaks specifically to livestock grazing by stating:

> The Secretary shall manage livestock grazing as authorized under existing permits or leases, and subject to appropriate terms and conditions in accordance with existing laws and regulations, consistent with the care and management of the objects identified above and in Proclamation 6920. Should grazing permits or leases be voluntarily relinquished by existing holders, the Secretary shall retire from livestock grazing the lands covered by such permits or leases pursuant to the processes of applicable law. Forage shall not be reallocated for livestock grazing purposes unless the Secretary specifically finds that such reallocation will advance the purposes of this proclamation and Proclamation 6920.

5.4.1 Current Conditions

There are 2,121,600 acres available for livestock grazing in the livestock grazing decision area and 109,600 allotted acres that are wholly or partially unavailable for livestock grazing. Allotments that are wholly or partially unavailable for livestock grazing include 88,600 acres in Glen Canyon. An additional 35,500 acres within the decision area are available for livestock grazing but are not being grazed, including 1,608 acres in Glen Canyon. Approximately 101 permittees have permits to graze on 76 active allotments in the decision area. There are 10 allotments that are completely or partially unavailable for grazing, in addition to some unallotted areas in Glen Canyon. Approximately 10 previously unavailable allotments have been made available for grazing, but livestock are currently not present; as no permits have been authorized for these allotments, no animal unit months (AUMs) have been allocated. See **Table 5-12** and **Figure 5-7, Appendix B.**

Table 5-12
Acres Available for Livestock Grazing Allotments

Status	Acres	AUMs
Available	2,121,600	106,202
Unavailable/closed	109,600	—

Source: BLM GIS 2022

The total permitted grazing in the decision area is 106,202 AUMs, which includes 76,957 active AUMs and 29,245 suspended AUMs. The 2020 Approved RMP directed the BLM to permit 107,995 AUMs. The increase in AUMs is attributed to the 10 previously closed allotments that were made available but where no permits have been authorized. The 2020 Approved RMP also directed the BLM to activate all suspended AUMs (BLM 2020). However, the BLM has not yet done any permit renewals that would move the suspended AUMs to the active category.

Little Bowns Bench Allotment (130 AUMs), the Wolverine Pasture of the Deer Creek Allotment (148 AUMs), and the Phipps Pasture of Phipps Allotment (140 AUMs) total 14,603 acres designated as forage

reserves[4] (BLM 1999) and together can supply up to 418 AUMs in emergency situations. Ten-year permits are not issued in these areas.

5.4.2 Trends

Table 5-13 displays the active use and the actual use of AUMs billed between 1996 and 2020. Actual use means where, how many, and what kind or class of livestock, and how long livestock graze on an allotment or on a portion or pasture of an allotment (43 CFR 4100.0–5).

Proper riparian management and improvement continues to be a high priority. Riparian areas comprise only a small fraction of the total BLM-managed acreage but receive a disproportionate amount of use, while providing key habitat for wildlife. The BLM coordinates water quality monitoring with other federal, state, and technical agencies, and BLM Utah Rangeland Health Standards are assessed according to BLM Handbook H-4180-1, Rangeland Health Standards (BLM 2001).

Livestock grazing allotments in the decision area that do not meet BLM Utah Rangeland Health Standards due to livestock grazing are Rock Creek-Mudholes and Vermilion. Grazing was a contributing factor, but not the sole causal factor, for Standard 4 not being met in the Headwaters, Last Chance, and Nipple Bench Allotments. Standard 4 was not met for the Cottonwood, Coyote, Fortymile Ridge, and Upper Paria Allotments, but this was due to factors other than livestock grazing. There are additional allotments in the decision area that did not meet Standard 4 due to natural conditions and the geology. Because the factors for not meeting Standard 4 are not issues that the BLM can resolve through management, the allotments were considered to meet BLM Utah Rangeland Health Standards; those allotments are Deer Springs Point, Wahweap, and Wiregrass (BLM 2006).

Table 5-14 summarizes the allotments not meeting rangeland health standards and the actions taken since 2006. The BLM continues to monitor and assess rangeland conditions through a variety of landscape-scale and site-specific data, such AIM Strategy data, the Landscape Monitoring Framework, and the LANDFIRE Vegetation Condition Class. However, few land health assessments have been completed since 2006.

[4] Forage reserve allotments are a designation for a type of allotment on which there is no current term permit obligation for some portion or all of the estimated livestock grazing capacity, and where there has been a project-level environmental analysis and decision made to infrequently use the available forage on the allotment to enhance management flexibility for authorized livestock use or to achieve a desired vegetation condition.

Table 5-13
Livestock Grazing Season of Use, Permitted AUMs, and Actual Use AUMs

Allotment	Season of Use	Allotment Acres*	Active Use (AUMs)	Actual Use[a] (AUMs)					
				5-Year Average					25-Year Average (1996–2020)
				1996–2000	2001–2005	2006–2010	2011–2014[b]	2015–2020[c]	
Alvey Wash	May 15–September 30	72,400	1,424	1,476	807	682	356	776	819
Antone Flat[e]		15,000	none allocated						*Nonuse*
Big Bowns Bench[f]	November 1–March 31	7,800	750	857[d]			*Nonuse*	3[d]	172[d]
Big Horn	November 1–June 15	50,20015	3,515	2,426	1,366	1,102[d]	2,272[d]	1,812	1796[d]
Black Ridge	November 1–May 31	11,700	903	438	390	315	318[d]	324	357[d]
Black Rock	June 6–October 16	9,300	408	758	651[d]	153[d]	221[d]	218	400[d]
Black Rock (State)	June 6–October 16	1,300	64	*Actual use averages are included in the Black Rock section*					
Boot	August 1–October 31	2,700	45	45	29[d]	42	45	43	41[d]
Boulder Creek	September 1–December 31	4,500	80	48[d]	26[d]	8[d]	14[d]	36[d]	26[d]
Bull Run (State)	July 1–February 28	600	5	*No use of the allotment since the BLM acquired it in 1998*					
Bunting Trust (State)	May 15–November 30	200	16	10[d]	11	17	22	16	15[d]
Calf Pasture	June 10–August 10 *(even years)* August 10–October 15 *(odd years)*	2,800	176	67	34	76	60	62	60
Circle Cliffs	November 1–March 31	30,300	1,050	842	43	402	874[d]	763	585[d]
Clark Bench	November 1–April 30	25,200	1,238	894	330	344	293	522	477
Cockscomb	March 1–May 31	2,800	36	14	18	8	21	29	18
Collet	June 16–September 15	16,700	97	95[d]	72	84	77	64[d]	78[d]
Cottonwood	November 1–May 31	103,300	3,188	2,656	1,692	2,121	2,348[d]	2,713	2,306[d]
Coyote	November 1–May 31	38,900	2,044	1,594	650	1,331	943[d]	1,348	1,173[d]
Death Hollow	November 1–March 31 April 1–May 15	19,500	1,057	607	210	541	712[d]	693[d]	553[d]
Deer Creek	November 1–February 28	18,000	358	344	103	45	91	95	136
Deer Creek-Wolverine Pasture[g]	October 1–March 31	(3,800)	148	0	0	0	117	0	0
Deer Range	August 1–October 15	11,100	231	194	0	42	92	95	85
Deer Spring Point	June 10–October 17	25,000	585	499	229	164	206	134[d]	246

Allotment	Season of Use	Allotment Acres*	Active Use (AUMs)	Actual Use[a] (AUMs)					
				5-Year Average					25-Year Average (1996–2020)
				1996–2000	2001–2005	2006–2010	2011–2014[b]	2015–2020[c]	
Dry Valley	March 1–December 31 March 1–January 31 July 1–October 31	11,400	699	672	449	576	635	591	585
Escalante River[f]	none	59,300	unavailable						
First Point	June 1–December 31	3,000	410	132	69	41	*Nonuse*	203[d]	89
Five Mile Mountain	November 1–April 30	17,800	385	380	51	13	*Nonuse*	282	145
Flood Canyon	July 1–October 31	13,600	148	63	22	30	62	51[d]	46
Ford Well	June 10–October 9	9,100	300	256	242	44	267[d]	172[d]	196
Fortymile Ridge[f]	October 15–May 31	57,900	4,290	2,582	1,291	3,713	2,703[d]	2,116	2,481[d]
Granary Ranch	July 1–November 30	2,000	70	7	41	30	42	44	33
Hall Ranch	March 1–February 28	30	12	*Nonuse*[d]	*Nonuse*	11.5[d]	8[d]	4[d]	5[d]
Harveys Fear[f]		4,300	unavailable						
Haymaker Bench	November 1–February 28	3,200	100	58	70	61	76[d]	40[d]	61[d]
Headwaters	November 1–March 15	154,400	3,469	3,393	1,981	1,991	2,578	2,315	2,452
Hells Bellows	May 1–October 15	2,100	44	44	32	35	42[d]	52	41
Johnson Canyon	June 1–November 15	10,100	274	165	111	67	127	138	122
Johnson Lakes	June 1–November 30	11,100	347	306	179	112	286	228	222
Johnson Point	November 1– March 31	2,300	135	*Nonuse*	10	*Nonuse*	*Nonuse*	*Nonuse*	2
King Bench	November 1–March 31	54,300	1,515	1,144	980	311	1,315[d]	1,261	1002[d]
Lake[f]	June 1–September 30	22,700	1,310	1,116	80	485	320	648	530
Lake Powell[f]	October 15–March 15	400	20						*Nonuse*
Last Chance[f]	March 1–February 28	250,100	4,642	2,672	1,015	967	961	1,213	1,366
Little Bowns Bench[g]	October 1–March 31	3,400	130	0	0	0	141	0	135[d]
Locke Ridge	December 1–April 30	4,500	172	118	134	78[d]	98[d]	100	106[d]
Long Canyon Stock Driveway[e]		1,000	None allocated	*Nonuse*					
Long Neck[e]	May 1–May 31	200	None allocated	*Nonuse*					
Lower Cattle[f]	October 1–April 15	81,400	7,488	4,680	3,514	5,294	4,342[d]	4,786	4,523[d]
Lower Hackberry	October 15–March 15	20,200	435	222	67	152	446	329	243
Lower Warm Creek[f]	November 1–March 31	15,900	225	80	100	*Nonuse*	59	81[d]	64[d]
Main Canyon	June 1–September 30	300	14	8[d]	10	53	6	9[d]	17[d]
McGath Point[e]		3,100	None allocated	*Nonuse*					

Allotment	Season of Use	Allotment Acres*	Active Use (AUMs)	Actual Use[a] (AUMs)					
				5-Year Average					25-Year Average (1996–2020)
				1996–2000	2001–2005	2006–2010	2011–2014[b]	2015–2020[c]	
Meadow Canyon	September 1–November 30	4,700	144	135	103	79[d]	95	123	107[d]
Mollies Nipple	March 1–February 28	102,400	3,880	3,785	2,784	2,874	2,621[d]	2,834	2,980[d]
Moody[f]	November 1–March 31	43,300	909	712	391	270	401[d]	607	476[d]
Mud Springs	July 15–October 15	15,700	277	214	200	79	97	112	140
Muley Twist		2,200	unavailable						
Navajo Bench[f]		12,900	unavailable						
Neaf	March 1–November 30	1,300	9	7	*Nonuse*	2	*Nonuse*	*Nonuse*	2
Nipple Bench[f]	December 1–April 30	30,500	1,042	349	311	361	437[d]	341	360[d]
No Man's Mesa		1,500	unavailable						
Phipps[g]	October 1–March 31	10,400	140	0	0	0	122	40	101[d]
Pine Creek	September 16–October 31	3,800	144	60	78	7	105[d]	169	84[d]
Pine Creek (State)	November 1–January 31	600	27	*Actual use averages are included in the Pine Creek section*					
Pine Point	June 16–October 15	8,800	365	245	169	108	168	238	186
Rattlesnake Bench		3,600	unavailable						
Rock Creek-Mudholes[f]	March 1–February 28	76,800	2,173	1,381	*Nonuse*	954	1,348[d]	632	863[d]
Rock Reservoir	November 10–May 10	1,100	22						
Round Valley	November 1–March 31	9,900	522	419	253	316	298	283	314
Roy Willis	November 1–March 15	200	9	2	4	4	9	2[d]	4
Rush Beds	November 1–April 30	18,800	252	38	126	76	118[d]	51	82[d]
Salt Water Creek	March 16–June 15 October 16 –December 15	12,100	120						
School Section	May 1–April 30	800	102	30[d]	37	15[d]	29[d]	38	30[d]
Second Point	August 1–September 30	5,900	98	52	18	19[d]	9	59	31[d]
Sink Holes	November 1–April 1	6,600	154	110	*Nonuse*	8[d]	82[d]	150	70[d]
Slick Rock (State)	June 1–June 30	600	24	*Insufficient data*	*Insufficient data*	15	6	4[d]	5[d]
Soda[f]	October 1–May 31	70,400	2,798	1,744	642	2,230	1,001[d]	1,414	1,406[d]
South Fork	March 1–February 28	100	12	*Nonuse*	*Nonuse*	9	8	17	7[d]
Spencer Bench[f]		8,500							unavailable
Steep Creek	November 1–March 31 May 15–June 16	7,500	318	unavailable					
Swallow Park	May 1–October 31	16,500	1,076	621	509	514	387	592	525
Timber Mountain	June 16–October 15	7,700	426	287	223	174	96	209	198

Allotment	Season of Use	Allotment Acres*	Active Use (AUMs)	Actual Use[a] (AUMs)					
				5-Year Average					25-Year Average (1996–2020)
				1996–2000	2001–2005	2006–2010	2011–2014[b]	2015–2020[c]	
Unalloted (NPS)		1,600							
Upper Cattle[f]	November 1–June 15	92,400	8,158	5,606	4,774	7,276	4,598	3,911	5,233
Upper Hackberry	November 1–March 31 April 16–June 15	22,800	654	472	270	217	343[d]	448	350[d]
Upper Paria	May 1–June 10 May 1–September 30	111,200	2,833	2,277	738	1,282	1,396	1,490	1,437
Upper Warm Creek[f]	November 1–May 31	77,300	1,638	364	401	682	609[d]	1,115	634[d]
Varney Griffin		15,300	None allocated	*Nonuse*					
Vermilion	February 16–February 28, 2014 March 1–May 15 June 1–September 15 October 1–January 15	43,100	2,849	2,080	1,104	416	814[d]	1,296	1,142[d]
Wagon Box Mesa[f]	November 1–March 31	29,000	637	267	248	201	244[d]	298	252[d]
Wahweap	December 1–April 30	17,200	491	361	206	224	415	440	329[d]
White Rock	December 1–January 31	1,400	60	55	47	23	*Nonuse*[d]	*Nonuse*	25[d]
White Sage	May 6–June 5	2,500	76	64	33	15	*Nonuse*	*Nonuse*	22
Wide Hollow	October 1–December 31	3,800	353	265[d]	118	354	261	274	254[d]
Willow Gulch	November 1–March 31 December 1–January 31	12,900	474	188	22	28	18[d]	73	66[d]
Wiregrass[f]	November 1–March 31	19,600	99	342	3	*Nonuse*	16	19	76

Source: BLM GIS 2022

* Acres rounded to the nearest 100 acres

[a] Actual use is supplemented with billed use where actual use data are not available.

[b] 2011–2013 actual use averages are for a 3-year period.

[c] 2015–2020 actual use averages are for a 6-year period.

[d] Period includes years with nonuse. Some data for 2013 are not available and could not be included in the averages.

[e] Allotment previously unavailable to grazing or available but unalloted; currently available

[f] Allotment partially or wholly in Glen Canyon

[g] Forage reserve

Table 5-14
Allotments Not Meeting Rangeland Health Standards and Actions Taken Since 2006

Allotment	Standard Not Met				Changes to Grazing Management[1]	Assessments Since 2006 Determinations
	1	2	3	4		
Circle Cliffs	X	X	X		• Restored the Lampstand, Onion Beds, and Prospect pasture seedings (2,500 acres) • Limited grazing use in the Gulch pasture no later than March 15	Proper functioning condition (PFC) assessments 2007 and 2012
Collet		X	X		• Increased use supervision to control unauthorized livestock • Coordinated 28 percent voluntary nonuse to meet BLM resource objectives (2007 –2013)	PFC assessment 2012
Cottonwood		X		X[2]	• Upgraded and maintained the Coyote well, pipeline, and associated infrastructure • Maintained Jack Riggs and Butler Valley water systems • Voluntary nonuse of the riparian pasture to trailing and emergency use • Restored the Eight Mile seeding (2008–2009) • Installed solar pump on Butler Valley well (2012) • Implemented two separate experimental rotation systems	PFC assessments 2007, 2010, 2013 and 2014
Coyote	X		X	X[2]	• Restored 2,634 acres of seeded pasture (2009) • Upgraded and maintained the Coyote well, pipeline, and infrastructure	Restoration monitoring conducted annually for first 5 years after project completion
Death Hollow		X			• 100 percent voluntary nonuse to meet resource objectives (2006–2007); voluntary nonuse during spring in 2002–2006 and 2012 • Cleaned and reconstructed stock ponds between Wolverine and Horse Canyon (2008)	Riparian monitoring 2012; PFC assessments 2013
First Point		X			• Fenced First Point Spring to exclude livestock (2007) • Maintained off-site water at First Point Spring	PFC assessments 2007
Ford Well		X			• Fenced Old Corral Spring and Ford Well Spring to exclude livestock • Provided off-site water at both springs, improving distribution	PFC assessments 2007

Allotment	Standard Not Met				Changes to Grazing Management[1]	Assessments Since 2006 Determinations
	1	2	3	4		
Fortymile Ridge[3]		X		X[2]	• 22 percent voluntary nonuse to meet resource objectives (2006–2012) • Maintained spring protection fences (2008) • Maintained the Wilcox Spring protection fence • Returned a portion of the Wilcox Spring flow to spring to recover riparian vegetation (2010) • Used supplement to improve livestock distribution (2006 to present)	PFC assessments 2007 and 2014 Upland assessments 2014
Headwaters		X		X[4]	• Implemented invasive weed management starting in 2001 • Changed season of use, livestock off on March 15 • Limited livestock use in the Wahweap "Box" riparian area	PFC assessments 2010 and 2014
Hells Bellows		X			• 100 percent voluntary nonuse in 2007	PFC assessments 2007
Lake[3]		X	X		• Removed more than 80 feral cattle • Maintained pasture and spring protection fences • Complete nonuse of the allotment from 2001–2003 and 2007	PFC assessment 2007
Last Chance[3]		X		X[4]	• 76 percent voluntary nonuse to meet resource objectives (2006–2012) • Removed feral cattle from the allotment (2003–present) • Maintained exclosure fence around Relishen Seep (2005)	PFC assessments 2010 and 2014
Lower Cattle[3]		X	X		• 33 percent voluntary nonuse to meet resource objectives (2006–2012) • Implemented a water-controlled, deferred rest rotation grazing system to better manage livestock distribution (2007–present) • Maintained stock ponds to improve water availability and distribution • Used supplement to improve livestock distribution (2006-present) • Used water-based rotation/distribution	PFC assessments 2007, 2013, and 2014 Upland assessments 2014

Allotment	Standard Not Met				Changes to Grazing Management[1]	Assessments Since 2006 Determinations
	1	2	3	4		
Mollies Nipple	X	X	X		• Restored three seeded pastures • 27 percent voluntary nonuse to meet objectives (2006–2012) • Due to drought, made adjustment to livestock use • Administered deferred rest rotation • Maintained Seaman Wash pipeline (2007) • Fenced Wildcat Spring (2009) • Constructed water developments in the Buckskin pasture (Sink Hole and Buckskin catchments) • Maintained two stock ponds in Buckskin pasture in 2007 • Fenced and restored springs	PFC assessments 2010 and 2013 Upland assessments 2014
Nipple Bench[3]		X		X[4]	Livestock grazing is not the causal factor for not meeting rangeland health standards. The road through the riparian area is constricting the ability to move toward meeting standards.	N/A
Rock Creek-Mudholes[3]		X		X	• Removed more than 65 feral cattle (2006–2008) • Permittee removed more than 25 additional feral cattle (2009–present) • Maintained four spring fences • Maintained pasture fences • Implemented 100 percent nonuse to meet BLM resource objectives (2001–2006) • Coordinated partial voluntary nonuse (2007-present)	PFC assessments 2015
School Section			X		• Implemented 100 percent nonuse to meet resources objectives (2007–2010) • Approximately 70 percent voluntary nonuse (2009–present)	Upland assessments 2013
Soda[3]	X	X			• Removed more than 45 feral cattle (2003–2004) • Maintained Cottonwood Spring protection fence (2010) • Maintained stock ponds and catchments (2011) • Maintained and improved Hole in the Rock well (2008) • 100 percent nonuse to meet objectives (2002–2005) • Ensured that rotational grazing system would be avoided after March 31 on consecutive years	PFC assessments 2013 and 2014 Upland assessments 2014

Allotment	Standard Not Met				Changes to Grazing Management[1]	Assessments Since 2006 Determinations
	1	2	3	4		
Swallow Park		X			• In the Bullrush Hollow pasture voluntary season of use, deferred use in summer and critical spring growing season • Implemented voluntary partial nonuse to meet resource objectives (2001–2008)	PFC assessments 2010
Upper Paria	X	X		X[2]	• Repaired and maintained erosion control structures in the Mudholes pasture (2005) • Completed restoration on 300 acres of seeded pasture in the Mudholes and Upper Jim Hollow pastures (2005) • 39 percent voluntary nonuse to meet resource objectives (2003–2013) • Installed riparian spring protection fence at Between the Creeks Spring (2008) • Repaired and upgraded spring development and spring protection fence at Dick Ott Spring (2006) • Maintained and upgraded the Sheep Creek pipeline and cleaned Upper Jim stock ponds (2006) • Installed 1-acre monitoring exclosure in Mudholes seeding for frequency/cover monitoring	PFC assessments 2010
Vermilion	X	X	X	X	• Maintained Sand, Cole, and Nephi spring protection fences; restored spring boxes (2007) • Completed seeding restoration in Resource Conservation Areas 1, 2, and 3, and Fossil Wash pastures (2006) • 81 percent voluntary nonuse to meet resource objectives (2006–2012) • Completed Sink Holes catchment in Government Reservoir pasture • Maintained Fossil Wash stock pond (2007)	PFC assessments 2012, 2013, and 2014 Upland assessments 2014

Source: BLM 2006; BLM GIS 2022

[1]This list is not all inclusive it is intended to give the reader an indication of actions taken by the BLM and grazing permittees to make progress toward meeting rangeland health standards.

[2]Livestock grazing was determined not to be a cause in not meeting Standard 4.

[3]Allotment partially or wholly in Glen Canyon.

[4]Livestock grazing was determined to be a contributing factor in not meeting Standard 4.

5.4.3 Forecasts

The BLM forecasts that the demand for livestock forage and livestock permits will continue and likely increase. Kane and Garfield Counties have expressed interest in improved land health and increased grazing levels. Local ranchers have stressed the importance of the area to their ranching operations and the importance of ranching to their families. While the future demand for grazing on BLM-managed lands to help make local operations viable will likely increase, demands for other uses of BLM-managed lands will also increase. An overall increase in area visitation has also resulted in livestock grazing and recreational use conflicts (for example., access issues and range improvement damage).

There is direct competition for forage and water between livestock and wildlife in some areas, especially in riparian areas. However, there are a variety of structural and nonstructural range improvements across the decision area, including fences, corrals, cattle guards, line cabins, water pipelines, well developments, spring developments, stock ponds, water catchments, seedings, and vegetation enhancement projects. Range improvements are generally used to assist with livestock management, but some (for example, fences) are also used to assist with wildlife management. Development of more water sources has the potential to shift grazing from the areas that have a history of heavy use to areas previously not grazed or lightly grazed. In addition, water developments provide for the development of grazing management systems, which improve resource conditions. Fence-riding by operators and placing salt-licks can be employed to improve livestock distribution.

Existing and planned vegetation management provide quality habitat for wildlife and livestock. Vegetation management also involves rest from grazing for the establishment of seeded species.

5.5 Recreational Use and Visitor Services

5.5.1 Current Conditions

GSENM is situated directly in the middle of five national parks: Arches, Bryce Canyon, Canyonlands, Capitol Reef, and Zion. Visitation numbers at Zion National Park more than doubled since 2007, from 2,657,281 to 5,039,835 in 2021 visitor numbers at Bryce Canyon National Park increased from 1,012,563 in 2007 to 2,104,600 in 2021, an increase of approximately 108 percent (NPS 2022). In Capitol Reef National Park, just east of the decision area, visitation numbers increased by 153 percent in the same period.

The BLM reports recreation visitation estimates using the Recreation Management Information System (RMIS), which is an internal database. The RMIS estimates participation in 65 types of recreational activities recorded at BLM sites and areas, based on registrations, permit records, observations, and professional judgment. Visitation is estimated by the number of visitors and visitor days. Visitors are the actual number of people who take part in a recreational activity. A visitor day is a common recreation unit of measure used among federal agencies that represents an aggregate of 12 visitor hours at a single site or area. **Table 5-15** lists RMIS data from 2010 through 2021. Visitor numbers at GSENM have increased from 742,586 in 2010 to 1,371,036 in 2021, an increase of approximately 85 percent (RMIS 2022; BLM GIS 2022). RMIS data reflects recreation management area (RMA) designations for the 2000 MMP (**Figure 5-8, Appendix B**); however, these designations were changed in the 2020 RMP (**Figure 5-9, Appendix B**).

Table 5-15
Visitation in the Planning Area from 2010 through 2021

GSENM Unit*	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020**	2021
Escalante Canyons SRMA	162,624	126,388	168,706	174,046	212,597	227,016	290,572	291,130	315,528	287,542	284,799	379,645
50 Mile Mountain SRMA	700	952	998	4,483	819	1,118	24	35	564	748	510	568
Highway 12 Corridor SRMA	310,520	333,189	301,686	277,997	310,610	308,555	230,908	275,502	312,653	314,423	237,218	290,621
Highway 89 Corridor SRMA	122,196	123,810	139,588	149,223	156,703	138,296	123,914	172,265	216,144	209,650	164,953	170,014
Pariah Canyon-Vermilion Cliffs SRMA	75	64	48	124	49,159	47,593	81,200	37,011	71,289	63,404	63,673	131,267
Paria/Hackberry SRMA	133,698	142,105	146,340	156,329	173,216	159,766	187,130	199,036	221,350	223,391	199,950	286,006
Total Visitation	742,586	751,678	788,817	797,282	917,319	912,054	926,235	982,993	1,157,916	1,118,102	959,234	1,371,036

Sources: RMIS 2022; BLM 2000
*GSENM units reflect the 2000 MMP (BLM 2000)
**The decrease in visitors in 2020 was largely due to temporary closures and other restrictions resulting from the COVID-19 pandemic.

Recreation levels in the planning area have been monitored for many years; however, recorded visitor numbers are only a representation of the actual level of recreation use. This can be attributed to multiple access points, lack of permit compliance, and the BLM's inability to count visitation in every location. Many areas lack direct visitation monitoring facilities such as traffic counters or visitor registers. Direct monitoring by BLM personnel is focused on areas of highest use or conflict. Discrepancies in actual use are also a result of the remote nature of much of the planning area that does not receive frequent monitoring. In addition, many popular use areas and trails are not designated, and there is currently no way to accurately determine the actual amount of recreational use these areas receive. Known types of recreational use in the area include hiking, camping, backpacking, all-terrain vehicles (ATVs) and utility-task vehicles (UTVs), automobile touring, equestrian activities, canyoneering, rock climbing, wildlife viewing, photography, and hunting. ATV and UTV use has become one of the fastest-growing—and one of the most controversial—recreational activities.

Recreation Management Areas

RMAs are the BLM's land use planning-level tool for managing recreational use of the public lands. Public lands are identified for recreation as a SRMA or an extensive recreation management area (ERMA). All lands that are not designated as either a SRMA or ERMA are considered public lands not designated as RMAs or non-RMA lands.

SRMAs recognize unique and distinctive recreation values; those values are managed to enhance a targeted set of activities, experiences, benefits, and recreation setting characteristics, which become the priority management focus. These areas often have high levels of recreation or valuable natural resources. ERMAs recognize existing recreational use, demand, or recreation and visitor services program investments. They are managed commensurate with other resources and resource uses to sustain the ERMA's principal recreational activities and associated qualities and conditions.

A recreation management area may be subdivided into recreation management zones (RMZs) to further delineate specific recreation opportunities (for example, mountain bike focus area). SRMAs may be subdivided into RMZs with discrete objectives. SRMA/RMZ objectives must define the specific

recreation opportunities (that is, activities, experiences, and benefits derived from those experiences), which become the focus of recreation and visitor services management. ERMAs may be subdivided into RMZs to ensure recreation and visitor services are managed commensurate with the management of other resources and resource uses.

For non-RMA lands, the BLM manages the lands to meet basic recreation and visitor services and resource stewardship needs. Recreation is not emphasized on these lands; however, recreation activities may occur, except on those lands closed to public use. Recreation and visitor services are managed to allow recreational uses that are not in conflict with the primary uses of these lands.

Currently, the BLM manages five SRMAs and two ERMAs in GSENM. These areas are shown in **Figure 5-9, Appendix B**.

SRMAs

- Burr Trail (6,600 acres), including the Deer Creek RMZ (600 acres) and the Gulch RMZ (100 acres)
- Calf Creek (7,000 acres)
- Hole-in-the-Rock Road (32,300 acres), including the Dance Hall Rock RMZ (600 acres); Dry Fork Wash RMZ (1,200 acres); Devil's Garden RMZ (600 acres); 20-Mile Dinosaur Tracks RMZ (300 acres); and Egypt Slot Canyons RMZ (6,200 acres)
- Skutumpah (1,500 acres)
- Paria Canyon Vermilion Cliffs (30,000 acres)

ERMAs

- GSENM (991,500 acres), including the Cottonwood Road RMZ (2,200 acres)
- KEPA (814,000 acres), including the Little Desert RMZ (2,500 acres) and the Cottonwood Road RMZ (3,100 acres)

Developed Recreation Sites

Developed recreation sites are areas that incorporate visitor use with infrastructure such as roads, parking areas, and facilities that protect the resource and support recreation users in their pursuit of activities, experiences, and benefits. Examples of these sites are listed in **Table 5-16**. Visitor-use infrastructure is a management tool that can minimize impacts on resources, concentrate use, and reduce visitor conflicts. Developed recreation sites help accomplish these goals.

Table 5-16
Current Day Use Sites and Trailheads by Unit

RMA*	Day Use Site or Contact Station	Campground	Trailhead	Point of Interest
Escalante Canyons	Calf Creek Recreation Area	Calf Creek Deer Creek	Boulder Mail Calf Creek Upper Falls Cedar Wash Dinosaur Track Site Dry Fork Coyote Gulch Early Weed Egypt Escalante River Escalante Town Forty Mile Harris Wash Horse Canyon Hurricane Wash Little Death Hollow Red Well The Gulch Wolverine	Dance Hall Rock Devil's Garden Outstanding Natural Areas (ONAs)/Instant Study Areas (ISAs)
Highway 12 Corridor	Cannonville Visitor Center Escalante Visitor Center		Henderson Canyon Escalante River Escalante Town	Highway 12 Blues Overlook Highway 12 Boynton Overlook Highway 12 Fremont Granary Highway 12 Head of the Rocks Highway 12 Hogback Highway 12 Hole in the Rock
Highway 89 Corridor	Big Water Visitor Center Kanab Visitor Center		Toad Stools	
Monument Extensive	Croton Road Death Ridge Four Mile Bench Smoky Mountain			
Paria Canyons and Plateaus	Buckskin Mountain			
Paria/Hackberry	Bull Valley Gorge Kitchen Corral Nephi Pasture Pahreah Old Town Site Paria Contact Station Paria Movie Set Rock Springs Bench		Cottonwood Narrows Lick Wash Lower Hackberry Round Valley Draw Sheep Creek/Upper Paria Willis Creek	Grosvenor Arch

Sources: RMIS 2022; BLM 2000
*RMAs reflect the 2000 MMP, hence the difference in names (BLM 2000)

Commercial, Competitive, and Organized Group Recreation

As authorized by the Federal Lands Recreation Enhancement Act, there are five types of uses for which special recreation permits (SRPs) are required: commercial, competitive, vending, individual or group use in special areas, and organized group activity and event use. SRPs are issued to outfitters, guides, vendors, recreation clubs, and commercial competitive event organizers that provide recreation opportunities or services without using permanent facilities. The permits are issued to manage visitor use, protect natural and cultural resources, and accommodate commercial recreational uses. The BLM issues SRPs for noncommercial use in certain special areas where a permit system for individual use would achieve management objectives. Large noncommercial group activities outside developed campgrounds could require a SRP, if necessary, to meet planned resource management objectives or resource conditions. If the group or activity does not warrant a SRP, a letter of agreement is often used.

The SRP activities often offer a specialized opportunity for the recreating public to experience activities that they themselves do not have the skills, equipment, or resource knowledge to perform independently. Some recreational use can be estimated through recreational activities requiring special permits. **Table 5-17** lists the numbers and types of SRPs (RMIS data). Demand for SRPs has been increasing in the planning area. In 2021, the BLM issued 144 permits for activities including hiking, backpacking, vehicle and OHV tours, shuttle services, horseback rides, pack stock services, canyoneering, historical and educational programs, photography workshops, bicycle tours, hunting outfitters, therapeutic youth programs, and vending services.

Table 5-17
Special Recreation Permits

Recreational Activity	Current Permits
Art festival event	1
ATV jamboree	2
Canyoneering	6
Cycling	6
Glamping	1
Hiking/backpacking	41
Horseback riding	9
Hunting	25
Llama pack trips	2
Outdoor education	20
Photography tours	8
OHV/vehicle/sightseeing tours	19
Vending (Calf Creek firewood)	1
Wilderness therapy	1
Total Permits	**142**

Source: BLM-Paria River District 2022

ATV/UTV use has become a substantial component of recreational use. This increase is due to growing ATV/UTV popularity, changes in demographics, increased commercial availability (purchase and rental opportunities), and marketing of multi-passenger ATVs/UTVs. The Nephi Pasture region is a popular ATV/UTV recreation destination. Some locations receive unmanaged, intensive ATV/UTV use based on landscape characteristics and easy access from local communities.

5.5.2 Trends

Recreational use is increasing throughout southwestern Utah, including GSENM. As recreational use increases throughout GSENM, conflicts between recreation and other uses, such as range and mining, are also increasing. Recreation specifically conflicts with rangeland resources when camping occurs adjacent to range facilities, including corrals, gates, and water troughs. There are frequent reports of camping occurring near gravel pits, which prevents access for open-pit mining. While camping stays are usually limited to 14 days throughout GSENM, there is an increasing issue with visitors camping greatly in excess of this stay limit which can result in user conflicts or impacts to other resources.

Increased visitor use also creates more challenges for law enforcement. Graffiti, inadvertent damage, and vandalism are issues, particularly around cultural sites. For example, the BLM prohibits camping, fires, and climbing in alcoves (BLM 2020a); however, this is difficult to enforce due to the large number of alcoves in GSENM and limited law enforcement personnel.

The Little Desert OHV open area is open to cross-country travel, resulting in resource damage that could be considered inconsistent with the protection of GSENM's objects and values.

Mountain biking and e-bike use is becoming increasingly popular in GSENM—and in the southwest Utah region, in general. This presents a need for GSENM management to consider additional trails designated for mountain bike and/or e-bike use. Proclamation 10286 does not address e-biking in GSENM.

In the planning area, an example of the growth in tourism and recreation is the request for SRPs for commercial services and events. Applications for SRPs to conduct commercial services on public lands has increased 227 percent over the past 17 years; these activities are anticipated to increase in the future as the public continues to spend more time on public lands. In the last few years, the BLM has received SRP applications to authorize bike tours and races, photography workshops, running races, OHV events, and historical and cultural events. The BLM will likely receive more permit applications for similar and other identified activities in the future. These events generally receive regionwide publicity, with event organizers seeking out-of-area distribution and participation. The BLM office in the planning area will continue to be responsive to applicants while carefully considering SRP applications to a high standard. The BLM should coordinate efforts to authorize commercial and organized activities across unit boundaries.

The popularity of drones has increased in recent years, as most have become more affordable to the public. Drones are banned in several national monuments and state parks, and are temporarily banned in national parks due to safety, noise, and impacts on wildlife. Proclamation 10286 does not address drone use in GSENM. The launching and landing of drones (or unmanned aircraft systems) are managed as OHV by the BLM per policy manual 1626.

5.5.3 Forecasts

Recreation use in the planning area is expected to increase due to the overall growing trend of people seeking public lands and the opportunities these lands provide. Without active management, natural resource conditions and the quality of the recreation experience would decline with increased recreational use.

Several factors contribute to the anticipated increase in use, including the following:

- Marketing of travel and tourism to southern Utah
- Displacement from national parks due to overcrowding
- Increasing leisure time and disposable income for the working population
- An increasingly active retired population with more disposable income
- An increase in Utah's population
- Rapidly evolving forms of recreation and new vehicles and gear for pursuing recreational activities
- A focus on the importance of natural resource-based recreation among the increasingly urbanized population
- The increasing importance of recreation as a component of the local and regional economic base, surpassing traditional industries in many areas
- The increasing popularity of outdoor recreation as a family-oriented activity

Recreation Management Areas

SRMA, ERMA, and non-RMA boundaries require revaluation based on updated GSENM boundaries and as required by BLM policy handbook H-8320-1.

ATV/UTV Use

ATV/UTV recreation is expected to intensify in high-demand areas and adjacent to communities. Most recreational activities in GSENM occur primarily during spring, summer, and fall. However, there has been a steady increase in winter recreation, particularly in Nephi Pasture, where local communities are utilizing ATVs/UTVs. Existing management efforts and processes, which were developed to address ATV recreation levels 20 years ago, are often inadequate. ATV and newer UTV recreation in some areas is expected to continue to involve resource and road damage and user conflicts.

Mountain Bike Use

There are many parts of GSENM that provide good opportunities for the mountain biker and/or e-biker to enjoy the scenic and rugged landscapes. Most routes are suitable for and traveled by four-wheel vehicles. No route in the area is formally developed or signed for mountain biking or e-bikes.

5.6 TRAVEL, TRANSPORTATION, AND ACCESS MANAGEMENT

5.6.1 Current Conditions

Current transportation and access routes into and through the decision area consist of federal and state highways; BLM roads, primitive roads, and trails; county road systems; and right-of-way (ROW) access roads. The transportation system encompasses approximately 2,400 miles of routes. Two paved roads provide access to GSENM: Highway US 89 on the south and State Route 12 on the north. The current travel system is shown on **Figure 5-10, Appendix B**.

Highways and main roads allow access to BLM-managed lands in the planning area. These are Burr Trail Road, Highway 12, Hole-in-the Rock Road, Skutumpah Road, Cottonwood Road, House Rock Valley Road, and Smoky Mountain Road. Secondary paved and unpaved roads used heavily by the public primarily include roads maintained by Kane and Garfield Counties. The combination of these road systems creates the access web for current uses.

All OHV (refers to all public motorized vehicles, including passenger cars and trucks) and mechanized (such as bicycles) travel within the decision area are limited to routes designated for those purposes. OHV use on BLM-administered lands provides for access, experience, and connectivity as outlined in BLM Handbook H-1626. **Table 5-18** displays the existing travel designations in the planning area per the 2020 Approved RMPs (BLM 2020a, 2020b). Mechanized travel is allowed on trails designated for that use as well as on routes and areas designated for OHV use, unless specifically prohibited. Most of the State- and county-maintained roads have either an existing BLM-issued ROW or are claimed as Revised Statute 2477[5] roads by the counties.

Table 5-18
Existing Travel Designations

Travel Designations	Acres
Open	100
Limited	1,863,700
Closed	1,500

Sources: BLM 2020a, 2020b; BLM GIS 2022

The GSENM 2020 ROD amended the GSENM Travel Management Plan (BLM 2000) to include the V-Road and Inchworm Arch Road, as open and available for OHV use. These routes are currently used by local residents and tourists to access certain archaeological and geological sites in GSENM. Please refer to the GSENM 2020 ROD for more information regarding the re-designation of these two routes (BLM 2020a).

Currently only ATVs/UTVs and high-clearance, four-wheel-drive vehicles can access the end of V-Road. This is due to deep sand and erosion damage along the old roadway. V-Road is used to access the Cosmic Vortex geological feature and allows livestock operators to access their cattle without needing specific BLM authorization. The Inchworm Arch Road crosses through an area with a high density of cultural resources and portions of two archaeological sites. The route provides the only OHV access to a natural arch site, and it receives use from ATVs/UTVs. The Inchworm Arch Road provides access for recreation opportunities associated with Inchworm Arch as well as access for those seeking opportunities for hunting, shooting, and other uses.

In addition to arterial and collector routes, there are numerous tertiary routes that connect more remote locations to the larger roads. These routes are used for recreation purposes, access to range improvements, and access to inholdings not managed by the BLM. Most of these roads and routes are not paved; most are unimproved, consisting of dirt, clay, or gravel surfaces. The decision area has a few

[5] The State of Utah and counties may hold valid existing ROWs in the Planning Area pursuant to Revised Statute 2477, Act of July 28, 1866, Chapter 262, 8,14; Stat. 252, 253, codified at 43 USC 932. Congress repealed Revised Statute 2477 through passage of FLPMA. Revised Statute 2477 rights are determined through a process that is entirely independent of the BLM's land use planning process. BLM RMPs are founded on an independently determined purpose and need that is based on resource uses and associated access to public lands and waters. This planning effort is not intended to provide any evidence bearing on or addressing the validity of any Revised Statute 2477 assertions and do not adjudicate, analyze, or otherwise determine the validity of claimed ROWs. Nothing in BLM RMPs extinguish any valid ROW, or alter in any way the legal rights the State and counties have to assert and protect Revised Statute 2477 rights or to challenge in Federal court or other appropriate venue any use restrictions imposed by RMPs that they believe are inconsistent with their rights. At such time as an administrative determination acknowledges a ROW or a binding judicial decision confirms a ROW, the BLM will adjust its management accordingly, if necessary.

abandoned backcountry airstrips on BLM-managed land in the area. Some of these are within wilderness study areas (WSAs). The New Home Bench airstrip near Boulder is the only airstrip maintained and identified in the 2000 MMP (BLM 2000).

Although most use on existing roads, primitive roads, and trails on BLM-managed land in the planning area are available for use by the general public, other travel considerations associated with administrative use and authorized actions, such as livestock grazing, forestry, and emergency purposes, may be considered during the planning process and during implementation-level travel management development.

ATV/UTV use also has become a popular method of recreation and a means of transportation while hunting, fishing, or camping. ATV/UTV use has become a significant use due to the increase in the number of users who participate in this recreation opportunity, the increased commercial availability (purchase and rental opportunities), and marketing of multi-passenger ATVs and UTVs. ATVs and UTVs are also often driven by local ranchers for administration of their grazing operations.

UTVs are larger than ATVs, often encumbering the entire width of routes. This can create a safety hazard on narrow roads. Additionally, UTVs are more powerful and have greater off-road capabilities; they can result in greater resource impacts, including dust, soil and vegetation compaction, and disturbances to wildlife and other users. They can also change the composition of roads by adding berms to roads, which make it challenging for normal pickup vehicles to navigate. This results in roads requiring continual maintenance to ensure accessibility for all vehicles.

Within the planning area, there are currently 35 developed trailheads; however, the 3-mile Lower Calf Creek Falls Trail is the only designated trail in GSENM. Backcountry trails are the primary means of nonmotorized travel, as many so-called trails change over time due to flooding, a lack of use, or simply because the route crosses slick rock or sand dunes and is not easily identifiable. Trail cairns are sometimes used to mark routes. In many cases, route braiding occurs, or a proliferation of rock cairns is created.

There are several scenic drives in GSENM. These are addressed in **Section 5.20**, Special Designations for Conservation and Protection.

5.6.2 Trends

Currently, high-use recreation areas experience heavy traffic demands that frequently require physical management during high-use periods (weekends, holidays, and school breaks in the spring and fall months). Additionally, there is a lack of adequate parking at popular recreation areas for the public during high-use periods, which can pose a public health and safety concern.

There are frequent public reports of unauthorized cross-country OHV travel in GSENM; however, some of these are BLM-authorized uses by permit holders. These roads are not clearly designated as such in current maps and signage. Additionally, there is inconsistency with on-the-ground and map signage. For example, some signs include county road numbers, while others use BLM road numbers. Clarifying which roads are open and closed to the public and improving the overall signage program present two management opportunities for the BLM.

Over the past 20 years, ATV/UTV use has become one of the fastest-growing recreational activities in southwestern Utah, drawing thousands of visitors each year. Visitors are drawn to this area to experience the numerous roads and trails available for ATV/UTV use, the diverse backcountry opportunities and spectacular scenery the area provides, and the challenging ATV/ UTV opportunities the landscape and terrain provide. This trend is expected to continue.

5.6.3 Forecasts

Visitation is increasing in Kane and Garfield Counties, which is expected to result in increased public demand on some routes within the existing transportation system. Increased travel across BLM-managed lands by motorized and nonmotorized equipment could increase the need to manage, maintain, and, in some cases, improve the current transportation system on some routes. The undeveloped nature of the area is highly valued by certain user groups, and the BLM would need to carefully consider development and improvements.

ATV/UTV travel is expected to intensify in high-demand areas and adjacent to communities. ATV/UTV management in some areas no longer adequately addresses the issues that are arising because of increasing ATV/UTV travel. This has resulted in conflicts that vary by location. Existing management efforts and processes, which were developed to address ATV/UTV travel levels 20 years ago, are often inadequate. The use of ATVs and newer UTVs and the associated resource and user conflicts are expected to grow.

5.7 Cultural Resource Management, Native American Religious Concerns, and Tribal Use

5.7.1 Current Conditions

Cultural resources consist of historic properties, which include archaeological and architectural resources. They are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places, as well as traditional resources. All of these may be considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. Archaeological resources are areas where prehistoric or historic activity altered the earth or where deposits of physical remains are discovered. Prehistoric archaeological resources are those materials deposited or left behind before the general Historic period (the time recorded by Euro-American history in Utah). Historic archaeological resources are those materials deposited or left behind during the general Historic period.

Architectural resources include standing structures of historic value. Traditional resources can include archaeological resources, structures, topographic features, habitats, plants, wildlife, and minerals that American Indians or other groups consider essential for the preservation of traditional culture and traditional values. Traditional values of living communities can be manifested at locations called traditional cultural properties, American Indian sacred sites, or cultural landscapes.

This section discusses both prehistoric and historic developments in and around GSENM. Southern Utah contains one of the richest records of prehistoric archaeology in the United States. The record is dominated by the remains of cultural material from Ancestral Puebloans (Virgin Branch) and Fremont People, although previous occupation by "preceramic" foragers and farmers is abundant. The area also shows considerable evidence of occupation by ethnohistoric and historic peoples in the following centuries. These cultures are broken down into four broad prehistoric periods in the GSENM area

(Spangler and Zweifel 2021): the Paleoarchaic (10,000–8000 BC), the Archaic (8000–1000 BC), the Formative (500 BC–AD 1300), and the Late Prehistoric (AD 1300–1775). These periods are then followed by the Historic period (post-AD 1776).

In this chapter, dates in years before present (BP) and also with calendrical dates using BC and AD are provided for the Paleoindian and Archaic periods, while calendrical dates using BC and AD are used for the Formative, Late Prehistoric, and Historic periods. The Late Prehistoric period ended when Euro-American explorers and settlers arrived in the region, which marks the beginning of the Historic period.

Paleoarchaic Period

The earliest conclusive evidence for a human presence in the northern Colorado Plateau region dates to just before 11,000 years BP or to approximately 13,000 calendar years ago (Beck and Jones 1997; Graf and Schmitt 2007). For the GSENM region, the Paleoarchaic period is considered to have occurred between 10,000 and 8000 BC (Spangler and Zweifel 2021:29). For decades, archaeologists believed that the earliest humans in the Americas were big game hunters who targeted Pleistocene megafauna; this period and lifeway were referred to as Paleoindian. More recently, a distinct adaptation known as the Paleoarchaic has been recognized west of the Rocky Mountains, which is typified by a distinct tool kit and broader-based subsistence than that found among Paleoindian groups found on the Great Plains and east of the Colorado River. GSENM is found near the boundary of these two adaptations, and artifacts that are associated with both groups are found in this region (Spangler and Zweifel 2021). Here, Paleoindian refers to the earliest period of occupation in the region (approximately 11,000 to 10,000 BP), while the Early Archaic period (10,000–6000 BP) encompasses the period during which Paleoarchaic adaptations merge into Archaic lifeways.

The Paleoindian period represents adaptations to terminal Pleistocene environments and is characterized by small groups of highly mobile foragers who used most sites only briefly or infrequently. This stage is further split into three traditions named for their characteristic projectile points: Clovis (12,000 to 11,000 BP), Folsom (11,000 to 10,300 BP), and Plano (10,300 to 9800 BP). The primary difference among these traditions is the slight variability in projectile point form that they exhibit, which likely resulted from changing environments and subsistence strategies. In many cases, Paleoindian-associated artifacts are found in lower elevations along major river valleys where Pleistocene megafauna congregated. As the climate warmed and vegetation changed, Plano peoples also began to exploit resources found in higher elevations, such as the La Sal Mountains.

Paleoindian archaeological materials are rare on the Colorado Plateau, especially in comparison with the Great Plains region to the east and the Great Basin region to the west (Spangler et al. 2010:56). However, sites such as Joes Valley Alcove, Cowboy Cave, and Joe Walter Cave on the Colorado Plateau, and specifically North Creek Shelter in GSENM, provide a variety of information about both the Paleoenvironment of the period and their inhabitants (Spangler and Zweifel 2021). North Creek Shelter's earliest strata demonstrate repeated use between approximately 11,500 and 10,000 years ago (Janetski 2011; Janetski et al. 2012).

Diagnostic projectile points from this period include fluted (Clovis and Folsom) and non-fluted (Plano complex), as well as large stemmed projectile points of the Great Basin/Western Stemmed varieties, such as North Creek Stemmed points found in the earliest deposits at North Creek Shelter (Spangler and Zweifel 2021). In GSENM, a Clovis point found by a private individual in Johnson Canyon was not

associated with any other artifacts, whereas one found near Boulder was found by a private individual within the context of a large lithic scatter (Spangler and Zweifel 2021:39). The Paleoindian archaeological record typically consists of isolated projectile points, features, or artifact scatters and kill sites, rock imagery, and small, open campsites.

Archaic Period

The Archaic period spans approximately 8000 to 1000 BC (Spangler and Zweifel 2021:49) Previously, Matson (1991) divided the Archaic into four subperiods: early, middle, late, and terminal. Recent radiocarbon dates suggest that site types, site complexity, and spatial patterning remain consistent throughout the Archaic period, and that these subperiod divisions are misleading. However, minor adaptive variations do appear to correspond with well-established periods of climatic change during the early, middle, and late Holocene (Spangler and Zweifel 2021).

The Archaic period encompasses the early Holocene (10,000 to 7500 BP) and middle Holocene (7500 to 4500 BP) periods of warm and increasingly dry climate, through the middle-late Holocene transition (4500 to 3000 BP) when the climate began to approach modern conditions (Grayson 1993, 2011). For the broad eastern Great Basin and northern Colorado Plateau region, environmental changes during the period leading up to and including the middle Holocene have been particularly well documented at Homestead Cave (Madsen 2000). These records indicate increased mean temperatures, increased aridity, and corresponding changes in vegetation, such as a substantial increase in the abundance of shadscale relative to sagebrush. Mixed-conifer forests retreated to higher elevations, and pinyon pine approached its modern distribution during this period (Rhode and Madsen 1998; Spangler and Zweifel 2021).

These environmental changes correspond with the changes in Archaic lifeways and technology. Early Holocene foragers broadened their subsistence to encompass a variety of smaller mammals, birds, and fish, alongside the collection of desert plants and small seeds. Excavations at North Creek Shelter show that earlier stemmed projectile points had been replaced by dart points by around 10,000 BP, and ground stone tools that represent dedicated small seed processing technology first appear around the same time. As aridity increased between 9000 and 7000 BP, the later strata at North Creek Shelter indicate its inhabitants spent more time collecting and processing plant foods to supplement large game (Janetski et al. 2012; Spangler and Zweifel 2021).

During the early Holocene, people were generally quite mobile, occupying a variety of task-specific sites (Simms 2008). On the Colorado Plateau, adaptive shifts and increased relative mobility likely explain gaps in the data from this period (Geib 1995). As noted by Spangler and Zweifel (2021), this mobility is evidence of less-common, longer-term residential bases in regional alcoves and rock shelters, including North Creek Shelter (Janetski et al. 2012), Dust Devil Cave (Ambler 1996), Sand Dune Cave (Lindsay et al. 1968), and Broken Arrow Cave (Talbot et al. 1999). No sites from GSENM have produced early Holocene radiocarbon dates (Spangler and Zweifel 2021:60). The archaeological record of Early Archaic use is derived entirely from sites dated through projectile point chronologies.

Spangler and Zweifel state (2021:75), "Little is known about middle Holocene adaptations in GSENM specifically, although 19 radiocarbon dates have been reported from 15 sites within or in close proximity to GSENM." Key middle Holocene sites in GSENM include Rodent Ridge, Jackrabbit Roast, Casa del Fuego, and Durffeys Kitchen (Spangler and Zweifel 2021:76–78). The previous impression that middle

Holocene climatic change resulted in the large-scale abandonment of the northern Colorado Plateau has been revised based on a growing number of radiocarbon dates at open and sheltered sites.

The middle Holocene is generally characterized by increasing heat and periodic drought conditions. As a result, the use of short-term foraging camps increased, and some lower-elevation base camps in and around GSENM without access to water may have seen reduced visitation or temporary abandonment. However, repeated seasonal use appears to have continued at sites located near permanent water sources, and there may have been increased residential and logistical use of cooler, wetter upland settings. In contrast, increasingly arid conditions at lower elevations may have created ideal environments for seed-bearing grasses to proliferate, intensifying the use of those resources (Spangler and Zweifel 2021).

Spangler and Zweifel note (2021:84 – 86), "Most of what is known about late Archaic adaptations in the GSENM region comes from investigations in the Glen Canyon and lower Escalante River areas, and from excavations at the Arroyo Site and Jackrabbit Roast in the Grand Staircase area." The onset of the late Holocene (circa 4500 BP) coincides with a drop in both the high temperatures and aridity associated with the middle Holocene, but this was still a period of significant climatic instability. The climate was like today's, with alternating wetter and dryer conditions over time. Pinyon forests that had retreated to higher elevations during the middle Holocene once again extended into mid-elevation ranges, which may have boosted their productivity (Bungart 1996). As a result, the population appears to have increased after 4000 BP, with evidence of larger groups coming together at times, possibly for communal hunting purposes (Spangler and Zweifel 2021).

Projectile points that first appear during the early Holocene consist of Pinto Series points, Elko Series points, and Humboldt Concave-base points. However, Elko Series points persist over a long span of time and are not solely diagnostic of the Archaic period. Large side-notched dart points (Northern, Sudden, Hawken, Rocker, and Sand Dune types) first appear during the middle Holocene. Projectile points that first appear during the late Holocene transition in the GSENM area consist of Gypsum, McKean, and San Rafael Side-notched points. However, the production of gypsum projectile points persisted into the Formative period (Spangler and Zweifel 2021).

Ground stone became more prominent in assemblages throughout the Archaic period. Trade in exotic or hard-to-find items, such as obsidian, turquoise, and marine shells, became more common. The presence of basketry, netting, and snares are diagnostic of the general Archaic period. Some rock imagery elements are also diagnostic of the general Archaic period. The oldest Archaic style in the area was Glen Canyon Linear, with Barrier Canyon Style and Glen Canyon Linear rock imagery elements appearing at the end of the Archaic. Split-twig figurines, which are diagnostic of the end of the Archaic period on the Colorado Plateau and have been found in the Grand Canyon and San Rafael Desert, have not yet been identified at any sites in GSENM (Spangler and Zweifel 2021).

Formative Period

The Formative period is marked by an emphasis on domesticated plants, most notably maize (*Zea mays*), to supplement foraging; sedentary or semisedentary settlement near areas optimal for horticulture; and the introduction of pottery (Horn et al. 1994; Matson 1991). The Formative period in southern Utah is represented by Ancestral Puebloan (Virgin Branch) and Fremont occupation. The culture phase sequence used here follows the classification system proposed by A. V. Kidder at the first Pecos

Conference in 1927. Although errors have been identified in this system, it is still used as a general starting point.

Ancestral Puebloan (Virgin Branch)

Basketmaker II/Early Agricultural

The transitional period when foragers began to cultivate plants in the Escalante River region (circa 1000 BC to AD 500) has previously been called the Basketmaker II period (McFadden 2016), despite criticism around the use of this term in this region. In other sources, this transition is referred to as the early Agricultural period (Geib 1996; Spangler and Zweifel 2021). This transitional period is marked by an increasingly sedentary settlement system, the advent of more substantial dwellings and storage systems, and an increasing reliance on maize and squash horticulture (Burrillo 2016). Although foraging for wild plants and hunting did not cease for all groups, there was a trend toward seasonal sedentism until settlement in small villages or hamlets replaced the nomadism of the Archaic period (Dohm 1994; Lipe 1999; Matson and Chisholm 1991).

There appears to be some differentiation in the various regions of GSENM when it comes to reliance on maize. Grand Staircase groups were heavily focused on maize and squash cultivation; farmer-foragers inhabited the Escalante River basin, and groups on the Kaiparowits Plateau maintained a focus on foraging (Spangler and Zweifel 2021). Starting in circa 100 BC, people built open-air, relatively substantial pit houses in higher upland areas that also offered floodwater farming potential; however, by the AD 300s, populations clustered into neighborhoods of pit houses in open upland settings in areas more suited to dry farming than floodwater farming (Dohm 1994; Matson and Chisholm 1991).

Artifact assemblages during this period were marked by the general absence of pottery and increase in hunting implements, including atlatls, curved throwing sticks, rabbit nets, and a variety of snares. Petroglyphs and pictographs were also relatively common features during this period, including San Juan Anthropomorphic and Basketmaker II styles.

Basketmaker III

In general, Basketmaker III sites (AD 500–750) on the Colorado Plateau in general and specifically in GSENM are numerous and have been well researched (Spangler and Zweifel 2021:232). The tool, faunal, and macrobotanical inventories from this period from a wide range of sites indicate that exploitation of wild resources continued, but farming had become the predominant subsistence activity. The widespread adoption of ceramic vessels during the Basketmaker III period marks the appearance of ceramic production in the local archaeology, including ceramic firing pits, or kilns. Common ceramics found at GSENM Basketmaker III sites include North Creek Corrugated, Shinarump Corrugated, Tusayan Grayware, and Mesquite Black on gray. Surface remains of kilns are generally limited to curvilinear alignments or enclosures of upright stone slabs. In most cases, kilns can be distinguished from similar-looking features like storage cists or hearths principally based on location (on slopes or in drainages, in areas between two drainages, and on slopes and benches below rims).

This period is marked by the adoption of ceramic vessels, typically brown wares constructed from self-tempered alluvial clays, although early gray and white wares are evident later in the period on plain gray jars and simple black-on-white bowls. Residential sites, or hamlets, became common, and pit houses are indicated by shallow depressions and house-sized ash stains. During this time, the bow and arrow

replaced the atlatl. The Rosegate style, Abajo Stemmed, and Dolores Straight or Expanding Stem projectile points are diagnostic of this period.

Pueblo I

The emergence of villages is often touted as the hallmark of the Pueblo I period (AD 750–900) throughout southeastern Utah (Spangler and Zweifel 2021:247). However, the period's expression was quite variable in form and organization (Allison et al. 2012; Wilshusen 1999). Changes in architecture, settlement layout, and diagnostic ceramic styles are notable (Wilshusen 2009:23). Notable Pueblo I sites have been identified in GSENM and the vicinity in Seaman Wash, Shinarump Bench, and Johnson Canyon in the Grand Staircase region; on Harris Mountain, Pipe Springs, and Yellowstone Mesa on the Arizona Strip; and on Little Creek Mountain above the upper Virgin River and its tributaries.

Villages consisted of multiple households with contiguous aboveground living and storage rooms. Sometimes they had an associated oversized pit structure or great kiva, rock imagery panels, and landscape features such as shrines and plaza areas. Spangler and Zweifel (2021:248) note, "Large-scale population aggregations have not yet been demonstrated for the high plateaus of the Grand Staircase region, although there were some smaller aggregations, and most certainly the spatial range of Pueblo I groups expanded." This pattern may represent a response to drought conditions during the AD 800s, with low precipitation and extended growing seasons favoring settlement along major drainages and in upland areas with higher effective precipitation (Petersen 1988).

Pueblo I habitations consisted of an arc of jacal, adobe, and/or stone masonry rooms with one or more pit structures located in an unenclosed plaza or courtyard area to the south with a deep, generally sub-rectangular structure with a ventilator shaft complex. Building walls were rectilinear, storage rooms were basally lined with upright slabs, and residential units also included room blocks arranged end to end to form curving or L-shaped composite room blocks with associated pit structures in front. Ceramic assemblages were marked by the addition of neck-banded gray ware (Moccasin Gray and early Mancos Gray), more refined white ware (White Mesa Black-on-white), and sophisticated red ware (San Juan Red Ware types such as Abajo Red-on-orange and Bluff Black-on-red).

Pueblo II

The Pueblo II period spans the interval from about AD 900 to 1150 (Spangler and Zweifel 2021:262). This period was likely caused by a climatic change to cooler, drier conditions around AD 890, which seems to have caused a shift in the settlement pattern to small hamlets (Benson and Berry 2009). In GSENM and the vicinity, the site structure changed very little. Spangler and Zweifel (2021:263) state, "The transition from Pueblo I to early Pueblo II was marked by only subtle changes. Indeed, distinguishing a Pueblo II site from surface architecture is not generally possible and instead subtle changes in ceramic assemblage composition are key observations when making such a determination. The most temporally diagnostic of these ceramic types is St. George Black-on-white."

Early Pueblo II populations dispersed over much wider areas to seek out those ecological niches where they could still practice their form of subsistence. Habitation sites of this period were not common, and regional populations appear to have been small. During the AD 1000s, climate appears to have been prevailingly hospitable to subsistence farmers, which resulted in a proliferation of settlement in most localities. The increase in the population and connection to other areas led to remarkable shifts in the ceramic types affiliated with this period.

Early Pueblo II sites are found in most northern Grand Staircase environmental settings and include sites such as the Kanab Site located along Kanab Creek and the Dead Raven Site located in Johnson Canyon. The Dead Raven Site is one of several locations located among a cluster of Pueblo II sites within the canyon. Trail Canyon Alcove and a site along Parunuweap Canyon are key late Pueblo II archaeological manifestations.

The late Formative period on the Kaiparowits Plateau and upper Escalante River basin is often referred to as the Fiftymile Mountain Phase in reference to a proliferation of late Pueblo II sites located on the Fiftymile Mountain portion of the Kaiparowits Plateau. A proliferation of available radiocarbon and tree-ring dates suggests a substantial occupational expansion during this time period, particularly in the Escalante River and Kaiparowits Plateau regions. The reasons for this apparent expansion are not well distinguished. There is disagreement among archaeologists as to whether migration or population growth was the primary cause (Spangler and Zweifel 2021:282–285).

Pueblo III

Pueblo III has been characterized by the emergence of large communities, highly elaborate artistry, and specialization of crafts and social functions. Importantly, however, as stated by Spangler and Zweifel (2021:289), "As traditionally defined in the greater Southwest, the Pueblo III period is marked by the appearance of certain ceramic indicators and architectural characteristics, none of which are evident in GSENM or surrounding areas." It is during the Pueblo III period (AD 1150–1300) that the iconic cliff dwellings of the Southwest appeared. The shift in settlement from locations featuring arable soils to those featuring water sources during the early Pueblo III period is intriguing.

In and around GSENM, the Pueblo III period is relatively poorly understood when compared with the voluminous published record of Pueblo III sites in the Four Corners region. Of the limited number of radiocarbon dates produced from GSENM sites, a majority come from the Arroyo Site, Pottery Knoll, and Gnatmare sites (Spangler and Zweifel 2021:291). The implications of these three sites for an understanding of Pueblo III lifeways in GSENM are unclear. Spangler and Zweifel (2021:294) state, "Collectively, these three sites are perplexing and in some respects contradictory. Pottery Knoll appears to represent an involuntary aggregation of dispersed, small farmsteads during a time of environmental stress, food shortages, and increased competition. Yet Gnatmare and the Arroyo Site appear to represent dispersed farming settlements with one or two families."

Fremont

The Fremont archaeological tradition in GSENM was active AD 500–1300 (Spangler and Zweifel: 160). Fremont archaeological sites are found across a broad area that includes much of the eastern Great Basin and northwestern Colorado Plateau. Fremont sites are found across nearly all of Utah and eastern Nevada, as well as in southern Idaho, western Colorado, and southwestern Wyoming. There is evidence for considerable adaptive diversity in the eastern Great Basin and surrounding areas throughout prehistory. This is especially the case for the Fremont period. As Madsen and Simms (1998) note, groups attributed to the Fremont complex adopted a variety of subsistence and mobility strategies, and individuals within those groups may have pursued a range of strategies within their lifetimes (see also Barlow 2002 and Coltrain and Leavitt 2002).

Fremont sites range from fairly large, settled villages, particularly on either side of the Wasatch Plateau, to more ephemeral camps that suggest a high degree of mobility; caves also continued to be used during

the Fremont period (see, for example, Aikens 1970 and Bryan 1977). The full range of subsistence strategies from pure hunting and gathering to relatively intensive farming is evident at Fremont sites. Barlow (2002) suggests that such variability in the importance of agriculture was due to variability over time and space in the productivity of wild resources, noting that intensive agriculture would have been economical only when and where high-return wild resources were encountered infrequently.

Fremont sites are common in GSENM and are often classified into early (AD 500–1050) and late (AD 1050–1300) subperiods (Spangler and Zweifel 2021:160). Fremont open site types found in GSENM include summer camps, both upland and lowland field camps, and task-specific foraging camps. One example of a typical lowland field camp is the Alvey Site located in Coyote Gulch (Spangler and Zweifel 2021:176). A key upland field camp is Deer Creek Shelter found along Deer Creek (Spangler and Zweifel 2021:178). Fremont architectural sites include pit houses—typically found in valleys—and seasonal residences located in nearly all geographies. Key pit house sites discussed by Spangler and Zweifel (2021) include Arrowhead Hill, the Spillway Site, the Barnson Site, and the Overlook Site. A common Fremont site type is a site apparently constructed specifically for storage of goods; it includes semi-subterranean storage cists and aboveground granaries. Some granary locations are high on cliff faces. Storage sites are found widely across the GSENM area.

Late Prehistoric

Spangler and Zweifel (2021:303) describe the Late Prehistoric period in and around GSENM as occurring between AD 1300 and AD 1775. In Utah and westernmost Colorado, this period is associated with the Numic expansion. After AD 1300, archaeology is sparse in the GSENM area, and occupation by Puebloan groups after the abandonment of the late thirteenth century cannot be demonstrated archaeologically (Spangler et al. 2010:137); however, it is during this time that modern-day groups, such as the Utes, Paiutes, and Navajos, began to utilize the area.

Initial occupation by the Utes, Paiutes, and Navajos is poorly understood and has only recently been a subject of intensive scrutiny (Spangler et al. 2010). The exact timing of the arrival of these groups in southern Utah is also debated, although it is believed that all of them had arrived within what is now the boundary of Utah by AD 1300 (Janetski 1994). The earliest documented contact between Utes and Europeans in the northern Southwest was the Spanish expedition led by Juan de Oñate in 1626; therefore, most researchers conclude that the Utes and Paiutes inhabited the Abajo Mountains region sometime between AD 1300 and AD 1500 (McPherson 2009:58). The oldest confidently dated Navajo structures in this region, hogans and sweat lodges in the White Canyon and upper Comb Wash areas, are tree-ring dated to the early AD 1600s (Spangler et al. 2010:151–152).

The Late Prehistoric period is characterized by abandonment of most of the Colorado Plateau and aggregation in massive communities in the northern Rio Grande and northeastern Arizona. Sites from this period typically consist of sparse lithic scatters with low quantities of brown ware ceramics, diagnostic rock imagery, and occasionally characteristic wikiup remains. Diagnostic artifacts include Uncompahgre Brown Ware, as well as Desert Side-notched and Cottonwood Triangular projectile points. During this period the archaeological record begins to match ethnographic descriptions of Ute, Paiute, and Navajo groups.

Historic Period

The first documented entry of Europeans into Kane County was the expedition of Father Francisco Atanasio Domingues and Silvestre Velez de Escalante in the autumn 1776 to establish an overland route between settlements in Santa Fe and Los Angeles (Bradley 1999; Newell and Talbot 1998). Today, many places bear Silvestre Velez de Escalante's name, including the town of Escalante, the Escalante River, the Escalante Basin, Escalante Mountain, Escalante Canyon, and Escalante Natural Bridge (Woolsey 1964). Because of a snowstorm near the present-day location of Milford, Utah, the expedition halted the attempt to reach California and instead followed a route to the southeast to return to Santa Fe. Along this route they named Sulphur Creek (later renamed the Virgin River), Rio de Pilar (later known as Ash Creek), and Hot Sulphur Springs (Alder and Brooks 1996; Bradley 1999).

Other European and Euro-American explorers to follow in these footsteps included Antonio Mariano Armijo in 1830, John C. Fremont in 1853, and leaders of the Church of Jesus Christ of Latter-day Saints (the church) who directed groups of Latter-day Saint pioneers from Salt Lake City in 1847 (Alder and Brooks 1996). US government expeditions into the region in the 1850s also contributed to Euro-American knowledge and settlement of the area.

Brigham Young, leader of the church, directed exploration and settlement of what would become the state of Utah from his base in Salt Lake City. Parley P. Pratt was sent by the church in 1849 to explore much of southern Utah and to gather information for planning Latter-day Saint settlements, including portions of Juab, Sevier, Paiute, Garfield, and Iron Counties. The church subsequently sent Latter-day Saint pioneers to establish towns at several of the sites Pratt recommended. These acted as jumping-off points for continued expansion into Garfield County.

Important to the Latter-day Saints' colonization effort was the organization of an Indian mission at Fort Harmony in what would become Washington County in early 1854. Jacob Hamblin, a Latter-day Saint explorer and settler of Kane County, led the effort to establish harmonious relationships with key Native American leaders. Additional exploration of south-central Utah was spurred by conflict between the church's leadership and the federal government, as Young directed Hamblin to scout the area for possible use as a refuge from government forces. Hamblin's knowledge of the area also facilitated government exploration and mapping projects, including a Colorado River voyage with John Wesley Powell in 1871 that documented the landscape of Glen Canyon and the present-day city of Kanab (Mullins et al. 2018).

Kanab is the principal settlement in Kane County. It was established by Hamblin and small parties of settlers around 1858. Washington County was established in 1852, but on January 16, 1864, the Utah Territorial Legislature approved an act that officially created Kane County from a portion of Washington County (Bradley 1999:56–59). Kane County remained isolated because of its challenging landscapes, its relatively small population, and its lack of connection to railroad lines.

The movement of Euro-American settlers and their livestock herds into Native American lands caused conflicts over both territory and resources throughout the state. In southern Utah, these coalesced into a series of 150 battles, skirmishes, and raids that took place in the 1860s, known as the Black Hawk War. The Ute leader Black Hawk organized a coalition of Ute, Paiute, and Navajo tribes to drive the invading Latter-day Saints from their lands, as their presence was causing starvation among the Native American peoples. Brigham Young directed church members to build forts in strategic locations and

relocate scattered settlers into them for defense against Black Hawk's warriors (Mullins et al. 2018). Black Hawk eventually entered into a peace treaty at the Uintah Reservation in 1868, although some members of the coalition continued to engage in raids until 1872 (Peterson 1994:43–44).

Escalante was first settled in 1875 by inhabitants of Panguitch who were looking for an area with a warmer climate and longer growing season. In 1882, a portion of what had been Iron County was split off and designated as Garfield County. After this change, the town of Tropic was established along the Paria River in 1889, also by former residents of Panguitch. With the addition of fruit trees in 1893, Tropic became an agricultural center with orchards, ranches, and dairy farms. However, Garfield County's remoteness prevented substantial populations from settling there during the 1800s (Newell and Talbot 1998:129–132, 202). The harsh environment made ranching a more lucrative occupation than agriculture in both Garfield and Kane Counties (Newell and Talbot 1998:79; Bradley 1999:84).

The recently designated Hole-in-the-Rock Trail Traditional Cultural Property was built in 1879 and 1880 by a group of missionaries of the church seeking to establish a new settlement on the banks of the San Juan River in today's San Juan County (NPS 2022). The trail is approximately 160 miles long, beginning near Escalante and crossing GSENM as it continues toward its terminus near Bluff. For many members of the church in Utah's southeastern corner, the Hole-in-the-Rock Trail represents an understanding that these nineteenth-century pioneers were willing to endure extremely harsh terrain and drive wagons and livestock through country offering little physical comfort in order to fulfill personal and communal commitments of faith.

A significant feature of the Hole-in-the-Rock Trail found in GSENM is Dance Hall Rock, a large sandstone shelter with a smooth, relatively flat floor that derives its name from its use for gatherings and dances by the San Juan Mission pioneers who camped a mile south at Forty Mile Spring (NPS 2022). This natural spring and campsite served as the major expedition headquarters for more than 3 weeks as individual groups journeyed along the trail in late 1879. The natural rock amphitheater of Dance Hall Rock was a gathering place for the pioneers where music and dancing provided a needed relief from the trail.

Garfield County benefited from the discovery of antimony in 1880 in Coyote Canyon. The Coyote Mining District was founded near the town of Antimony. Production of the mineral continued into the twentieth century, finally dropping in 1918 at the end of World War I (Newell and Talbot 1998:225). The Escalante area was mined for coal deposits, although Coal Canyon near Parowan was the center of coal production in the region (Bradley 1999:335–336). Some gold was also extracted through placer mining along the Colorado River in the 1880s (Mullins et al. 2018:6.109).

At the beginning of the twentieth century, as automobiles became more generally available, several large parks were developed in southern Utah for tourism. Bryce Canyon, Zion, and Grand Canyon National Parks drew tourists to the region, in what was known as the Grand Circle of National Parks (Mullins et al. 2018:6.119).

The crash of the stock market in late 1929 heralded the onset of the Great Depression and brought a swift and permanent end to many Utah mining operations. The mining and agricultural industries, which contributed heavily to the region's economic base, were hit hard by the Great Depression. In response to this situation, agricultural resettlement programs were instituted in Utah as part of the federal government's New Deal aid package. The resettlement program provided for the construction of

hundreds of miles of irrigation canals and water transportation features as well as for the relocation of families from minimally fertile lands in areas such as Garfield County to more arable land in Utah County.

As the nation continued to languish in the throes of the Great Depression, the US government established programs of institutional relief. As part of President Franklin Roosevelt's New Deal, various forms of federal aid poured into struggling communities. In general, western states received more financial support than eastern states, with Utah ranking ninth overall in federal aid per capita (Holzapfel 1999:215). In addition to social welfare programs, including both federally run programs and those operated by the church for the benefit of its members, a wide variety of work relief programs benefited local residents. Works Progress Administration (WPA) and Civilian Conservation Corps (CCC) crews engaged in numerous community betterment activities, including road construction and maintenance, bridge construction, snow shoveling, wood chopping, and trails and parks development. Several CCC camps were operated in Garfield and Kane Counties. Many WPA and CCC work crews constructed new schools and community and government buildings. Others were responsible for digging miles of irrigation and drainage ditches along Utah's roadways.

The presence and importance of the WPA, CCC, and other work relief programs in Utah remain evident today in buildings, water storage and transportation features, sidewalks, landscaping, and parks, such as Bryce Canyon and Zion National Park. In GSENM, CCC camps were instrumental in building the first Escalante-to-Boulder road and the work undertaken to install range improvements across the GSENM area. These facilities remain and are physical reminders of a significant period, a character-shaping era, in the region's history.

World War II and its resulting demand for both mineral and agricultural products in support of the war effort helped pull Utah out of the Depression. The lumber industry increased in importance during the post-war period, as an economic boom led to the construction of family homes and other structures. As a result, lumber companies and sawmills were established in Escalante, Hatch, and Panguitch in Garfield County, and on the Kaibab Plateau and at Fredonia in Kane County (Mullins et al. 2018:6.132). Uranium mining was also briefly profitable in the region, although the Atomic Regulation Commission ended uranium purchases in 1957 (Mullins et al. 2018:6.134).

Currently, most traffic through the area is generated by tourists headed to attractions such as Bryce Canyon National Park, Zion National Park, and GSENM. These major tourist destinations are all accessible via US Highway 89, which bisects Long Valley and proceeds through every town in Kane County except Alton (Bradley 1999:8).

5.7.2 Trends

Under current management, long-term observations and specific site monitoring suggest that cultural resources are in a stable condition. These observations are possible because GSENM has had a site monitoring component in its cultural resource program since GSENM's inception. Also, for more than a decade, it has had an active site steward program. Administrative management of the site steward program has recently been transferred to the Utah State Historic Preservation Office to provide for a more consistent statewide program.

Looting of cultural resource sites is rare. Vandalism is also uncommon. The casual collection of artifacts and historic objects continues to be a problem; however, this is actively addressed by public education efforts. Nonetheless, current observations suggest that looting has tapered off in recent years largely due to public education and law enforcement efforts.

Increased visitation and recreation have caused impacts on cultural resources. Notably, impacts on cultural resources from other uses in GSENM and casual collecting have increased with increased OHV use. The reasons for this likely include ease of access and simple increases in the number of visitors who can access cultural resource localities. Additional factors contributing to impacts on cultural resources from visitation and recreation include publication of site locations on social media; unintentional effects from visitor use, such as camping in alcoves and on open sites; and social trailing and user-created parking areas in or across sites.

In a study of 24 grazing allotments in GSENM, Zweifel (2016) found that among those allotments with previously documented grazing-related impacts on cultural resources, those impacts had been substantially reduced over the years prior to his study. Zweifel attributes the apparent reduction in grazing-related impacts on possible lessening of actual grazing pressures, differential land use by cattle year to year, vegetation changes, and simple weather-related erasure of cattle use indicators over time and between seasons of use.

5.7.3 Forecasts

Under current management, conditions will likely remain stable. Recreation and tourism are expected to increase regionally and are expected to accordingly increase in GSENM. Such increased visitation will likely bring increased OHV use and an associated increase in access to more remote cultural resources. More visitation to these more remote locations will likely have an associated impact on these sites.

Under current management, grazing restrictions that were implemented for the initial GSENM area were removed from portions of GSENM. Removal of these areas allowed for increased grazing in those areas in the KEPA If those reduced restrictions were to remain—which would be the case under current management—then there could be increased grazing-related impacts on cultural resources in those areas in the former KEPA lands that have been added back into GSENM.

Wildfire and other natural forces resulting from climate change will continue to stress resources in GSENM. With wildfires, sensitive materials and objects may be damaged or destroyed, but post-fire conditions may threaten sites through intensified erosion or other post-fire processes. Additionally, the removal of the vegetation cover also encourages unauthorized motorized use within burned areas. Fluctuations in precipitation, freeze-thaw cycles, and seasonal access to GSENM are also stressing cultural resources. High-intensity rainfall may alter erosional patterns and accelerate structural decay, while fluctuations in weather patterns may permit a wider window of visitor access.

Since its inception, the BLM has successfully employed many NHPA Section 110 projects or archaeological survey projects in GSENM designed to collect background information and for scientific inquiry rather than as a response to ground-disturbing projects. Set aside as a monument with protection and research goals, GSENM has hosted many archaeological researchers, field schools, and graduate students. GSENM has also produced several important archaeological studies and documents. It has been the only contributor to the Utah BLM Cultural Resource publication series for the past 20

years or more. In addition, the BLM in GSENM has sponsored additional research that has contributed many more important research documents to the realm of archaeological research. The future of GSENM will see continued support for such projects.

5.8 FORESTRY AND WOODLAND

Woodland resources in the decision area consist primarily of pinyon and juniper communities, with small, scattered patches of ponderosa pine forests, Douglas-fir forests, and aspen groves.

5.8.1 Current Conditions

Woodland Types

There are 855,700 total acres of woodlands within the 1.87 million-acre decision area. **Table 5-19** breaks this total down by woodland type and acreage. **Figure 5-1 (Appendix B)** displays major vegetation communities in the decision area, including the two dominant woodland types, Colorado Plateau Pinyon-Juniper and Colorado Plateau Pinyon-Juniper Shrubland.

Table 5-19
Woodland Types in the Decision Area

Woodland Type	Acres
Colorado Plateau Pinyon-Juniper Woodland	506,400
Colorado Plateau Pinyon-Juniper Shrubland	347,600
Southern Rocky Mountain Ponderosa Pine Woodland	1,600

Source: LANDFIRE 2022; BLM GIS 2022

Woodland Uses

Fuelwood harvesting by individuals is the primary use of woodlands in the decision area. Harvesting of cedar posts and Christmas trees also occurs to a lesser degree. Fuelwood harvesting, post cutting, and Christmas-tree cutting are allowed by permit in Buckskin Mountain (19,400 acres) and Rock Springs Bench (4,600 acres) fuelwood designated areas (**Figure 5-3, Appendix B**). **Table 5-20** shows the amount of woodland products harvested by permit commercially and non-commercially over the past 7 years in these fuelwood harvesting areas. In addition to these two fuelwood areas, management direction in the 2020 RMP allows commercial and noncommercial fuelwood harvesting, post cutting, and Christmas-tree cutting in all areas except designated WSAs and areas posted as closed. The cutting of ponderosa pine for Christmas trees is also prohibited by the 2020 RMP. These decisions apply only to the boundaries of GSENM, as defined in Proclamation 9682.

Oak harvesting is a traditional Native American use in the decision area; the BLM issues free permits for this use.

The sale of forest treatment residues as secondary wood products or biomass is allowed under the 2020 RMP, as are commercial and noncommercial timber harvesting for promoting or sustaining forest health. These decisions apply only to the boundaries of GSENM, as defined in Proclamation 9682.

Table 5-20
Woodland Products Harvested 2015–2021

Type	2015	2016	2017	2018	2019	2020	2021
Cords of fuelwood	232.5	262.5	390	336	281	344	308
*Tons of fuelwood	294	327	487	420	351	430	385
Cedar posts	25	40	38	108	140	190	990
**Tons of cedar post biomass	0.125	0.2	0.195	0.54	0.7	0.95	4.95
Christmas trees	15	14	8	0	3	2	0

Source: Allan Bate, GSENM Forester, personal communication in July 2022, regarding woodland product harvest numbers for 2015-2021.
*1 cord = 2,500 pounds
**1 post = 10 pounds

Stewardship Contracts

Since 2005, the BLM has had a stewardship program that has actively promoted the utilization of biomass and the creation of a biomass industry. Congress authorized the stewardship program through September 2013 in the Omnibus Appropriations Bill of 2003 (PL 108-7, Section 323). The program authorized combining previously separate contract instruments (service contracts and product sale contracts) into one contract and required that any vegetation removal be a byproduct of the project goals. The stewardship program was designed to help achieve land management goals and objectives.

From 2005 through 2010, the BLM awarded 14 stewardship contracts in GSENM for land treatments on approximately 1,757 acres, with a biomass volume approaching 4,800 tons, as shown in **Table 5-21**. Projects addressed a diverse set of land management objectives, including, but not limited to, forest health, wildlife habitat and vegetation improvement, wildland fuels reduction, livestock grazing, public recreation, and visual resource management (VRM).

Table 5-21
Stewardship Contracts 2005–2013

Fiscal Year	Stewardship Contact	Acres	Tons
2005	Buckskin Stateline	105	315
2007	Powerline 2	308	924
	Mustang 1	208	624
	Mustang 2	205	410
	Buckskin Research	82	164
	P/J 1	159	318
2008	Powerline 3	75	150
2009	Buckskin Sinkholes	95	285
	Pine Hollow 1	75	150
	Pine Hollow 2	52	104
	Pine Nut	132	396
2011	Buckskin Eagle Sink	101	202
2012	Telegraph 2012	80	160
2013	Telegraph	80	160
	Total	1,757	4,797

Source: BLM 2018

In the Buckskin Mountain fuelwood area, the BLM has partnered with the Utah Department of Water Quality and the Watershed Restoration Initiative to treat (hand thin with chainsaws) approximately 6,869 acres of pinyon/juniper trees with a biomass volume approaching 12,000 tons. The project's purpose was to improve wildlife habitat by reducing the canopy cover of the pinyon-juniper trees. **Table 5-22** outlines the hand-thinning projects in the Buckskin Mountain fuelwood area. **Figure 5-3, Appendix B** displays the variety of vegetation treatments that have occurred within the Buckskin Mountain and Rock Springs Bench fuelwood areas, although not all projects displayed are specific to fuels management.

No stewardship projects have been initiated since 2013 due to a lack of funding.

Table 5-22
Buckskin Mountain Fuelwood Area Hand-Thin Projects 2008–2016

Fiscal Year	Stewardship Contact	Acres	Tons
2008	Utah Partners for Conservation and Development 1, 2008	273	546
	Utah Partners for Conservation and Development 2, 2008	154	308
	Utah Partners for Conservation and Development 3, 2008	77	154
	Utah Partners for Conservation and Development Hand Thin 2008	650	1,350
2009	Utah Partners for Conservation and Development Hand Thin, 2009	1,471	2,942
2011	Utah Partners for Conservation and Development Hand Thin, 2011	1,782	3,562
	Utah Department of Water Quality Hand Thin, 2011	604	1,208
	Utah Department of Water Quality Units, 2011	598	1,196
2013	Utah Department of Water Quality Hand Thin, 2013	630	1,260
	Total	6,869	11,526

Source: BLM 2018
The trees were hand thinned by a crew with chainsaws. The pinyon/juniper trees were limbed and bucked up into approximately 4-foot lengths. These treatment areas within the Buckskin Mountain fuelwood area are where the majority of fuelwood harvesters have gathered their fuelwood since 2008. There have been no acres treated within the Rock Springs Bench fuelwood area.

5.8.2 Trends

Due to past management, such as fire suppression, there are artificially high fuels loads across broad, remote landscapes that pose unique management challenges in terms of method (for example, prescribed fire) and outcomes (for example, potential for noxious and invasive infestations), as well as management of human safety during wildfire response and treatments.

Many pinyon-juniper woodlands in the planning area, as with pinyon-juniper woodlands across the western US, have expanded over the past 150 or more years into vegetation types that were once mostly tree free (BLM 2018). For instance, some of the decision area's forested stands may be ecologically outside their natural range of variability. Although pinyon-juniper expansion has occurred in the planning area, some die-off has also been observed in stands along Highway 89 and Highway 12. The die-off appears to be happening in drier areas, and may be caused by a decrease in available water due to climate change.

In general, the demand for fuelwood harvesting has been relatively stable. The supply is relatively ubiquitous and plentiful, except for areas that have burned or received some type of vegetation management with tree thinning as a goal.

5.8.3 Forecasts

Based on the existing harvest demand, forest and woodland resources provide ample opportunities for future harvest of woodland products (that is, post, fuelwood, and Christmas trees). The relatively stable demand for forest and woodland products is expected to continue in the future. However, demand could increase if areas outside of WSAs remain open for fuelwood harvesting and the public's awareness of harvesting opportunities increases. The demand for products generated from stewardship contracts would likely increase if new funding is identified, depending on the future of the biomass and bio-energy industries.

Stands that are outside of their ecological range should be evaluated for either 1) site-specific projects to restore original vegetation types, or 2) future management as "persistent" woodlands.

Climate change and ongoing drought may require more regular evaluation of unique woodland stands to preserve GSENM's objects and values. Understanding the health of these stands would allow for prioritization and flexible and adaptive management actions.

5.9 WILDFIRE AND FUELS MANAGEMENT

5.9.1 Current Conditions

Current and desired fire management resource conditions can be described by the fire regime groups and the Vegetation Condition Class, which indicates the general level to which current vegetation is different, or departed, from the estimated historical or reference conditions. This departure from the historical conditions can be a result of changes in one or more ecosystem components, such as fuel composition, fire frequency, or other ecological disturbances. **Table 5-23** summarizes fire regimes, and **Table 5-24** summarizes the condition classes.

Table 5-23
Fire Regime Groups

Group	Frequency	Severity
I	0–35 years	low
II	0–35 years	stand replacement
III	35–200 years	mixed
IV	35–200 years	stand replacement
V	200+ years	stand replacement

Source: National Wildfire Coordinating Group 2022

Table 5-24
Vegetation Condition Class

Class	Departure
I.A	Very low, vegetation departure 0%–16%
I.B	Low to moderate, vegetation departure 17%–33%
II.A	Moderate to low, vegetation departure 34%–50%
II.B	Moderate to high, vegetation departure 51%–66%
III.A	High, vegetation departure 67%–83%
III.B	Very high, vegetation departure 84%–100%

Source: LANDFIRE 2022

Fire Regime Groups

Table 5-25 summarizes the decision area acres in each fire regime group. Most acres are in fire regime groups I, II, and V. This is largely driven by the dominant vegetation types found in GSENM (sagebrush, salt desert scrub, pinyon-juniper, and oak; see **Section 5.1**, Terrestrial Vegetation Resilience, and Conservation [Large-scale and Local Ecotypes]). The dominance of fire regimes I, II, and V, along with the vegetation types found in these groups, is predictive of future mixed-severity, large-scale wildfire.

Table 5-25
Fire Regime Groups in the Decision Area

Fire Regime Group	Acres	Percent of Decision Area
I	241,700	13
II	1,041,900	56
III	0	0
IV	100	0
V	568,600	31

Source: BLM 2018

Vegetation Condition Class

Acres of GSENM in each vegetation condition class are summarized in **Table 5-26**.

Table 5-26
Vegetation Condition Classes

Vegetation Condition Class	Acres	Percent of Decision Area*
I.A	103,600	6
I.B	276,200	15
II.A	893,000	48
II.B	199,500	11
III.A	23,300	1

Source: BLM GIS 2022

* Percentages do not add up to 100 due to portions of GSENM that are mapped as agriculture, barren, or urban and thus do not fall into vegetation condition classes.

Fire Occurrence

Fire occurrence in GSENM over the last 20 years in shown in **Table 5-27**. Due to the remoteness of much of GSENM, there have been very few human-caused fires over the past 20 years (years for which fire data are available). Human-caused fires have accounted for only 32 acres burned (28 fires total). Most fires have been caused by lightning (505 total), which have burned 10,808 acres. However, the total acres burned (10,840 acres) reflect a very small portion (less than 1 percent) of the total acres in GSENM. This is likely due to fire suppression tactics that have been implemented since Euro-American settlement.

Table 5-27
Fire Occurrence in GSENM from 2000 to 2020 by Ignition Source

Year	Lightning		Human	
	Number of Fires	Acres	Number of Fires	Acres
2000	1	735	0	0
2001	24	8.7	2	0.2
2002	25	13.7	3	7.3
2003	38	0.4	0	0
2004	53	2,431	0	0
2005	26	3.9	3	6.4
2006	53	1,587	4	0.4
2007	27	3.6	1	0.1
2008	32	5.1	0	0
2009	39	5	4	0.8
2010	30	4.6	1	0.1
2011	29	3.3	2	15
2012	45	4.5	0	0
2013	27	3.2	3	0.3
2014	8	17.7	0	0
2015	17	5.28	3	0.3
2016	11	2.91	0	0
2017	13	2.6	2	0.8
2018	2	139	0	0
2019	1	301	0	0
2020	4	5,530	0	0
Total	505	10,808.36	28	31.7

Source: BLM 2018; BLM GIS 2022

Fuels Management

The number of fuels projects has increased in recent years. The Fuels Management Program's primary goals are to address hazardous fuels issues, which include 1) providing for resilient and resistant landscapes by restoring and/or improving the Vegetation Condition Class; 2) protecting fire-adapted communities by reducing fire hazard, with an emphasis on wildland-urban interface areas; and 3) improving safe and effective wildfire response. These goals are accomplished through interdisciplinary partnerships, such as the Utah Watershed Restoration Initiative. Together, these partnerships identify priority watersheds to address a variety of interdependent resource issues and improve long-term watershed conservation and restoration. These watersheds are then targeted and prioritized for funding through BLM program dollars, with additional coordination and funding prioritized through the Utah Watershed Restoration Initiative.

Management actions have mainly included mechanical treatments (hand thinning, hand piling, harrow, Ely chaining and mechanical mulching). In addition to meeting goals set forth in the hazardous fuels program, numerous other resource benefits, such as improved watershed conditions, forest and rangeland health, and wildlife habitat, are realized. Seeding is used in conjunction with each treatment, where appropriate.

Prescribed Fire Treatments

Prescribed fire has played a very small role in GSENM over the past 20 years. This is likely due to a variety of factors that make it difficult to plan prescribed burns, including increased and unnatural fuel loading, unfavorable weather for burning, resource availability, clearing index (a measure of the atmospheric mixing and wind speed), and risk. Tourism and protection of GSENM values also factor into prescribed fire management decisions. Prescribed fire has only been used on a total of 1,273 acres in GSENM over the past 20 years.

Emergency Stabilization and Rehabilitation

There is an active emergency stabilization and rehabilitation program in the Color Country District, which includes GSENM. The size of the emergency stabilization and rehabilitation program is proportional to the severity of the wildfire season each year. Due to the low number of wildfires in GSENM, few emergency stabilization and rehabilitation efforts have been used in this area. However, emergency stabilization and rehabilitation could be a valuable tool in future management scenarios.

Fire Management Plan

The Color Country District Fire Management Program covers BLM-managed, National Forest System, and state lands in the planning area, as well as fires on private land. Fire personnel handle fire management responsibilities, such as preparedness, suppression, and extended attack. Dispatching occurs from the Color Country Interagency Dispatch Center in Cedar City, Utah.

The current suppression strategy for the planning area calls for appropriate management response on all wildland fires in accordance with management objectives and based on current conditions and the fires' location. Every wildland fire is assigned an appropriate management response to protect firefighters, the public, and values at risk, and to minimize suppression costs. Protecting human life is the single overriding priority, with the other priorities being communities, property and improvements, natural and cultural resource values, human health and safety, and suppression costs. The appropriate management response can vary from aggressive initial action to monitoring.

The BLM Fire Management Plan, which the BLM updates periodically, describes fire and fuels management activities in the decision area. The Fire Management Plan provides for firefighter and public safety and includes fire management strategies, tactics, and alternatives based on direction outlined in the GSENM RMP. The Fire Management Plan identifies values to protect and public health issues, describes fuels and restoration projects, and is consistent with resource management objectives. Suppression tactics outlined in the Southern Utah Support Area Fire Management Plan vary by vegetation type and resource values at risk. The acres of each fire management unit in GSENM are summarized in **Table 5-28** and depicted in **Figure 5-11, Appendix B.**

Fire management units are specific land management areas within the Fire Management Plan that are defined by fire management objectives, management constraints, topographic features, access, values to protect, political boundaries, and fuel types. The fire management units were created based on similarities of the specific resource objectives identified in GSENM.

Table 5-28
Fire Management Units in the Decision Area

Fire Management Unit	Acres
Big Deer	516,400
Collett – Fiftymile Mountain	167,700
East Sands	1,000
Escalante – Circle Cliffs	547,400
Glendale Bench	13,000
Kaiparowits	568,400
Paria	20,800
The Blues	30,800

Source: BLM GIS 2022

5.9.2 Trends

Fire is an inherent component of ecosystems and historically has played an important role in promoting plant succession and developing plant community character. Controlling fires during the last century has changed plant communities and resulted in conditions that can sustain large-scale fires when natural vegetation ignition occurs. As discussed above, fires in the decision area have occurred naturally and been human caused.

Wildfire in many of Utah's vegetation communities was historically a regular occurrence that helped define species' composition, structure, and productivity (Bradley et al. 1992; Paysen et al. 2000). Therefore, many plants that comprise these communities are adapted to withstand wildfire. Grasslands, sagebrush, mountain shrub, aspen, and mixed conifer are examples of fire-adapted vegetation communities in the decision area. Frequent wildland fire is not part of the normal ecology of other vegetation communities. Salt desert shrub and blackbrush are examples of such vegetation communities. Fire in these communities is viewed as detrimental because it can take decades to centuries for the vegetation to recover.

The widespread presence of invasive species (see **Section 5.2**, Noxious Weeds and Invasive Plants) has greatly altered the resource character and values across the landscape and could pose an even greater threat in the future. Historical post-fire recovery processes might no longer dominate the recovery and regeneration process due to introduced species. Cheatgrass and some other types of vegetation are known to alter fire return intervals and can dramatically expand their range after fire. These communities can facilitate expansion of invasive species, have lower biological resource values, and have increased fire hazards.

Although there have not been a significant number of fires or acres burned over the past 10 years, there is potential for more acres to be burned. Fire frequency and fire severity are expected to be higher than historical levels because most of the decision area is in Vegetation Condition Class II.A. Invasion of annual grasses and conifer woodlands into shrub and grassland, and increased live and dead fuel loads within conifer stands, are the primary factors for this potential trend. Increased recreational and backcountry use in GSENM could also increase the risk of human-caused wildfires.

5.9.3 Forecasts

Wildland fire management options for GSENM typically include appropriate management response; prescribed fire; non-fire fuels treatments, including mechanical, biological, chemical, and biomass

removal; post-fire rehabilitation and restoration; and community protection and assistance and rural fire assistance. In an effort to minimize wildland fire impacts and reduce invasive and noxious weed spread, the BLM Color Country District Office has developed and implemented the emergency stabilization and rehabilitation program. Collectively, the fire management program addresses current vegetation condition classes and impacts on other resources. It is expected that due to the current fire regime conditions in the planning area and factors outside the control of the fire program (for example, invasive weed control, vegetation management issues, drought, and livestock grazing), the Vegetation Condition Class categories would be maintained at or near their current conditions.

Based on prolonged drought conditions and invasive species establishment, the BLM anticipates that the potential for uncharacteristic wildfire effects will continue under present management in the lower-elevation sagebrush plant communities. It is also anticipated that under continued management, live and dead fuel loadings in forest stands and conifer and juniper expansion into aspen and higher-elevation sagebrush communities will continue, increasing the risk for wildfires with potentially uncharacteristic fire effects. Management actions to reduce fire severity, including hazardous fuel reductions and emergency stabilization and rehabilitation, could slow resource decline.

5.10 WILDLIFE AND FISHERIES

The decision area supports complex and fragile ecosystems with fish and wildlife that have developed unique adaptations to the conditions of their environments. Typical of the Colorado Plateau, the highly diverse topography and vegetation of the decision area create important habitat for a range of invertebrate species and vertebrate animals, including mammals, fish, reptiles, amphibians, and birds.

The BLM works closely with the UDWR to manage habitat for fish and wildlife (including big game, upland game, waterfowl, neotropical migratory birds, small mammals, amphibians, and reptiles) to achieve and maintain suitable habitat for desired population levels and distribution within the decision area. The UDWR is responsible for managing wildlife population levels, while the BLM is responsible for managing wildlife and fisheries habitat in a condition that will support desired levels of species. The BLM works cooperatively with the UDWR through habitat management and restoration to maintain and reestablish populations of species that have used the historic range within the decision area.

5.10.1 Current Conditions

Fish

The decision area contains two major river systems that support fish populations: the Paria and Escalante and their tributaries. A tributary to the Colorado River, the Paria River is characterized as a warm-water system. One native fish species, speckled dace (*Rhinichthys osculus*), has been verified within the river system.

The Escalante River is also a tributary to the Colorado River and has both warm-water and cold-water habitats. Surveys of fish species richness in the Escalante River in Glen Canyon found both native and introduced fish species (Mueller et al. 1999). This study found three distinct fish communities: the middle portion, lower portion, and side canyons. The middle portion displayed an intact community of largely native fish (99 percent native species) while the lower portion and the side canyons were dominated (89 percent) by nonnative species (Mueller et al. 1999). Five native fish species were identified during fish inventories: speckled dace, flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*), roundtail chub (*Gila robusta*), and Colorado River cutthroat trout (*Oncorhynchus clarki*

pleuriticus) (Mueller et al. 1999). Speckled dace were the most abundant native species observed during these surveys. Colorado River cutthroat trout are present in the Escalante River drainage but are limited to cooler waters above and upstream of the decision area. Calf Creek, a tributary to the Escalante River, has nonnative brown and Yellowstone cutthroat trout above the lower falls. Eleven nonnative species were identified during these surveys: brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), fathead minnow (*Pimephales promelas*), channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), red shiner (*Cyprinella lutrensis*), yellow bullhead (*Ameiurus natalis*), striped bass (*Morone saxatilis*), largemouth bass (*Micropterus salmoides*), and green sunfish (*Lepomis cyanellus*) (Mueller et al. 1999).

Aquatic habitats in the decision area also support a diverse assemblage of aquatic invertebrate species (Vinson and Dinger 2008). These organisms provide critical food sources for fish, birds, and mammals. Other habitat components important to healthy aquatic systems are stable riparian conditions, well-vegetated banks, and riparian zones with a multilayered canopy of woody and non-woody riparian vegetation. These features support the maintenance of water temperatures, facilitate dissipation of energy from storm runoff, and provide substrates for fish reproduction.

Wildlife and Habitat

Wildlife habitat needs vary significantly by species. It is generally understood that healthy and sustainable wildlife populations can be supported where there is a diverse mix of vegetation communities that supply structure, forage, cover, and other specific habitat requirements. The current conditions in this section are generalized and reflect inventories, museum records, and research conducted in GSENM.

Surveys for herptiles have been conducted yearly since 2016 in the general vicinity of GSENM. In 2021, surveys took place in Beaver, Garfield, Iron, Kane, Piute, San Juan, and Wayne Counties (Heyborne and Gardner 2021). These surveys identified six species of amphibians: Arizona tiger salamander (*Ambystoma mavortium nebulosum*), red-spotted toad (*Anaxyrus punctatus*), Woodhouse's toad (*Anaxyrus woodhousii*), canyon tree frog (*Hyla arenicolor*), plains leopard frog (*Lithobates blairi*), and Great Basin spadefoot *(Spea intermontana)*); 12 lizards: western whiptail (*Aspidoscelis tigris*), plateau striped whiptail (*Aspidoscelis velox*), Great Basin collared lizard (*Crotaphytus bicinctores*), eastern collared lizard (*Crotaphytus collaris*), long-nosed leopard lizard (*Gambelia wislizenii*), greater short-horned lizard (*Phrynosoma hernandesi*), northern sagebrush lizard (*Sceloporus graciosus*), desert spiny lizard (*Sceloporus magister*), western fence lizard (*Sceloporus occidentalis*), eastern plateau fence lizard (*Sceloporus undulatus elongatus*), ornate tree lizard (*Urosaurus ornatus*), common side-blotched lizard (*Uta Stansburiana)*; and six snakes: striped whipsnake (*Coluber taeniatus*), Great Basin rattlesnake (*Crotalus oreganus lutosus),* desert night snake (*Hypsiglena chlorophaea deserticola*), common kingsnake (*Lampropeltis getula*), Great Basin gopher snake (*Pituophis catenifer deserticola*), and western terrestrial garter snake (*Thamnophis elegans vagrans*).

The desert night lizard (*Xantusia vigilis*) and the common chuckwalla (*Sauromalus ater)* have not been observed during the five years of survey, despite concerted efforts (Heyborne and Gardner 2021). All known locations for both species have been surveyed multiple times, with no observations. Historically, the desert night lizard has been observed both in the Glen Canyon and in GSENM (Persons and Nowak 2008). Previous observations in GSENM were very localized between Kelly Grade and Last Chance Creek along Smoky Mountain Road. Records of the common chuckwalla in the region are also rare, with only five observations during surveys from 2001 to 2003 in the adjacent Glen Canyon. Previous observations of the common chuckwalla in GSENM are also very localized, with observations only in

lower Little Valley, Croton, and Last Chance Creek Canyons. The Arizona toad (*Anaxyrus microscaphus*) has also not been observed during recent surveys, although historical reports confirm the species' presence in GSENM. Heyborne and Gardner (2021) suggest these observations may constitute misidentified specimens.

During the 2020 and 2021 surveys, the plains leopard frog, a species not known to occur within Utah, was confirmed by multiple observations (Heyborne and Gardner 2021). However, they are likely not native and are a population introduced during the transport of fish to the Wahweap Hatchery. Occurrences have not been recorded outside of the Wahweap Wash, indicating the species has likely not moved to other areas in GSENM. As more inventories are conducted, it is possible that new occurrences and range extensions will be discovered.

There are over 200 species of birds in GSENM. Some are year-round residents, while most are present seasonally and are considered migratory. Common raptor species include bald eagles (*Haliaeetus leucocephalus*), golden eagles (*Aquila chrysaetos*), California condors (*Gymnogyps californianus*), and peregrine falcon (*Falco peregrinus)*. Many neotropical (migratory) birds concentrate around the Paria and Escalante Rivers and other riparian corridors in the decision area, while others require upland habitat such as sagebrush (*Artemisia* sp.) or piñon (*Pinus monophyla*) and juniper (*Juniperus osteosperma*). The decision area is in Bird Conservation Region 16, Southern Rockies/Colorado Plateau (USFWS 2021). The United States Fish and Wildlife Service (USFWS) lists 13 bird species of conservation concern that have the potential to occur in the decision area (**Table 5-29**; USFWS 2022) and has identified these species as needing special conservation actions.

Table 5-29
Birds of Conservation Concern That Have the Potential to Occur in GSENM

Species	Scientific Name	Habitat	Potential for Occurrence in GSENM[6]
Bald eagle	*Haliaeetus leucocephalus*	Large lakes and surrounding forests	Common in winter; no nesting
Clark's grebe	*Aechmophorus clarkia*	Large freshwater lakes and marshes	Rare; common near Lake Powell, White Hollow Reservoir
Black rosy-finch	*Leucosticte atrata*	High-altitude mountains	Rare
Black-chinned sparrow	*Spizella atrogularis*	Dry brushlands and chaparral	Rare
Cassin's finch	*Carpodacus cassinii*	Coniferous forests	Rare
Evening grosbeak	*Coccothraustes vespertinus*	Coniferous forests	Rare
Grace's warbler	*Dendroica graciae*	Coniferous forests	Rare
Lesser yellowlegs	*Tringa flavipes*	Marshes and wetlands	Very Rare
Lewis's woodpecker	*Melanerpes lewis*	Ponderosa pine forests, higher elevations	Rare
Long-eared owl	*Asio otus*	Coniferous forests	Rare
Olive-sided flycatcher	*Contopus cooperi*	Boreal and coniferous forests	Rare
Pinyon jay	*Gymnorhinus cyanocephalus*	Piñon-juniper woodlands	Common
Virginia's warbler	*Vermivora virginiae*	Piñon-juniper woodlands	Common

Source: USFWS 2022

[6]Lisa Church, BLM GSENM wildlife biologist, personal communication on August 4, 2022, regarding bird species in the decision area.

A literature and museum survey of GSENM mammals lists 82 confirmed contemporary species (including the big game species discussed below). As many as 24 rodent species are thought to occur in the decision area (Flinders et al. 2002). Rodents are the most represented group, and common rodents represented in the region include: woodrats (*Neotoma* spp.), which are known for their storage and waste structures, called middens; pocket mice (*Perognathus* spp.); kangaroo rats (*Dipodomys* spp.); chipmunks (*Tamias* spp.), pocket gophers (*Thomomys* spp.), and mice (*Peromyscus* spp.) (NPS 2007). Dr. David Willey of Montana State University recorded 12 distinct rodent species while conducting a Mexican spotted owl prey study in the decision area (Willey and Willey 2010).

Black-tailed jackrabbit (*Lepus californicus*) and desert cottontail (*Sylvilagus audubonii*) are the only rabbit species in GSENM. Carnivorous mammals include black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and mountain lion (*Puma concolor).* These species prey on rodents, birds, lizards, and other large mammals (Flinders et al. 2002).

Sixteen bat species have been observed in GSENM (Flinders et al. 2002 and recent capture data[7]), including pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), little brown myotis (*Myotis lucifugus*), fringed myotis (*Myotis thysanodes*), western pipistrelle (*Parastrellus larkia*), and Brazilian free-tailed bat (*Tadarida brasiliensis*). Bats in GSENM include both year-round residents and migrants. Bats roost alone or in colonies in the cliffs and canyon walls during the day and emerge at dusk to hunt for insects.

Game animals provide an important recreation and economic benefit through hunting and wildlife-viewing. Game populations in the area consist of desert bighorn sheep (*Ovis canadensis larki*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and elk (*Cervus canadensis*). In addition, the decision area provides suitable habitat for raccoon (*Procyon lotor*), badger (*Mustelidae mephitidae*), long-tailed weasel (*Mustela frenata*), beaver (*Castor canadensis*), and upland game birds. The UDWR manages wildlife populations and hunting seasons. The decision area is in UDWR game management units 25C/26 and 27.

Bighorn Sheep

In partnership with local conservation groups, the UDWR has reintroduced and supplemented populations of bighorn sheep in Utah since 1973. Since that time, over 1,000 desert bighorn sheep have been released in areas of historical habitat (UDWR 2018). Year-long crucial habitat for desert bighorn sheep, approximately 546,800 acres, is found throughout the decision area (BLM GIS 2022; **Figure 5-12, Appendix B**). An additional 8,600 acres of substantial habitat has also been identified. The largest intact crucial habitat extends southwest from the Straight Cliffs to Highway 89. Smaller crucial habitat is located near Rock Springs Bench and Circle Cliffs. As of 2018, the UDWR estimates Utah's population of desert bighorn sheep at 2,900. The decision area is home to two bighorn sheep populations: Kaiparowits East/West and Kaiparowits Escalante. In 2018, the estimate for these combined populations was 954 sheep (UDWR 2018). Bighorn sheep prefer very open vegetation types such as low shrub, grassland, and other treeless types typically associated with steep talus and rubble slopes. Bighorn diets consist of a variety of shrubs, forbs, and grasses. Bighorn sheep lambing occurs on steep talus slopes, typically within 1 to 2 miles of reliable water sources.

[7]Cameron McQuivey, BLM GSENM wildlife biologist, personal communication on July 6, 2022, regarding bat species in the decision area.

Bighorn sheep are extremely vulnerable to a variety of viral and bacterial diseases carried by livestock, principally domestic sheep. In some reported cases, bighorn sheep exposure to these diseases has resulted in the decimation of entire populations. These diseases are transmitted in numerous ways, including nose-to-nose contact and wet soils associated with areas of concentrated use such as stock watering ponds. Management of bighorn sheep is guided by the following BLM documents: Utah BLM Statewide Desert Bighorn Sheep Management Plan Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat (Western Association of Fish and Wildlife Agencies Wild Sheep Working Group 2012), Utah Bighorn Sheep Statewide Management Plan (UDWR 2018), and corresponding UDWR herd management plans.

Pronghorn

Archaeological data suggests that pronghorns were present in portions of south-central Utah but were extirpated by the early 1900s. In the 1970s the UDWR began a reintroduction program that was unsuccessful. Poaching led to the herd being extirpated for the second time by the 1980s. With the establishment of GSENM, reintroductions were once again initiated in 1999 and continued until 2005. Approximately 400 individuals were released during this period.

The Utah statewide population estimate for pronghorn is 15,695, and efforts are ongoing to reintroduce the species into historical habitats to augment existing populations (UDWR 2017). The Kaiparowits population has been a beneficiary of such augmentation, receiving just under 400 individuals between 1999 and 2004. However, the current population was estimated at 60 individuals in 2017. The Paunsaugunt population was estimated at 800 in 2017 and was stable (UDWR 2017). Only 40 individuals are estimated across all of GSENM.[8]

Year-long crucial habitat for pronghorn, approximately 82,900 acres, is located within the decision area (BLM GIS 2022; **Figure 5-13, Appendix B**). Pronghorns use shrub-steppe habitat, characterized by large expanses of open, low, rolling, or flat terrain (UDWR 2009). Lactating females rely on succulent forbs in the spring and early summer and need high-quality browse above snow level in winter (UDWR 2017). Pronghorn fawning occurs throughout the range of this species. Pronghorn diets consist of a variety of forbs, shrubs, and grasses. Forbs are of particular importance during spring and summer, while shrubs are more important during the winter.

Mule Deer

Mule deer habitat, approximately 1,239,100 acres including winter, year-long, and summer habitat, is found throughout the decision area (BLM GIS 2022; **Figure 5-14, Appendix B; Table 5-30**). Mule deer use a variety of habitats, usually areas in the early stages of plant succession, where they browse on forbs and grasses (UDWR 2019a). In winter in the decision area, they use piñon-juniper, sagebrush, and mixed vegetation cover types; in the summer, they use sagebrush, bitterbrush, and rabbitbrush (Messmer and Klimack 1999). They rely especially on shrubs for forage during critical winter months.

[8]Cameron McQuivey, BLM GSENM wildlife biologist, personal communication on July 27, 2022, regarding pronghorn populations.

Table 5-30
Acres of Mule Deer Habitat within Grand Staircase-Escalante National Monument

Habitat	Acres
Summer crucial	126,500
Summer substantial	17,400
Winter crucial	852,600
Winter substantial	224,000
Year-long substantial	18,400
Total	1,239,100

Source: BLM GIS 2022

A major challenge to mule deer management in Utah is that many of the UDWR-designated crucial deer ranges are in late successional plant community stages. These areas are dominated by mature stands of piñon-juniper or other conifer trees and old, even-aged stands of shrubs, such as sagebrush. This makes them less favorable to mule deer (UDWR 2019a).

Mule deer are migratory, moving seasonally between summer and winter ranges. Mule deer usually summer at high elevations and winter at low elevations. Approximately 21,100 acres of migration corridors have been identified for mule deer in GSENM. Studies have shown that some mule deer on the Paunsaugunt Plateau migrate south into Arizona for winter (Messmer and Klimack 1999). An estimated 6,500 mule deer migrate from higher elevations of the Paunsaugunt Plateau and travel up to 30 miles to winter habitats at lower elevations in areas such as Buckskin Mountain, Nephi Pasture, and Fivemile Mountain.

Mule deer have a high degree of fidelity to specific winter ranges where high population densities concentrate on relatively small areas. Big game species, including mule deer, are vulnerable to stress caused by human activity, and can displayed varied response such as altered behavior and reduced vigor and productivity (Anderson 1995).

Elk

Habitat for elk, approximately 165,600 acres including winter, year-long, and summer habitat, exists within the decision area at mid to high elevations (BLM GIS 2022; **Figure 5-15, Appendix B; Table 5-31**). Elk are habitat generalists and have a varied diet consisting of grasses, forbs, and shrubs. This flexible diet allows elk to live in a variety of habitat types, including all of Utah's mountains and some of the low deserts. Many elk in the decision area are migratory, moving seasonally between summer and winter ranges. Elk generally spend their summers at high elevations in aspen and conifer forests, and winters at mid- to low-elevation habitats that contain mountain shrub and sagebrush communities (UDWR 2020). There are also established year-round residents in the Circle Cliffs and Skutumpah Terrace. Human activity in elk winter range adds additional stress to the natural stress of winter survival.

The Paunsaugunt and Plateau, Boulder elk herds are both managed primarily through hunting. Herds are initially kept low and are uncommon throughout GSENM. The 2014 population estimate for the Paunsaugunt herd was 175 individuals, and the Plateau, Boulder herd was estimated at 1,700 (UDWR 2020). It should be noted that the Plateau, Boulder herd encompasses a large area outside of GSENM.

Table 5-31
Acres of Elk Habitat within Grand Staircase-Escalante National Monument

Habitat	Acres
Summer substantial	10,800
Winter crucial	13,300
Winter substantial	79,900
Year-long substantial	61,500
Total	165,600

Source: BLM GIS 2022

Special Status Species

On the lands it manages in the decision area, the BLM is directly responsible for managing habitat for special status species and is indirectly responsible for the health of special status species that these habitats support. These species are animals and plants that require specific management attention because of population or habitat concerns. Special status species are federally threatened, endangered, proposed, and candidate species, and BLM sensitive species. BLM sensitive species include all documented or suspected federal candidate species, those listed by Utah as endangered or threatened, and any other species that may be designated by the director.

It is in the interest of the BLM to implement conservation actions for sensitive, non-listed species before listing is warranted. It is also in the interest of the public for the BLM to implement conservation actions that improve the status of such species so that their BLM sensitive recognition is no longer warranted. In so doing, the BLM will have greater flexibility in managing the public lands to accomplish native species conservation objectives and other legal mandates. BLM Manual 6840 provides policy and guidance for the conservation of BLM special status species and the ecosystems upon which they depend on BLM-managed lands (BLM 2008a).

Federally Listed Species

Endangered or threatened species are those that the Secretary of the Interior has officially listed under the ESA, and for which a final rule has been published in the *Federal Register*. Proposed species are those that the Secretary has officially proposed for listing as endangered or threatened, and for which a proposed rule has been published in the *Federal Register*. Candidate species are those that the USFWS has designated as candidates for listing as endangered or threatened and are included on a list published in the *Federal Register*. Candidate status indicates that existing information warrants listing the species, but other species have higher priority for listing.

The BLM has two objectives for special status species: 1) to conserve or allow to recover ESA-listed species and their habitats so that ESA protections are no longer needed, and 2) to initiate conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of, and need for, listing under the ESA (BLM 2008b).

A list of federally threatened, endangered, and candidate species that have the potential to occur in the decision area was obtained from the USFWS's Information for Planning and Consultation website on June 27, 2022. Ten animal species have the potential to occur in the decision area; however, after consultation with the GSENM biologist, this list was refined to include eight species (**Table 5-32;** USFWS 2022). The decision area overlaps designated critical habitat for the Mexican spotted owl and the southwestern willow flycatcher.

Table 5-32
Federally Listed Species that Have the Potential to Occur in GSENM

Species	Scientific Name	Federal Status	BLM Status
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Sensitive Species
California condor	*Gymnogyps californianus*	Experimental Population	Sensitive Species
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Sensitive Species
Humpback chub	*Gila cypha*	Threatened	Sensitive Species
Bonytail chub	*Gila elegans*	Endangered	Sensitive Species
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Sensitive Species
Razorback sucker	*Xyrauchen texanus*	Endangered	Sensitive Species
Monarch butterfly	*Danaus plexippus*	Candidate	Sensitive Species

Source: USFWS 2022

Due to lack of occurrence records, it was determined that the Utah prairie dog (*Cynomys parvidens*) does not have the potential to occur in the decision area. Suitable habitat for western yellow-billed cuckoo (*Coccyzus americanus*) is not present in the decision area. Although this species has been observed in dense riverside tamarisk thickets at several locations on the Colorado and San Juan Rivers, the primary element of their critical habitat, vast riparian woodlands with mixed willow-cottonwood vegetation in contiguous patches greater than 325 feet in width and 200 acres or more in extent (NPS 2014), is not present in the decision area. Additionally, there are no known occurrence records for the western yellow-billed cuckoo in the decision area.[9]

BLM Sensitive Species

It is the BLM's policy to ensure that actions authorized, funded, or carried out do not contribute to the need for the species to become listed (BLM 2008b). The sensitive species designation is normally used for species that occur on BLM-managed surface land for which it has the capability to significantly affect the conservation status of the species through management.

The Utah BLM State Director's sensitive species list includes sensitive animal and plant species that the BLM and UDWR recognize. Many of the sensitive species listed by the BLM overlap with the Utah sensitive species list; however, because the lists are maintained separately, they differ slightly. These lists are subject to periodic updates, and new lists will be incorporated into the land use plan through plan maintenance or amendments. The most recent IM listing Utah BLM state sensitive species is IM UT-2019-005 (BLM 2019), updated March 4, 2019.

BLM biologists reviewed and narrowed down the Utah Bureau Sensitive Species List (BLM 2019) to species in or with potential to occur in the decision area (**Table 5-33**).

[9]Cameron McQuivey, BLM GSENM wildlife biologist, personal communication on July 6, 2022, regarding federally listed species in the decision area.

Table 5-33
BLM Sensitive Species Documented in or Potentially Occurring in the Decision Area

Species	Scientific Name	BLM Status	State Status	Occurrence in GSENM
Birds				
Northern goshawk	*Accipiter gentilis*	Conservation Agreement Species	Conservation Agreement Species	One confirmed territory in Mud Springs Canyon and one additional territory in Rock Creek/Mudholes; occasionally observed in winter in piñon-juniper habitat
Golden eagle	*Aquila chrysaetos*	Sensitive Species	Species of Concern	Permanent resident in the decision area; commonly observed
Burrowing owl	*Athene cunicularia*	Sensitive Species	Species of Concern	Documented in the Hole-in-the-Rock area and near Church Wells
Short-eared owl	*Asio flammeus*	Sensitive Species	Species of Concern	Uncommon permanent resident in the decision area
Ferruginous hawk	*Buteo regalis*	Sensitive Species	Species of Concern	Commonly observed during winter raptor surveys; two historically unoccupied nests on West Clark Bench
Greater sage-grouse	*Centrocercus urophasianus*	Sensitive Species	Species of Concern	Approximately 5,800 acres of priority habitat management areas (winter habitat) in the Skutumpah/Glendale Bench area
Bald eagle	*Haliaeetus leucocephalus*	Sensitive Species	Species of Concern	Winter resident in the decision area; commonly seen during winter raptor surveys
Lewis's woodpecker	*Melanerpes lewis*	Sensitive Species	Species of Concern	Uncommonly observed in piñon-juniper and oak habitats in the decision area
Mammals				
Townsend's big-eared bat	*Corynorhinus townsendii*	Sensitive Species	Species of Concern	Known to occur in the decision area
Spotted bat	*Euderma maculatum*	Sensitive Species	Species of Concern	Known to occur in the decision area
Allen's big-eared bat	*Idionycteris phyllotis*	Sensitive Species	Species of Concern	Known to occur in the decision area
Western red bat	*Lasiurus blossevillii*	Sensitive Species	Species of Concern	Potential habitat in the decision area
Fringed myotis	*Myotis thysanodes*	Sensitive Species	Species of Concern	Known to occur in the decision area
Big free-tailed bat	*Nyctinomops macrotis*	Sensitive Species	Species of Concern	Confirmed at the decision area through mist net capture (BLM 2008b)
Insects				
Western bumble bee	*Bombus occidentalis*	Sensitive Species	Species of Concern	Known to occur in the decision area
Monarch butterfly	*Danaus plexippus*	Sensitive Species	Species of Concern	Known to occur in the decision area, although breeding habitat is likely limited

Species	Scientific Name	BLM Status	State Status	Occurrence in GSENM
Amphibians				
Arizona toad	*Bufo microscaphus*	Sensitive Species	Species of Concern	Not found in 5 years of surveys (Heyborne and Gardner 2021)
Reptiles				
Common chuckwalla	*Sauromalus ater*	Sensitive Species	Species of Concern	Not found in 5 years of surveys (Heyborne and Gardner 2021)
Desert night lizard	*Xantusia vigilis*	Sensitive Species	Species of Concern	Not found in 5 years of surveys (Heyborne and Gardner 2021)
Fishes				
Bluehead sucker	*Catostomus discobolus*	Conservation Agreement Species	Conservation Agreement Species	Present in the Escalante River drainage
Flannelmouth sucker	*Catostomus latipinnis*	Conservation Agreement Species	Conservation Agreement Species	Present in the Escalante River drainage
Roundtail chub	*Gila robusta*	Conservation Agreement Species	Conservation Agreement Species	Present in the Escalante River drainage
Colorado River cutthroat trout	*Oncorhynchus clarkia pleuriticus*	Conservation Agreement Species	Present in the Escalante River drainage	Colorado River

Source: BLM 2019

Greater Sage-grouse

The greater sage-grouse is a keystone species and is representative of the quality of sagebrush habitat it shares with other wildlife, including many big game species, mammals, and other avian species. In 2010, the USFWS determined that the greater sage-grouse warranted ESA protection because of population declines caused by loss and fragmentation of sagebrush habitat, and a lack of regulatory mechanisms to control habitat loss. However, higher-priority listing actions precluded the USFWS from taking action to list the greater sage-grouse.

However, management plans and actions from partners have added thousands of acres of quality habitat that have reduced the risks to this species. The future of the greater sage-grouse depends on the successful implementation of these management plans and the actions, as well as a focus on invasive species and managing rangeland fire.

Greater sage-grouse is considered a sagebrush ecosystem obligate species; it relies on sagebrush at a landscape level and on a microhabitat scale. It requires large, intact, interconnected expanses of sagebrush shrubland to exist (Connelly et al. 2004; Wisdom et al. 2011). As a landscape-scale species, it moves between habitats seasonally, and requires contiguous winter, breeding, nesting, and summer habitats to sustain a population (Connelly et al. 2011).

During the spring breeding season, male greater sage-grouse congregate to perform courtship displays to attract females on areas called leks. Females nest under shrubs with herbaceous understory, which provides concealment and cover (DeLong et al. 1995). Chick survival is associated with high grass and forb understory cover. This is because chicks eat insects for their first 3 weeks and mostly forbs until they are 3 months old (Barnett and Crawford 1994; Gregg et al. 1994; Connelly et al. 2004; Casazza et al. 2011). As the herbaceous understory in sagebrush habitats begins to dry out in midsummer, greater sage-grouse move to where the herbaceous understory is green, including higher elevations or in valleys

where succulent forbs are present (Fischer et al. 1996, Braun et al. 2005). In winter, they rely almost entirely on sagebrush for food and thermal cover. They congregate at lower elevations, where sagebrush habitat is available above the snow (Crawford et al. 2004; Schroeder et al. 1999).

Greater sage-grouse lek counts were conducted in 2021 by the UDWR. In Utah's Sage-grouse Management Areas (SGMAs), 357 greater sage-grouse leks were visited and 184 of those leks had at least one male counted. Across all leks counted within the SGMAs there was a high count of 2,127 males, for an average of 11.6 males per lek. Statewide, a total of 387 greater sage-grouse leks were visited. Of the leks visited, 197 had at least one male counted. Across all counted leks where sage-grouse were detected there was a high count of 2,230 males, for an average of 11.3 males per lek. Within the SGMAs, 16 leks counted were classified as undetermined and contributed 83 males to the total count. Outside the SGMAs, there were not any male greater sage-grouse counted on undetermined leks (UDWR 2021).

There are approximately 5,800 acres of greater sage-grouse priority habitat management area in the Skutumpah/Glendale Bench of the decision area (BLM GIS 2022; **Figure 5-16, Appendix B**). Priority habitat management areas are areas identified with the highest conservation value for maintaining sustainable greater sage-grouse populations. Priority habitat management areas in the decision area comprise the far southern portion of the Panguitch population area, and it is identified as wintering habitat (BLM and the United States Forest Service [USFS] 2015). Opportunity habitat is area that contains elements of sage-grouse habitat that could become occupied with land management practices promoting healthy sagebrush steppe. Opportunity habitat is not mapped, but rather identified on the ground using criteria listed in the Utah Conservation Plan for Greater Sage Grouse (State of Utah 2019). Habitat in the Panguitch population area is experiencing localized threats of habitat loss from piñon-juniper expansion.

5.10.2 Trends

Fish

Some of the decision area's aquatic habitats, notably the Paria River, have gradually declined over the last century due to a combination of human influences such as water diversions, irrigation projects, improper livestock grazing, roads, farming and ranching practices that dewater the system, mining, and recreational use. Such activities have led to a loss of wetland and riparian habitats, reduced water quantity and quality, increased water temperatures, increased loss of instream habitat, and fragmented stream reaches, all of which have led to declining native fish populations. At present, only the speckled dace is known to occur in this system. Fish species in the Escalante River drainage are trending better than those in the Paria River, according to UDWR monitoring data (UDWR 2019b). Although the Escalante River contains many nonnative species, the current diversity of native and nonnative species has been present in the river system for decades.

Wildlife

Most fish and wildlife species are not monitored thoroughly enough to determine changes in distribution and abundance. However, big game populations and trends are estimated in each species' statewide 5-year management plan. Specific trends in the decision area are unknown.

Bighorn Sheep

As of 2018, the UDWR estimated Utah's population of desert bighorn sheep at 2,900. Utah currently has 13 individually managed populations of desert bighorn sheep, many of which are the result of transplant efforts. Five of these populations are showing increasing trends, seven are stable, and one is declining because of culling efforts due to disease outbreak. Trend counts for the two populations in the decision area were 88 individuals in the Kaiparowits, Escalante Unit (2017) and 355 individuals in the Kaiparowits, East/West Unit (2015) (UDWR 2018).

Pronghorn

Between 1999–2005, there were a total of 373 pronghorn released in the East Clark Bench area of GSENM and state lands. The UDWR set a population objective of 600 pronghorn, but that goal has never been met. In recent years, two herds, the Flat Top and Telegraph Flat herds, are thought to be extirpated. The lack of water throughout the region is thought to be one of the main limiting factors affected pronghorns' ability to establish a sustainable population.

Mule Deer

The 2019 post-season statewide population estimate for mule deer in Utah was 372,500, 82 percent of the long-term management objective of 453,100 individuals. The population had good growth during the mid- to late-1990s, but then declined during the severe drought years from 2000 to 2003 when fawn production decreased. The harsh winters in northern Utah in 2007–2008 and in southern Utah in 2009–2010 negatively impacted adult and fawn survival, resulting in population declines. Weather conditions from 2011–2015 were favorable for mule deer, resulting in an increase of nearly 100,000 deer. Overall, the deer population in Utah has grown at an average rate of 1.6 percent over the past 20 years (UDWR 2019a). Habitat conditions in the Kaiparowits and Paunsaugunt population units in the decision area have been declining; desert conditions, along with limited water distribution, may exacerbate habitat limitations (UDWR 2015a, 2015b).

Elk

Elk are well established throughout Utah, with the current statewide population estimated at approximately 81,000. From 1975–1990, the elk population in Utah grew from an estimated 18,000 to 58,000 individuals, largely due to population levels below carrying capacity and the abundance of available habitat. From 1990–2005, population growth slowed considerably from expanded harvest management designed to reduce population growth rates (UDWR 2020). Currently, elk inhabit two main areas of GSENM: the Skutumpah Terrace/Glendale Bench area and the Circle Cliffs.

Special Status Species

Few data exist to determine trends for special status fish species, specifically in GSENM. However, monitoring conducted by the UDWR in the region indicates most populations of flannelmouth sucker, roundtail chub, and bluehead sucker are stable (UDWR 2019b). However, 2015 was the most recent year roundtail chub were identified in the Escalante River (UDWR 2015c). Factors affecting populations that are declining include drought, nonnative species, and habitat degradation (UDWR 2019b).

Properly functioning riparian conditions in good ecological form are necessary to maintain quality fish habitat. Riparian PFC assessments completed in the decision area between 2000–2014 and are displayed on **Figure 5-17** (**Appendix B**) show that 66 percent of lentic sites (standing water) were in PFC, and

an additional 17 percent were functioning at risk (FAR), with an upward trend toward PFC. Fourteen percent of lentic sites were FAR, with a downward trend or no apparent trend, and 3 percent were nonfunctional. Of lotic sites (moving water), 74 percent were in PFC, 4 percent were FAR with an upward or static trend, 23 percent were FAR with no apparent or a downward trend, and zero percent were nonfunctional (BLM GIS 2022). These data suggest that most riparian and wetland sites assessed are in functioning condition or are moving toward functioning condition.

Special status fish species populations have generally been declining throughout Utah. The downward trend is largely due to habitat degradation and loss of habitat complexity caused by erosion, riparian vegetation removal, and channelization (UDWR 2019b). Additionally, increased drought, stream dewatering, and fish barriers pose substantial threats to sensitive aquatic species recovery and contribute to declining numbers. Nonnative predation on and resource competition with special status fish species also threaten native aquatic populations throughout Utah.

The Colorado Plateau Rapid Ecoregional Assessment modeled near-term (2025) aquatic habitat intactness in the Colorado Plateau ecoregion, which includes the decision area. Modeled habitat intactness for aquatic species, including razorback, flannelmouth sucker, and Colorado River cutthroat trout, declined from low to very low (Bryce et al. 2012), which may be related to declining trends for these species.

The southwestern willow flycatcher relies on dense riparian systems at critical stages of their life cycles (USFWS 2002a; UDWR 2011). Critical habitat for southwestern willow flycatcher in the decision area exists along the Paria River, and nonbreeding individuals have been observed in riparian areas in both the Paria and Escalante River corridors. Approximately 1,100 acres of critical habitat overlap the decision area (BLM GIS 2022; **Figure 5-16, Appendix B**).

Several breeding pairs of Mexican spotted owl have been observed over multiple years in the decision area (Willey and Willey 2010; Hockenbary 2011). Critical habitat exists in the decision area, and nesting territories are also protected by eight federally designated protected activity centers (PACs), a component of the species' recovery plan (USFWS 2012). Approximately 440,900 acres of critical habitat and 5,300 acres of PACs overlap the decision area (BLM GIS 2022; **Figure 5-16, Appendix B**).[10] Population trends across the species' range remain unclear, due to few data on populations or occupancy rates (USFWS 2012); similarly, conclusions cannot be drawn from the limited data available in the decision area.

Regional habitat intactness can be used to gauge trends for terrestrial special status wildlife species. The Colorado Plateau Rapid Ecoregional Assessment modeled near-term (2025) terrestrial habitat intactness. Results indicate relatively small changes in the negative direction (that is, lower habitat intactness). According to the Colorado Plateau Rapid Ecoregional Assessment near-term (2025) terrestrial habitat intactness model, greater sage-grouse showed the most notable declines in habitat quality of all the bird species, due to development projected in the ecoregion (Bryce et al. 2012). Because development density is much lower in the decision area, habitat declines there for greater sage-grouse would be less notable than modeled in the Colorado Plateau Rapid Ecoregional Assessment. Other bird species, including Mexican spotted owl, golden eagle, burrowing owl, and peregrine falcon, all currently have a wider range of more intact habitat classes (Bryce et al. 2012). These species showed

[10] Due to the recent addition of the eighth PAC, acreages and locations only represent the previous seven PACs.

consistent declines in higher-quality habitat intactness, with matching increases in lower-quality habitat intactness in the near term (2025) (Bryce et al. 2012).

Based on data during the 2021 greater sage-grouse lek counts, overall observations on greater sage grouse management areas were down 2.2% from 2020. This continues the overall trend of declining population totals since the last high count in 2015. Population counts in 2020 and 2021 were slightly higher than 2019; however, as compared to past cyclic behavior, populations should have increased significantly (UDWR 2021).

5.10.3 Forecasts

Fish

Temperatures for many streams across southern Utah, including those in GSENM, are predicted to increase by 2080 (NorWeST 2014). Increases in stream temperatures will have impacts on habitat suitability for a variety of species, especially those requiring cold-water habitat such as trout.

The BLM has little influence over the uses occurring in the upper reaches of the Paria River. Irrigation and water rights allowing diversion and dewatering are outside of the BLM's span of control. Streams and river systems in the decision area are flashy in nature and experience extreme ranges in flow patterns due to monsoonal events. Restoration or improvement of fisheries, where possible, is mainly tied to sustainable water flows, instream habitat (pools and riffles), and riparian vegetation. The UDWR has proposed restoration of native fish species (Colorado River cutthroat trout) in tributaries of the Escalante River, such as Calf Creek. The BLM could coordinate among all landowners (federal, state, and private) to ensure that watershed conditions are adequate to support fish populations, implement habitat improvement projects, and to ensure protection of fisheries habitats. Whenever possible, the BLM could work with the State of Utah to secure instream flows.

Wildlife and Habitat

The threat of climate change and its associated impacts is a significant threat faced by fish and wildlife. Warming temperatures, drought, wildfire, and other extreme weather effects are expected to increase in frequency. This will likely contribute to impacts on fish and wildlife and their habitats as climate change continues. The Colorado Plateau Rapid Ecoregional Assessment suggests that the ecoregion is expected to undergo general warming over the entire region, with as much as a 3.6°F (2°C) increase by 2060 in some locations, particularly in the southern portion of the ecoregion (Bryce et al. 2012). Average summer temperatures are expected to increase, but even greater increases are simulated for the winter (Bryce et al. 2012).

Vegetation communities expected to have the greatest exposure (that is, higher probability for change) to climate change are shrublands (especially big sagebrush and blackbrush-Mormon tea communities), riparian vegetation, and piñon-juniper woodland (Bryce et al. 2012).

Insects and disease will play a collateral role to the impacts of climate change in altering the dominance and distribution of various vegetation species (Bryce et al. 2012); this will, in turn, alter the distribution and availability of habitat for fish and wildlife.

Another major threat further exacerbated by climate change is shifts in vegetation community structure and composition. Piñon-juniper woodlands have increased dramatically in the decision area over the past

century, and now occupy many other vegetation communities where they were once not present or at least not dominant. Shrub-steppe communities, especially sagebrush communities, have suffered greatly due to this vegetation shift. Sagebrush-obligate wildlife species such as songbirds, sage-grouse, and big game have declined in western states. Although this expansion has slowed in recent years, the impacts from the expansion remain. Opportunities are numerous within the decision area to restore degraded habitats.

5.11 HYDROLOGY (GROUNDWATER, SURFACE WATER, WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND WATER QUALITY)

5.11.1 Current Conditions

Surface Water Sources

Although water shaped much of the terrain of the planning area, there are limited sources of surface water under present day conditions. Surface water in this region flows to the Colorado River (whether above or below Glen Canyon Dam). The planning area crosses five level 4 (hydrologic unit code [HUC] 8) subbasins (**Figure 5-18, Appendix B**). The subbasins and acreages within the planning area boundary include the Kanab Creek Subbasin (HUC 15010003; 111,600 acres), the Paria River Subbasin (HUC 14070007; 492,300 acres), the Lower Lake Powell Subbasin (HUC 14070006; 593,100 acres), the Escalante River Subbasin (HUC 14070005; 664,500 acres), and the Upper Lake Powell Subbasin (HUC 14070001; 4,000 acres).

On the planning area's west side, the Kanab Creek Subbasin (including Johnson Wash and its tributaries) drains into the Grand Canyon. The Paria River Subbasin (including Hackberry Creek and Cottonwood Creek) extends from the Bryce Canyon-Bryce Valley area, terminating below Glen Canyon Dam near Lee's Ferry. The Paria River is perennial from below the town of Cannonville downstream to below the confluence of Cottonwood Creek; then, it becomes intermittent to the Colorado River. The upper reaches of the Paria River are intermittent and are often diverted for irrigation of agricultural lands near the towns of Tropic and Cannonville.

Last Chance Creek and Wahweap Creek within the Lower Lake Powell Subbasin are the primary tributaries off the Kaiparowits Plateau, flowing into the main body of Lake Powell. Wahweap Creek and Last Chance Creek are perennial only along portions of their length. The Escalante River and tributaries—many of which are perennial—within the Escalante River Subbasin flows from the Aquarius Plateau into the upper portions of Lake Powell. Above the town of Escalante, most of the river's flow is diverted seasonally to Wide Hollow Reservoir for irrigation of agricultural lands.

In total, there are approximately 7,000 miles of streams and washes within the planning area (BLM GIS 2022). Approximately 97 percent of these are intermittent or ephemeral. See Table 1 in Appendix P of the GSENM/KEPA EIS (BLM 2020) for a full list of subbasins and surface waterbodies in the planning area. There are no Federal Emergency Management Agency mapped floodplains in GSENM. See **Section 5.3** for more information on soils found in GSENM.

Flash Floods

Ephemeral channels and arroyos, the most prevalent drainage ways in the planning area, are subject to rare but intense short-duration flows during and immediately following up-gradient precipitation events. A flash flood is a rapid rise of water (generally within 6 hours) along a stream or low-lying area after a heavy rainfall or from the failure of a dam, levee, or ice jam. Flash flooding can occur in canyons and

washes in the planning area. The National Weather Service's Salt Lake City office produces a product called the Flash Flood Potential Rating for areas such as Glen Canyon and GSENM that is issued twice daily during the summer and fall seasons, approximately mid-May to late October (NOAA 2013). The Flash Flood Potential Rating provides a rating for the potential for flash flooding over the following 2 days.

Flash floods can cause damage to water resources and related infrastructure (such as range improvements). For example, flash floods can damage fences and instream pipelines, and increase the potential for erosion by stripping vegetation and other soil-stabilizing agents from the landscape. Flash floods can also alter drainage patterns and deposit unusually high volumes of sediment or pollutants in water sources. The longevity of impacts from flash floods varies depending on a variety of factors, including the location, intensity, and duration of the flash flood; the integrity of land surface conditions prior to the flash flood; and the type and location of structures within the flood's path.

Riparian and Wetlands

Riparian vegetation generally occurs next to rivers, creeks, lakes, springs, and wetlands. Riparian areas are a transition zone between upland and aquatic ecosystems. Riparian areas occur where water is perennial, intermittent, or ephemeral. Riparian areas are defined as a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas.

Wetlands occur in spaces between terrestrial and aquatic systems where the water table is usually at or near the surface or where shallow water covers the land. Soil, water conditions, and vegetation type distinguish wetlands from all other ecosystems. The U.S. Army Corps of Engineers regulates wetlands, which are defined as "those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas".

PFC is a qualitative method for assessing the condition of riparian-wetland areas. The term is used to describe both the assessment process and a defined, on-the-ground condition of a riparian-wetland area. The on-the-ground condition termed PFC refers to how well the physical processes are functioning. PFC is a state of resilience that allows an area to produce desired values. Riparian-wetland areas that are not functioning properly cannot sustain these values. PFC is a qualitative assessment performed by an interdisciplinary team. Functioning condition is rated by category to reflect ecosystem health.

The BLM completed riparian PFC assessments in the decision area between 2000–2014 (**Figure 5-17, Appendix B**). Sixty-six percent of lentic sites (standing water) were in PFC, and an additional 17 percent were functioning at risk (FAR), with an upward trend toward PFC. Fourteen percent of lentic sites were FAR, with a downward trend or no apparent trend, and 3 percent were nonfunctional. Of lotic sites (moving water), 74 percent were in PFC, 4 percent were FAR with an upward or static trend, 23 percent were FAR with no apparent or a downward trend, and zero percent were nonfunctional (BLM GIS 2022).

Currently, under the 2020 Approved RMP, a 330ft buffer is applied to riparian resources where new surface-disturbing activities are to be avoided unless it could be shown that (1) there are no practical alternatives (e.g., a designated utility corridor), (2) all long-term impacts could be fully mitigated, or (3) the activity would benefit and enhance the riparian area (**Figure 5-19, Appendix B**).

Water Quality

Every other year, the Utah Department of Environmental Quality, Division of Water Quality compiles all readily available data and conducts analyses to determine whether the water quality is sufficient to meet the beneficial uses assigned to waters in Utah (Utah DEQ 2018). Forty-one assessment units that cross into the planning area are protected for the following beneficial uses:

- 1C – Domestic/Drinking Water Source
- 2A – Frequent Primary Contact Recreation (for example, swimming)
- 2B – Infrequent Primary Contact Recreation (for example, wading and fishing)
- 3A – Cold Water Fishery/Aquatic Life
- 3B – Warm Water Fishery/Aquatic Life
- 3C – Nongame Fishery/Aquatic Life
- 4 – Agriculture (crop irrigation, stock watering)

For the 2022 reporting year, forty-one percent of assessment units within the decision area were classified as impaired and failing to meet water quality standards. **Table 5-34** identifies the impaired assessment units and their causes of impairment. **Figure 5-19, Appendix B** shows riparian areas and the impaired assessment units. Additionally, forty-nine percent of assessment units had insufficient data to be assessed, five percent supported all designated uses, and 10 percent of assessment units supported all designated or assessed uses.

Impairments in the planning area are a result of elevated total dissolved solids (TDS), temperature, and benthic macroinvertebrate assemblages, all of which are common sources of impaired uses in the arid west region streams (see **Table 5-34**). In some cases, livestock grazing may contribute to water quality impairment via direct effects, such as those of animal waste on dissolved oxygen or nutrients (nitrogen or phosphorus), or by indirect effects, such as by increasing erosion, which increases sediment loading (turbidity), TDS, and associated metals. Such effects may also impair benthic macroinvertebrate and fish habitat and result in low observed and expected bio-assessment scores.

Table 5-34
Utah List of Assessment Units in the Planning Area for Reporting Year 2022

Waterbody Name	Assessment Unit ID	Acres in Planning Area	Assessment Category	Beneficial Use	Cause of Impairment
Birch Creek	UT14070005-002_00	13	5 – total maximum daily load (TMDL) required	2B, 3A, 4	3A: Temperature
Calf Creek	UT14070005-007_00	8,600	5 – TMDL required	2B, 3A, 4	3A: Temperature

Waterbody Name	Assessment Unit ID	Acres in Planning Area	Assessment Category	Beneficial Use	Cause of Impairment
Cottonwood Creek	UT14070007-004_00	68,100	5 – TMDL required	2B, 3C, 4	3C: Dissolved Oxygen
Escalante River Lower	UT14070005-011_00	1,500	5 – TMDL required	2B, 3B, 4	3B: Dissolved Oxygen
Escalante River Upper	UT14070005-012_00	2,000	5 – TMDL required	2B, 3B, 4	3B: Benthic Invertebrate Assessment 4: TDS
Halls Creek	UT14070001-001_00	4,000	5 – TMDL required	2B, 3B, 4	3B: Temperature
Johnson Wash-1	UT15010003-004_00	97,100	5 – TMDL required	2B, 3C, 4	4: TDS and Boron
Johnson Wash-2	UT15010003-005_00	12,400	5 – TMDL required	2B, 3A, 4	2B: pH 3A: pH, Temperature, Benthic Invertebrate Assessment, zinc, and dissolved oxygen 4: pH and TDS
Kanab Creek-1-2	UT15010003-002_02	1,400	5 – TMDL required	2B, 3C, 4	4: TDS
Kanab Creek-2	UT15010003-003_00	700	5 – TMDL required	2B, 3C, 4	3C: Selenium 4: Selenium, TDS, and Boron
Last Chance Creek	UT14070006-004_00	141,300	5 – TMDL required	2B, 3B, 4	3B: Benthic Invertebrate Assessment and Dissolved Oxygen 4: TDS
Oak Creek	UT14070003-011_00	200	5 – TMDL required	1C, 2A, 3A, 4	3A: Temperature
Paria River-1	UT14070007-001_00	88,700	5 – TMDL required	2B, 3C, 4	3C: Temperature and Benthic Invertebrate Assessment 4: TDS
Paria River-2	UT14070007-002_00	113,400	5 – TMDL required	2B, 3C, 4	3C: Temperature 4: TDS
Paria River-3	UT14070007-005_00	60,000	5 – TMDL required	2B, 3C, 4	3C: Benthic Invertebrate Assessment 4: TD)
The Gulch	UT14070005-010_00	38,800	5 – TMDL required	2B, 3B, 4	3B: Benthic Invertebrate Assessment
Wahweap Creek	UT14070006-001_00	194,500	5 – TMDL required	2B, 3B, 4	3B: Temperature 4: TDS

Source: BLM GIS 2022

Note: Although there are impaired waters identified in the watersheds that cross into the planning area, the BLM is only responsible for management of units within the decision area boundary.

Water quality management plans were developed for the Escalante River and Paria River watersheds in 2007 and 2004, respectively, to address exceedances of water quality standards in those areas (MSE 2007, 2004). In 2002, the Upper Escalante River assessment unit was identified as being impaired due to the exceedance of Utah's temperature criteria for cold-water species of game fish and other aquatic life (beneficial use category 3A). In the 2007 Watershed Plan, created for the Escalante River, temperature exceedances were suggested to be a result of livestock grazing, a lack of riparian habitat, and low instream flows due to diversions for irrigation (MSE 2007). In 2008, the Upper Escalante River assessment unit was listed as impaired for aquatic wildlife (warm-water) beneficial use; this was due to exceedances of the benthic macroinvertebrates bio-assessment criteria. In 2016, the same assessment unit was identified as being impaired for agricultural beneficial uses due to exceedances of TDS numeric criteria. Both of these impairments are still listed for the Upper Escalante River assessment unit as part of the 2022 Utah Integrated Report Assessment (UDWQ 2022).

In 2002, two reaches (Reach 1 and Reach 3) within the Paria River were identified as being impaired due to exceedance of Utah's TDS criteria for protection of agricultural uses (Class 4 waters), including irrigation and stock watering. In 2008, Reach 3 of the Paria River was also listed as impaired for aquatic wildlife use (nongame fish and other) due to benthic macroinvertebrates bio-assessments. In 2014, Reach 2 was listed as impaired for aquatic wildlife use (nongame fish and other) due to exceedances of temperature criteria (UDWQ 2022).

Currently, the Paria River-1, Paria River-2, and Paria River-3 segments are all still assessed as not meeting criteria to support beneficial uses (UDWQ 2022). As a result of the 2022 Utah Department of Water Quality assessment of impaired waters, all reaches were listed as impaired for agricultural use based on exceedances of TDS. Reaches 1 and 2 were listed as impaired for aquatic wildlife (nongame fish and other) based on temperature exceedances, and Reaches 1 and 3 were listed as impaired for aquatic wildlife (non-fish game and other) based on benthic macroinvertebrate bio-assessments. Additionally, the Utah Department of Water Quality identified all three reaches as target waterbodies for development of total maximum daily loads.

The Paria River Water Quality Management Plan identified that the predominant source of TDS loading in the Paria River is from naturally occurring geologic formations prevalent within the watershed, particularly Tropic Shale, as well as saline aquifers (MSE 2004). The plan recommended implementing site-specific TDS standards (2,500 milligrams per liter and 1,500 milligrams per liter for Reach 1 and Reach 3, respectively) to reflect the natural background concentrations of TDS in the river. The plan also recommended, to the extent possible, reducing TDS loads by improving irrigation efficiency in the watershed, stabilizing stream channels, and protecting stream banks from erosion (MSE 2004). Since the plan was completed, no site-specific TDS standards have been developed for the Paria River; however, there have been multiple projects that concentrate on reducing erosion.

One specific threat to water quality throughout GSENM is invasive woody plants. Invasive woody plants favor riparian areas where the soil is moist. However, over time these invasive plants can crowd out native riparian plants and significantly decrease the diversity of riparian cover (USDA 2020). One invasive woody plant, Russian olive, is particularly problematic in GSENM and was identified as an issue in the 1980s (Scott et al. 2017). This invasive woody species can take over riparian areas, alter the flood regime, and cause channel narrowing (Scott et al. 2017). Russian olive spreads quickly through seeds that

are transported by animals, wind, and water (USDA 2020). The major threat to water quality (TDS) by these invasive species is through change in channel geometry and resulting channel erosion.

Throughout GSENM, various public organizations and government entities conduct measures to control woody invasive plants. This work, principally on Russian olive and sometimes tamarisk, has been conducted in the Escalante River watershed since 2009. To date, approximately 89 stream miles have been treated within the Escalante River watershed (on the main stem and tributaries). Woody invasive plants were removed in an effort to revegetate the riparian corridor with native species. This provides nonpoint source reduction through both bank stabilization and restoration and enhancement of the riparian community and associated hydrologic, sediment trapping, and biogeochemical processes (Utah DEQ 2013).

In 1999, the BLM worked with permittees to gradually reduce the potential effect of livestock grazing on riparian habitats. The BLM closed livestock grazing allotments along the main stem of the Escalante River, in the Sand and Death Hollow watersheds, primarily to improve riparian and wildlife habitat and to reduce livestock grazing conflicts. The BLM has implemented projects to restore altered watersheds and improve conditions.

Groundwater Sources

The Colorado Plateau aquifers underlie the decision area (Robson and Banta 1995). The Colorado Plateau aquifers underlie an area of approximately 110,000 square miles in western Colorado, northwestern New Mexico, northeastern Arizona, and eastern Utah. In general, the aquifers in the Colorado Plateau area are composed of permeable, moderate- to well-consolidated sedimentary rocks. Much of the land in this sparsely populated region is underlain by rocks that contain aquifers capable of yielding usable quantities of water of a quality suitable for most agricultural and domestic uses. The groundwater quantity and quality in the Colorado Plateau aquifers are extremely variable.

There are several aquifer systems underlying the decision area. The major aquifer system is within the Navajo Sandstone and underlying sandstones that exist in most parts of the area. This system is part of a regional aquifer system that encompasses parts of Colorado, Arizona, and Utah. This system is now called the Glen Canyon aquifer. This aquifer is recharged partly by precipitation that infiltrates the Navajo Sandstone where it crops out in the northeastern and southwestern parts of GSENM, and partly by snowmelt and rainfall that infiltrate the higher plateaus to the north. It is also recharged partly by the Kaiparowits Plateau where the water must move down through overlying strata before it reaches the Glen Canyon aquifer. The Glen Canyon aquifer sustains part of the base flow in Johnson Creek, the Paria River, and the Escalante River and its tributaries (Freethey 1997).

Other regional aquifers exist under the decision area. The Kaiparowits Plateau includes the Mesa Verde, the Dakota, the Morrison, and the Entrada-Preuss aquifers that overlie the Glen Canyon aquifer. Carbonate aquifers of Paleozoic age underlie all of the planning area, but they are largely inaccessible because of the depth. The direction of groundwater movement, estimated from water levels from a few wells and from knowledge about the nature of recharge to aquifers, is from the northwest to the southeast, toward Lake Powell. From meager data sites, it is thought that locally, groundwater moves toward and discharges into the deepest canyons. The thickness of these regional aquifers ranges from 200 feet for the Dakota aquifer to 2,200 feet for the Glen Canyon aquifer (Freethey 1997).

Springs supply much of the natural water flow within the decision area. They are important for sustaining ecosystem functions within riparian areas during drier periods. In addition, springs and underground wells supply much of the water used for domestic, municipal, irrigation, and livestock watering in the decision area. In 2006, an inventory of springs in GSENM completed by Northern Arizona University found evidence that the higher-elevation benches that extend south into the study area are the primary pathways of groundwater recharge in the region (Rice and Springer 2006). Water quality measurements were taken at seven springs across GSENM. The temperature ranged from 53.4 to 60.6°F (11.9°C to 15.9°C) the average pH value across all sites was 7.94, dissolved oxygen ranged from 1.58 to 8.1 milligrams per liter and TDS ranged from 100 to 530 milligrams per liter (Rice and Springer 2006). They also found that the primary source of recharge to the groundwater in the basin is from winter precipitation in high-elevation areas (Rice and Springer 2006).

In 2013, the BLM coordinated with the United States Geologic Survey (USGS) to complete an inventory of wells and springs within the planning area in an effort to document potential locations for establishing a groundwater monitoring program. The 2013 inventory included springs and wells within 10 miles of the planning area boundary. In total, 262 springs and 1,450 underground wells (active water rights) were identified in the planning area. Well estimates only included water rights that did not lapse/expire or were not rejected or terminated.

Since 2013, the BLM has worked with the USGS to complete an additional spring survey in an effort to develop a more accurate inventory of springs in the planning area. The inventory included springs and wells as well as management recommendations at each spring. In total, 436 springs were identified and over 50 springs were surveyed as part of the 2021 survey, most of which were influenced by anthropogenic alteration for livestock watering (Spring Stewardship Institute 2021). Suggested management recommendations include removing broken infrastructure or erecting fencing to reduce impacts from livestock (Spring Stewardship Institute 2021).

Water Rights

There are 2,039 total rights within the planning area and 1,379 BLM water rights in the decision area. The vast majority of BLM water rights are point to point stock watering rights. There have been no active new uses or large applications in the past 10 years. Water use in the decision area is mostly for agriculture, but there is also some domestic and industrial use to support fire suppression, domestic wells, and oil and gas wells. Five drinking water protection zones and two culinary water service areas are within the decision area (**Figure 5-20, Appendix B**). The BLM is currently aware of the importance of preserving GSENM's water rights and has a stringent process of reviewing water right applications and protesting applications that have the potential to affect GSENM. Additionally, the BLM plans to continue actively monitoring water right applications and to keep water rights in GSENM active.

New water rights appropriations occur occasionally within the decision area; however, they are limited because water sources are considered by the state engineer to be fully appropriated (Utah Division of Water Rights 2011a, 2011b). Where available, new appropriations are generally limited (cumulatively) to the requirements of one family, 0.25 acres of irrigation, and 10 head of livestock (such as 1.73 acre-feet in total), or an equivalent amount for other uses. Although water uses are relatively static, the use of Wide Hollow Reservoir has increased slightly; Henrieville water use has also increased. Livestock water uses have remained static.

Water Quantity

Precipitation

Average precipitation in the planning area is varied based on the elevation. In the past 10 years, the BLM has installed a network of weather stations in the planning area to collect more accurate data to use for long-term trend assessment and drought modeling.

The average annual precipitation for the planning area is between 6 and 24 inches, with areas closer to Lake Powell receiving closer to 6 inches and areas north and northeast of Kanab receiving 15 to 23 inches (**Figure 5-21, Appendix B;** Utah Division of Water Resources 2014).

In the planning area, there are 2,039 total water rights, including 1,388 BLM-administered water rights, with the vast majority being point to point stock watering rights. There have been no active new uses or large applications to consider in the past 10 years. The quantification of uses is not practical with this dataset, as most of the water user claims are unevaluated for 0.015 cfs.

5.11.2 Trends

Surface Water Sources

Section 319 funding is awarded each year to the State of Utah through a grant from the United States Environmental Protection Agency (EPA) in accordance with Section 319 of the Clean Water Act. Section 319(h) funds are distributed at the local level to help address water quality issues resulting from nonpoint source pollution. In 2022, the Utah BLM continued to implement a Healthy Lands and Watershed Restoration program; this program focuses on improving habitat, vegetation, and water quality by reducing erosion from BLM-managed land. These efforts included many watershed improvement projects, which will contribute to improved land health and the long-term reduction of erosion and sediment loading, which will also reduce TDS (salinity). The BLM's Escalante River Watershed Partnership is an example and includes efforts such as woody invasive control, riparian restoration, and data inventory projects.

In the Colorado Plateau ecoregion, creeks, streams, and rivers have experienced diminished instream flow and altered flow regimes created by dams, channelization, canal systems, and water diversions (Bryce et al. 2012). River flow regulation, channelization, levees, and dikes have eliminated spring flooding in some cases.

PFC assessment data for 2010-2014 suggest that the condition on assessed allotments are in functioning condition or are moving toward functioning condition. Additional reporting for the last 10 years would assist in confirming this upward trend.

Groundwater Sources

In the 2006 spring study, Northern Arizona University found that the groundwater flow path and length are variable across GSENM (Rice and Springer 2006). This variance was observed when they calculated groundwater residence times for springs discharging from the Navajo Sandstone. It is possible that canyon cutting due to flow erosion is the driver of spring locations throughout GSENM and that this canyon cutting may also affect the flow of groundwater in the planning area (Rice and Springer 2006).

Water Quality

TDS (that is, salinity), temperature, total phosphorus, and benthic macroinvertebrate bio-assessments are water quality problems in GSENM. Additional data is needed to determine trends Based on limited data, these water quality problems are believed to be stable and are not worsening.

Water Quantity

The BLM issued IM 2013-094, Resource Management During Drought, to provide general guidance regarding BLM program management in the face of drought. Although this guidance is centered on the biological resource programs that have direct impacts on the long-term health of rangelands, the communication and coordination principles also apply to many other resource programs. The procedures outlined in the IM provide guidelines for line managers regarding their approach to formulating and implementing actions to mitigate the effects of BLM-authorized uses on drought-stressed resources. Not all procedures will be applicable to all situations and, where necessary, these may be adapted or modified to suit local circumstances. This policy is supplemental to standard BLM program procedures and is intended to be used as a tool to help address and mitigate the impacts of drought (IM 2013-094).

Due to a change in the state water law in 2015 (Senate Bill 274 amendment to Utah Code 73-3-31), the BLM no longer has the authority to apply for new livestock-related water rights throughout the decision area. Any new BLM water uses or locations involving livestock are accomplished via a change in existing water rights. Approvals of other beneficial uses of water are considered on a case-by-case basis in limited areas.

5.11.3 Forecasts

Surface Water Sources

The BLM adapts its water quality monitoring plan to ensure there are enough monitoring sites and sufficient data for 303(d) streams in order to identify ways to improve water quality management. Additionally, working toward total maximum daily load development within the decision area will guide future efforts to reduce loading to streams in GSENM and improve the water quality.

The BLM is working with local watershed coordinators to compile more comprehensive information through monitoring of other aquatic resources. There are multiple active water quality projects to restore water resources in the decision area that are completed as part of the Colorado River Basin Salinity Control Program. In the past 20 years, ninety-three features/structures that have been repaired/maintained with the effect of capturing sediment in various drainages and watersheds in the decision area (**Figure 5-19, Appendix B**). Mitigation of disturbances to saline soils and management practices that mitigate the transport of saline soils are essential for the BLM to comply with the Colorado Plateau Salinity Control Act (BLM 1987) and with water quality standards. The BLM will continue to implement management practices to reduce salt transport on BLM-managed lands.

The BLM works closely with the Escalante River Watershed Partnership on projects in the Escalante River watershed. As part of the Escalante River Watershed Partnership's riparian restoration project, the Escalante River Watershed Partnership is working toward a goal of monitoring the entire watershed every 3 years and progressing toward the following goals (ERWP 2022):

- Reducing Russian olive relative cover to less than 5 percent

- Greater than 90 percent relative cover of native woody species
- Evidence of natural recruitment of native species
- Greater than 50 percent relative cover of herbaceous native species
- Less than 10 percent relative cover by secondary weed species of concern

Groundwater Sources

The BLM will continue to work with the USGS and State of Utah to identify priority sites and monitoring wells within the Glen Canyon aquifer and other important regional aquifers in the planning area to develop groundwater-level information to support management decisions.

Water Quantity

For the planning area, the BLM assumes populations in nearby communities will remain constant or increase. Increasing populations are expected to place greater demands on recreation opportunities in GSENM and the KEPA. Therefore, demand for water supplies to support the public and water-based recreation would experience a corresponding increase. There is unallocated water outside GSENM and the KEPA, and new water rights are anticipated to occur occasionally. The use of the Escalante Reservoir is anticipated to increase, and Henrieville water use is also anticipated to increase. Livestock water uses are anticipated to remain fairly static. Increasing development in areas around Escalante and Boulder is expected to increase water use.

5.12 MINERALS

GSENM is withdrawn from all forms of mineral entry and location per Presidential Proclamation 10286, which states:

> [A]ll Federal lands and interests in lands within the boundaries of [GSENM] are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or other disposition 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, other than by exchange that furthers the protective purposes of [GSENM] (**Appendix A**).

The discussion below pertains to existing fluid minerals leases, mineral materials sales contracts and permits, and mining claims. There are no existing leases for coal or any other solid leasable mineral in GSENM.

5.12.1 Oil and Gas (Fluid Leasable Minerals)

Current Conditions

There are 34 authorized oil and gas leases in the Circle Cliffs area; the leases have not recorded any production and are currently suspended. There is also one pending hydrocarbon lease application for tar sands development that covers the same parcels as the 34 oil and gas leases (Mineral and Land Records System 2022). Two recorded producing leases in the Upper Valley Oil Field extend into GSENM

boundaries, southwest of the Town of Escalante. Within this oil field, there are seven producing oil wells and two injection wells inside GSENM.[11]

Trends

The Uinta and Paradox Basins, which do not overlap GSENM, are the focus of most oil and gas development within Utah due to high rates of drilling success, well-established infrastructure, and major exploitable oil and gas reserves in those areas (BLM and UGS 2018). Development of fluid leasable minerals in Utah is expected to continue to occur primarily within the Uinta and Paradox Basins.

Forecasts

If the suspension on the existing oil and gas leases in the Circle Cliffs GSENM was lifted, it is possible that these leases could be developed; however, the leases were issued in 1975 and have not been developed since then, so development is unlikely. The accumulation may not be of significant size, or logistical or economic conditions may make development difficult or outweigh potential profits. Due to the level of surface disturbance required to extract tar sands, it is unlikely that the pending hydrocarbon lease could be developed within the requirements of GSENM management.

Most companies exploring in Utah are expected to focus their efforts on the Uinta and Paradox Basins, where there are high rates of drilling success, well-established infrastructure, and major exploitable oil and gas reserves (BLM and USGS 2018).

Presidential Proclamation 10286 withdrew GSENM from mineral leasing; no future leases for oil and gas will be issued.

5.12.2 Locatable Minerals

Current Conditions

In the time between Presidential Proclamation 9682, which shrunk the boundaries of GSENM and opened the KEPA to mineral location and entry, and Presidential Proclamation 10286, which restored GSENM to its earlier boundaries and closed the area to mineral location and entry, several mining claims were staked in the area. Claims for cobalt deposits were recorded in the Colt Mesa area and claims for high-grade alabaster were recorded in the Butler Valley area.[12]

Trends

Cobalt is listed on the US Geological Survey 2022 Final List of Critical Minerals (DOI 2022). It is a key component in many rechargeable batteries, and demand is likely to grow as the number of electric vehicles increases.

Forecasts

The mining claims would need to go through a validity examination process before they could be developed. The probability of development depends on a variety of factors, including the quality of the deposits, price trends of the subject mineral resources, and the distance to processing facilities and markets. Any development would also be required to prevent unnecessary or undue degradation.

[11]James Holland, BLM Kanab Field Office geologist, email to Francis Craig, EMPSi, on July 6, 2022.
[12]James Holland, BLM Kanab Field Office geologist, contact report with Francis Craig, EMPSi, on June 23, 2022.

Presidential Proclamation 10286 withdrew GSENM to mineral location and entry; no new mining claims can be staked and located in GSENM. GSENM is also closed to casual collecting of mineral resources (e.g., septarian and iron concretions, agate, and jasper).

5.12.3 Mineral Materials

Current Conditions

Mineral materials include common varieties of sand, gravel, rock, and clay, typically used in construction and road building. These materials are common within the decision area. GSENM was closed to mineral material disposal following the issuance of Presidential Proclamation 6920 in 1996 until the issuance of Presidential Proclamation 9682 in 2017, which shrunk the boundaries of GSENM and opened the KEPA to salable minerals disposal. Proclamation 10286 in 2021 again closed the entirety of GSENM to mineral material disposal. The only current use of salable minerals in the decision area is the removal of sand and gravel under material site ROW authorizations that predated the creation of GSENM in 1996. Due to the terms of the authorizations, these sites are able to continue to operate. GSENM is closed to all other saleable mineral development.

Forecasts

The removal of sand and gravel under material site ROW authorizations that predated the creation of GSENM is likely to continue under the terms and conditions of the ROW authorizations.

Under Presidential Proclamation 10286, all lands in GSENM are withdrawn from all forms of entry, location, selection, sale, leasing, or other disposition; no new mineral materials permits will be issued in GSENM as a result.

5.12.4 Abandoned Mine Lands

Current Conditions

Montezuma Mine is located in Johnson Canyon and consists of natural sandstone passageways that were extended and expanded in the search for rumored hidden Aztec gold in the 1910s. Some passages are still accessible, and the mine is explored by some GSENM visitors (WildernessUSA 2016). Some vertical shafts could pose a danger of entrapment, but much of the mine is relatively level and easily explored. Because mining only expanded existing natural passageways and only sandstone was removed, risk of collapse or subsidence is likely lower than in entirely human-made mines, and the mine does not have many of the typical abandoned mine land issues such as toxic tailings piles or acid mine drainage.

5.13 PALEONTOLOGY AND GEOLOGY

The decision area is located near the western margin of the Colorado Plateau physiographic province. It comprises a series of plateaus, buttes, and mesas that reflect the type and structure of the underlying geological strata (**Figure 5-22, Appendix B**). The Colorado Plateau is characterized by relatively flat-lying strata that have been locally offset and folded during vertical movements between north- and south-oriented blocks in the earth's crust. This uplift and folding have created the spectacular scenery for which the area is known worldwide. The diverse geological features include a sequence of sedimentary rock layers exposed in the western part of GSENM, known as "the Grand Staircase" and contributing to the GSENM name. To the east are Kaiparowits Plateau, Escalante Canyons country, and the Circle Cliffs uplift adjacent to the famous Waterpocket Fold (Capitol Reef National Park).

The planning area includes bedrock geological formations ranging in age from Permian to Late Cretaceous (265–73 million years ago) and unconsolidated Neogene deposits probably dating back to at least the early Pleistocene. Fossils occur in all bedrock formations and in the Neogene units in the planning area. Permian through Jurassic units yield fossil fauna and flora that can largely be viewed over wide areas of the Colorado Plateau.

Between one-third to one-half of all permits issued to researchers at GSENM are for paleontological studies. The most paleontologically important bedrock formations, largely because of their vertebrate fossil content, are the Chinle and Morrison Formations and entire Late Cretaceous succession. Of these, the Late Cretaceous succession is unique to the planning area and holds extremely high scientific and public significance. Dozens of new dinosaur and other large vertebrate taxa (for example, giant turtles and giant alligators), as well as hundreds of species of fish, turtles, amphibians, lizards, snakes, birds, and mammals, have been found (Titus et al. 2017), making it one of the most complete Late Cretaceous age terrestrial fossil vertebrate successions in the world. This fact alone qualifies the Kaiparowits Plateau region as a potential UNESCO World Heritage Site. Formation-by-formation summaries of resource type, distribution, and potential fossil yield classification (PFYC) for all geological units in the decision area are provided in **Appendix C**, Paleontology, and shown in **Figure 5-23, Appendix B**. Because of the high significance of Cretaceous and other fossil resources within the decision area, the BLM has actively managed this resource since 2000. This has occurred through an in-house program, comparable to that at Dinosaur National Monument or John Day Fossil Beds National Monument, and by engaging in long-term partnerships with various museums and universities. Because of the high quality of animal preservation (of skin, nails, beaks, and other soft tissue) in the Cretaceous Kaiparowits Formation, the continuity of the fossil record through the Late Cretaceous, and the uniqueness of this fossil record to the Kaiparowits Plateau region, the western Kaiparowits Plateau could probably qualify as a UNESCO World Heritage Site. Outside of special designation frameworks such as monuments, the FLPMA and the Paleontological Resources Preservation Act of 2009 provide the broad legal framework for federal agencies to manage fossil resources on federal lands.

Approximately one-quarter of all research permits issued to researchers working in GSENM are for geological/geomorphological studies. GSENM's bedrock geological units record the earth's surface conditions during end-Permian to end-Cretaceous (almost the entire Mesozoic era), as well as the post-depositional effects of the Laramide Orogeny and uplift of the Colorado Plateau, overprinted with Neogene erosional features. Given its proximity to the western portion of the Cordilleran Foreland Basin, the stratigraphic record is especially complete and of interest to researchers studying end-Permian/Mesozoic climate, isotopic records, tectonics, stratigraphy, rock-forming processes, sedimentation patterns, and numerous other topics. Examples of groundbreaking geological research in GSENM include insights into Martian iron concretion formation (known as "blueberries"), insights into the living biofilms that inhabit rocks, and teasing out the effects of massive submarine volcanic eruptions on shallow marine ecology/stratigraphy.

5.13.1 Current Conditions

GSENM contains exceptional paleontological resources, with ongoing related science that involves excavations and discoveries. Fossils occur subsurface in unconsolidated or bedrock units, weathering on the surface in recent colluvium, or in private and public collections. These exceptional paleontological resources are accessible due to the excellent exposures of their host geologic formations. Traditionally, the BLM has measured fossil condition with a single indicator: are fossils in collections or in the field in

good condition? However, beyond their simple presence in the landscape as inanimate objects integrated into the geology, they derive most of their value to humans as objects of scientific, public, hobby, or artistic use. In other words, the true indicators of resource condition and effective management are how fossils are utilized by various interest groups that are legally permitted to use them. While this is more labor intensive to implement and assess, it is imperative that special designation areas like GSENM strive toward such holistic active management. Such approaches are appropriately used in many NPS units that manage fossil resources of similar or lesser significance.

The BLM has been actively managing fossil resources in the decision area since 2000, when the first full-time staff paleontologist was hired. Since that time, the program has been working toward the desired conditions that include complete survey of sensitive areas (defined as PFYC 4 or 5 and those of low designation containing known fossil resources), publications on GSENM paleontological resources, federally approved curation of GSENM fossils, and public outreach through exhibits and in situ field sites. The paleontology program has not developed sites for public collecting, as it is prohibited under the past and current RMPs (BLM 2000, 2020a). In theory, even such collecting sites could be permissible within a BLM-managed monument if they did not conflict with the Antiquities Act and the designating proclamation, but this would complicate enforcement of rules prohibiting illegal collecting. Major paleontological resource partnerships formed to leverage resources and scientific management expertise exist with the Natural History Museum of Utah. These facilitate cleaning and stabilizing fossils, curating important specimens, field collecting significant specimens, providing exhibits and interpretation, and conducting research. The higher the number, the greater benefit the public and the fossils will receive. These do not necessarily need financial support.

On average, within the decision area annually, approximately 5,000–6,000 new acres with moderate to very high potential for significant fossils (PFYC 3, 4, or 5) are proactively inventoried. The BLM's in-house paleontology program surveys approximately 1,500 acres annually; the remainder is surveyed through cooperative agreements with museums. Due to the nature of cyclic erosion in badlands, the goal is to survey the highest-potential, highest-significance areas by 2050, and then to begin to re-examine the highest-potential areas. Under current conditions, annual survey acreage is on track to reach that target.

In situ paleontological resource field sites are monitored for resource condition and trend. Each year, approximately 20–30 sites are monitored for public impacts (including theft, vandalism, and unintentional impacts), scientific potential, and basic condition. This ensures that the data needed to manage and conserve the sites are available. Currently, on average, approximately 5–15 larger quarries and approximately 300–500 new specimens are added to collections each year. This pace generally keeps up with the natural erosional threats to resources and ensures their protection.

The BLM works with its paleontological resource partners to ensure that collections from GSENM are managed to curatorial standards. Approximately 15,000 specimens are housed at the Natural History Museum of Utah, GSENM's official repository. The largest collection of an additional 30,000 specimens (10,000 vertebrates and 20,000 plants) are housed at the Denver Museum of Nature and Science. Smaller but significant collections (approximately 7,000 specimens) of GSENM fossils are housed at the Museum of Northern Arizona in Flagstaff; the Sam Noble Museum of Natural History in Norman, Oklahoma; the Raymond Alf Museum in Claremont, California; and elsewhere. High numbers of specimens not being housed to federal guidelines indicate a threat to the resource and a need for

intensive intervention by the BLM. Collections space is limited at most museums holding GSENM specimens.

Efforts to share scientific discoveries in GSENM are twofold: scientific publication and public exhibits and interpretation. An average of 2–10 publications (including abstracts) on GSENM paleontological resources are completed annually; approximately 1–3 exhibits are completed each year for public exhibition. Some of these are portable, while others are fixed at institutions like visitor centers and museum exhibit halls. Special public events and public outreach via lectures, schoolroom demonstrations, field tours, and others keep the public informed on issues and discoveries and gain public support for resource management.

Annually, there are typically between 2–5 instances of illegal fossil collection or resource destruction. Nobody has ever been cited or prosecuted for such crimes, as it extremely difficult to do so unless they are caught in the act. There are currently no provisions for public casual collecting of fossils for hobby or educational purposes, as it is prohibited by current management, even though it was permissible on lands excluded from GSENM from 2019–October 2021. Five sites are currently managed in situ for field-based paleontological interpretation or education, and these are supported by interpretation, signage, and more: The Blues Overlook, Flag Point Tracksite, Twentymile Wash Dinosaur Tracksite, Cottonwood Canyon Oyster Beds, and Wolverine Petrified Wood Area.

The most significant geological features include special deposits of minerals or mineral bodies (such as the roll-front ores of the Circle Cliffs area and iron concretion concentrations in the Spencer Flat area) and the large and small special erosional landscape features (cliffs, canyons, slot canyons, and hoodoos) showcased at The Toadstools, along the Waterpocket and East Kaibab structures, in the Canyons of the Escalante, along the Skutumpah Terrace, and in numerous badlands areas (for example, The Blues, Paria Townsite, and The Cove). No special monitoring programs are currently in place for geological features. Collectable commodities, such as petrified wood, septarian and iron concretions, agate, and jasper occur in various locations across the decision area. Looting of petrified wood from the Escalante and Circle Cliffs areas is common, and large volumes of iron concretions have been illegally taken from the Spencer Flats area for commercial purposes in the past. No monitoring plan for geologic hazards has been completed.

5.13.2 Trends

Visitor use is increasing in the planning area. This will increase the probability of unique or significant paleontological and geological features and materials being affected. More visitor use will result in a greater potential for accident or injury from geological hazards and looting of both fossil and geological resources.

The number of major partners has been stable over the years, with an increasing number finding their own support as BLM financial support has dwindled. However, in the last couple of years, two major partners (Denver Museum of Nature and Science and The Raymond Alf) suspended their field activities in GSENM. How this will specifically impact trends remains to be seen, but a decrease in the number of annual publications on GSENM fossils is possible.

The number of in situ field sites monitored for resource condition and trend fluctuates depending on the number of sites excavated each year. A core set of approximately 20 sites are visited every year. An

increasing number of in situ field sites is a positive trend, indicating a robust research and inventory program.

Acres in areas with significant fossil potential that are being proactively inventoried has stayed relatively constant since 2000, when the inventory program was established. Likely as a result, the number of significant fossils collected and curated annually has also remained relatively constant. The decision by the two major partners to halt survey and excavation in GSENM could result in a decline in total acres surveyed and/or significant fossils collected and curated. As survey and collection continued at a near-constant rate and new collections are made, the number of fossils actively managed to curatorial standards in collections has steadily increased. No instances of objects being housed in unacceptable conditions have arisen, and that is the desired condition. If major partnerships dissolve or conditions change over time, standard GSENM-specific paleontological curation policy would be helpful for both new collections and those fossils collected but not formally curated.

The number of annual publications on GSENM paleontology has steadily increased since 2000, largely because of direct BLM support of research and inventory. Higher numbers of annual publications indicate effective, proactive management of the research component. While there have been no formal citations or prosecutions, instances of illegal fossil collection or resource destruction have increased since GSENM establishment in 2000. Legal public fossil collection has not been allowed in GSENM, with the exception of those lands excluded from GSENM from 2019–October 2021. The area formally within the KEPA was available for causal collection of noncommercial amounts of certain minerals, and invertebrate and plant fossils, except for Camp Flats and Tibbet Head. The remainder of GSENM is also unavailable to casual fossil collection (**Figure 5-24, Appendix B**). The desired number of public collecting sites in GSENM is as many as resources and law allow. The number of paleontology-specific exhibits or other interpretive materials or events has been stable since 2000, when the first GSENM paleontologist was hired. The exception is Cottonwood Canyon Oyster Beds, which was temporarily removed from GSENM from 2019–October 2021 (BLM 2020b). Within the current GSENM, all five of the in situ fossil sites, which were originally dedicated for public visitation and supported by interpretation, signage, and other publicly available information, remain. The higher the number of exhibits, interpretive material, events, and in situ sites, the more effective the outreach and interpretation—and the greater the public enjoyment.

5.13.3 Forecasts

Geological features that may need protection include the Devils Garden and Wahweap Hoodoos, the Cockscomb, and the Toadstools. Other special geological areas include arches, bridges, and slot canyons. Areas of high use include Navajo Sandstone slickrock between Boulder and Escalante and between the creeks off Skutumpah (Paria River Canyon). An increase in illegal hobby collecting may necessitate more aggressive law enforcement to curb the problem. Targets could include Moki Marbles, septarian nodules, agates, fossil oysters and ammonites, vertebrate fossils, and petrified wood.

Ongoing paleontological discoveries will continue to make invaluable contributions to the understanding of the earth's past. Given the general trend of current intensive paleontological resource management, the number of scientifically important fossil specimens in museums will increase, the number of scientific publications and described species will increase, public enjoyment and understanding of the unique nature of the resource should increase, and the protection of important in situ fossil sites should continue. Paleontological outreach efforts should also help counter looting and vandalism and lead to

greater citizen stewardship. GSENM-specific paleontological guidance documents would help advance scientific goals and resource protection, preservation, and conservation. It is anticipated that additional curatorial space could be necessary to safely house newly collected specimens within the life of the plan.

5.14 AIR QUALITY

5.14.1 Current Conditions

Air quality is measured by the concentration of air pollutants and air quality-related values such as visibility and atmospheric deposition within a geographic area. Ecological factors such as wind, temperature, humidity, geographic features, vegetation, and wildfire, as well as human-related activities such as recreation and livestock grazing, have the potential to affect air quality.

Air quality indicators include criteria air pollutants and sulfur and nitrogen compounds that could contribute to visibility impairment and atmospheric deposition. National and state ambient air quality standards set the maximum thresholds for criteria air pollutants, and the federal Prevention of Significant Deterioration (PSD) program establishes allowable increases of a given pollutant for Class I areas and Class II areas of interest such as wilderness.

Criteria Air Pollutants

The EPA, in accordance with the 1963 Clean Air Act, as amended, has established national ambient air quality standards (NAAQS) for six air pollutants: particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, and lead. **Table 5-35** shows current NAAQS for the EPA-designated criteria pollutants (EPA 2022).

The existing air quality in the planning area is typical of undeveloped regions in the western United States. Air quality receptor locations, modeling boundary, and meteorological stations are shown in **Figure 5-25, Appendix B**. Kane and Garfield Counties are currently designated attainment/unclassifiable for all criteria air pollutants. The Utah Division of Air Quality (UDAQ) is responsible for regulating air quality in Utah. At present, UDAQ does not have state ambient air quality standards, and is responsible for ensuring compliance with the NAAQS within Utah.

The UDAQ emphasizes air quality monitoring in more experienced areas of the state where nonattainment of NAAQS is more problematic. There is only one UDAQ-operated air monitoring station in the planning area; this station monitors ozone at GSENM in Garfield County (UDAQ 2022). Federal agencies have collected data near the planning area related to pollution concentrations, visibility, and atmospheric deposition.

The most recent Utah Statewide Emissions Inventory Report (UDAQ 2017) estimates that the primary air pollutant in Kane and Garfield Counties is volatile organic compounds (VOCs), followed by carbon monoxide, PM_{10}, nitrogen oxides, $PM_{2.5}$, and sulfur oxides. **Table 5-36** lists the criteria pollutant levels (those compounds for which pollution criteria have been established) in tons per year from the Statewide Emissions Inventory.

Table 5-35
National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
		Primary	8 hours	9 parts per million (ppm)	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead		Primary and Secondary	Rolling 3-month average	0.15 µg/m3 (1)	Not to be exceeded
Nitrogen dioxide		Primary	1 hour	100 parts per billion (ppb)	98th percentile, averaged over 3 years
		Primary and Secondary	1 year	53 ppb (2)	Annual mean
Ozone		Primary and Secondary	8 hours	0.070 ppm (3)	Annual 4th-highest daily maximum 8-hour concentration, averaged over 3 years
Particle pollution	particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)	Primary	1 year	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary	1 year	15 µg/m^3	Annual mean, averaged over 3 years
		Primary and Secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	particulate matter less than 10 microns in diameter (PM_{10})	Primary and Secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide		Primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: EPA 2022
(1) In areas designated nonattainment for the lead standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.
(2) The level of the annual nitrogen dioxide standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) ozone standards additionally remain in effect in some areas. Revocation of the previous (2008) ozone standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(4) The previous sulfur dioxide standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous sulfur dioxide standards or is not meeting the requirements of a State Implementation Plan call under the previous sulfur dioxide standards (40 CFR 50.4(3)). A State Implementation Plan call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Table 5-36
2017 Emissions Inventory by Source (Tons per Year)

County	Source	Carbon Monoxide	Nitrogen Oxides	PM_{10}	$PM_{2.5}$	Sulfur Oxides	VOCs
Kane	Area source	402.91	8.17	3,526.32	399.35	2.51	187.03
	Oil and gas	0.00	0.00	0.00	0.00	0.00	0.00
	Off-road mobile	796.55	51.99	4.95	4.57	0.22	171.96
	On-road mobile	1,285.96	441.59	149.23	45.93	1.86	130.61
	Point source	16.05	20.56	14.54	2.07	3.41	8.37
	Biogenics	9,007.66	361.81	0.00	0.00	0.00	41,916.60
	Wildfires	10.96	0.18	1.15	0.97	0.09	2.59
	Total	**11,520.10**	**884.30**	**3,695.19**	**452.89**	**8.09**	**42,417.16**
Garfield	Area source	237.28	7.42	2,568.76	302.25	1.92	174.47
	Oil and gas	0.10	0.08	0.00	0.00	0.08	183.77
	Off-road mobile	644.51	44.52	6.21	5.79	0.29	120.36
	On-road mobile	913.15	269.47	71.38	22.93	1.28	90.81
	Point source	0.26	0.08	0.13	0.03	0.06	0.02
	Biogenics	9,381.27	396.02	0.00	0.00	0.00	44,976.50
	Wildfires	42,736.93	571.81	4,337.46	3,675.81	317.70	10,079.80
	Total	**53,913.49**	**1,289.40**	**6,983.94**	**4,006.81**	**321.24**	**55,442.04**

Source: UDAQ 2017

VOCs are organic compounds that easily become vapors or gases. Biogenic sources of VOCs in Garfield and Kane Counties make up 80 and 99 percent of total VOC emissions, respectively. Biogenic releases of VOCs are from biological sources such as vegetation and soils. Along with carbon, VOCs can contain elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen. Many VOCs are hazardous air pollutants. VOCs combined with nitrogen oxides and sunlight react in the atmosphere to form ground-level ozone, or smog. Burning fuel such as gasoline, coal, natural gas, and wood releases VOCs. VOCs would be expected to increase during periods of high wildfire or prescribed fire activity. VOCs and smog formation are more problematic during periods of atmospheric stability and in valley bottom areas prone to inversions, and much less problematic during periods of atmospheric instability (that is, high-velocity ground-level winds and winds aloft).

While not a recognized air quality issue in the planning area, ground-level ozone is a regional issue affecting Class 1, metropolitan, and energy-producing areas in Utah and surrounding states. Ozone and its precursors (VOCs and nitrogen oxides) can be transported both into and out of the planning area, and, therefore, are pollutants of concern.

Carbon monoxide is produced by the incomplete burning of various fuels, including coal, wood, charcoal, oil, kerosene, propane, and natural gas. Products and equipment powered by internal combustion engines such as portable generators, cars, heavy construction equipment, OHVs, airplanes, and trains also produce carbon monoxide. Carbon monoxide combines with oxygen in the atmosphere to create carbon dioxide. In Garfield County, wildfires account for approximately 80 percent of carbon monoxide emissions; in Kane County, biogenic sources make up the majority (78 percent) of carbon monoxide emissions.

Nitrogen oxides are emitted through the use of nitrogen fertilizers, certain industrial and waste management processes, and when fuel burns at high temperatures, such as in internal combustion engines. In Garfield County, wildfires account for the highest contribution to nitrogen oxide emissions, followed by biogenic and on-road mobile sources. In Kane County, on-road mobile sources are the largest contributors to these emissions.

Natural sources of sulfur dioxide include volcanoes and hot springs. Sulfur dioxide is formed by the oxidation of hydrogen sulfide. Oxidation occurs when hydrogen sulfide combines with the oxygen in air. Human-made sources of sulfur dioxide include fossil fuel processing and burning, with high-sulfur fuels generally producing higher levels of sulfur dioxide as a byproduct. Almost all of the sulfur oxide emissions in Garfield County come from wildfires. Kane County's sulfur oxide emissions are not significant compared to sulfur oxide emissions reported for Garfield County (8.09 and 321.32 tons per year, respectively).

PM_{10} and $PM_{2.5}$ concentrations are expected to be higher near towns, unpaved roads that experience high volumes of traffic, and areas with depleted vegetative cover. Regional levels are likely a result of fugitive dust sources. Fugitive dust is likely to occur naturally across the planning area during high-wind events. Areas such as dry lakebeds, deserts, dunes, and recovering wildfire areas are prone to high-wind dust events. Given the potential for localized impacts from fugitive dust, and the need for active management of this source category related to BLM-authorized activities, particulate matter (both PM_{10} and $PM_{2.5}$) is considered a pollutant of concern. In Garfield County, wildfires are the biggest emitters of particulate matter, followed by area sources; in Kane County, area sources make up the biggest contributor to particulate matter.

Prescribed and naturally caused fires present a concern to air quality. Short-term effects on air quality from prescribed fires include a general increase in particulate matter, carbon dioxide, and ozone precursor emissions. Any smoke emissions resulting from annual prescribed burning projects or treatments in the planning area are managed in compliance with guidelines in the Utah Smoke Management Plan and interagency group program (UDAQ 2021). Active group participants include various federal and state agency land managers, and UDAQ. The purpose of this program and the smoke management plan is to ensure the implementation of mitigation measures to reduce the impacts on public health and safety and visibility from prescribed fire and wildland fire used for resource benefits. Compliance with the plan is the primary mechanism for land managers to implement prescribed burns while ensuring compliance with the Clean Air Act. Burn plans written under this program include actions to minimize fire emissions, exposure-reduction procedures, a smoke dispersion evaluation, and an air quality monitoring plan. The program coordinator reviews proposed burns daily and approves or denies burns based on current weather and air quality conditions.

Prevention of Significant Deterioration

The PSD program ensures that air quality in areas with clean air does not significantly deteriorate, while maintaining an allowable margin for future industrial growth. The PSD program protects air quality within Class I areas by allowing only slight incremental increases in pollutant concentrations. Class I air quality areas include national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that existed or were authorized as of August 7, 1977. They receive the highest degree of air quality protection under the Clean Air Act. Class I areas near the decision area are Bryce Canyon, Capitol Reef, and Zion National Parks (NPS 2022a).

Areas of Utah not designated as PSD Class I are classified as Class II. For Class II areas, greater incremental increases in ambient pollutant concentrations are allowed, as a result of controlled growth.

Visibility and Regional Haze

Visibility is "the clarity with which distant objects are perceived" (EPA 2001) and is affected by pollutant concentrations, plume impairment, regional haze, relative humidity, sunlight, and cloud characteristics. A typical visual range without any human-made air pollutants would be about 140 miles in the western states (EPA 2001). Aerosols (small particles made of solid and/or liquid molecules dispersed in the air) are the pollutants that most often affect visibility in the Class I areas. Five key contributors to visibility impairments are sulfate, nitrate, organic carbon, elemental carbon, and crustal materials.

Visibility can be expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person or equivalate to about a 10 percent change in light extinction. To estimate potential visibility impairment, monitored aerosol concentrations are used to reconstruct visibility conditions for each day monitored. These daily values are then ranked from clearest to haziest and divided into three categories to indicate the mean visibility for all days (average); the 20 percent of days with the clearest visibility (20 percent clearest); and the 20 percent of days with the worst visibility (20 percent haziest).

The Clean Air Act included legislation to prevent future and remedy existing visibility impairment in Class I areas. In 1985, the EPA established a collaborative monitoring program called IMPROVE to monitor visibility in Class I areas. IMPROVE operates a monitor in Bryce Canyon National Park, west of the decision area.

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems. It is reported as the mass of material deposited on an area (kilogram per hectare) per year. Atmospheric deposition can cause acidification of lakes and streams. One expression of lake acidification is change in acid neutralizing capacity, 'he lake's capacity to resist acidification from atmospheric deposition. Acid neutralizing capacity is expressed in units of micro-equivalents per liter, µeq/l.

Wet deposition refers to air pollutants deposited by precipitation, such as rain and snow. One expression of wet deposition is precipitation pH, a measure of the acidity or alkalinity of the precipitation. There are five National Atmospheric Deposition Program stations in Utah: Logan, Murphy Ridge, Green River, Bryce Canyon National Park, and Canyonlands National Park. The National Atmospheric Deposition Program stations in Bryce Canyon and Canyonlands National Parks have assessed precipitation chemistry since 1985 and 1997, respectively.

Dry deposition refers to the transfer of airborne gaseous and particulate material from the atmosphere to the earth's surface. The Clean Air Status and Trends network has measured dry deposition of ozone, sulfur dioxide, nitric acid, sulfate, nitrate, and ammonium in the United States since the late 1980s. The closest Clean Air Status and Trends network station to the planning area is located at Canyonlands National Park.

5.14.2 Trends

Regional air quality is influenced by a combination of factors, including climate, meteorology, the magnitude and spatial distribution of local and regional air pollution sources, and the chemical properties of emitted pollutants. Within the lower atmosphere, regional and local scale air masses interact with regional topography to influence atmospheric dispersion and transport of pollutants.

Wind patterns in the area vary widely by season and local terrain; therefore, dispersion and transport of pollutants from area sources are also variable in the region.

Current trends suggest an increase in recreational activities and travel to the area. Some recreational visitors engage in motorized activities that represent emission sources in addition to the highway vehicles utilized for transportation. Additional concerns focus on oil and gas projects, livestock grazing, and prescribed fire and wildfires.

Pollutants of Concern

Ozone is a regional problem typical in the western states as precursor gases (nitrogen oxides and VOCs) from forest fires, transport from shipping lanes, electric power generation, oil and gas production, and a conglomerate of other sources combine under certain meteorological conditions to form ozone. Particulate matter is another issue during dust storms or when kicked up from other activities in this dry region.

Data collected at Bryce Canyon and Capitol Reef National Parks and Glen Canyon National Recreation Area show that recent ozone concentrations remain below the NAAQS. The ozone concentrations at Canyonlands National Park show a relatively unchanging trend between 2011–2022 (NPS 2022b). While current ozone concentrations are below the NAAQS, they are still near the standard, and the historic data record shows past exceedances.

The BLM regularly authorizes projects that, without adequate mitigation measures applied, would have the potential to raise levels of fugitive dust, PM_{10}, and $PM_{2.5}$. Locations vulnerable to decreasing air quality due to particulate matter in the planning area include the immediate operation areas around surface-disturbing activities such as energy and mineral development and construction of major ROWs projects.

Visibility

The visibility trend data from 2011–2020 are available from the NPS (NPS 2022b) for Bryce Canyon and Capitol Reef National Parks and Glen Canyon. Improvement in park visibility on the most impaired days has been documented for all three since 2011, but visibility on the haziest and clearest days has not changed significantly for Bryce Canyon and Capital Reef National Parks, while Glen Canyon shows improvement for the clearest days. The Clean Air Act visibility goal requires visibility improvement on the 20 percent haziest days, with no degradation on the 20 percent clearest days. While some visibility impairments are the result of natural, uncontrollable sources, such as windblown dust and soot from wildfires, human-made sources of pollution can also impair visibility. The human-made sources include motor vehicles (organic carbon), electric utility and industrial fuel burning (sulfates and particulate), and manufacturing operations (sulfates and fine particulate matter). Visibility in the area is most influenced by sulfates, course particulate matter, and organic carbon.

Atmospheric Deposition

Total deposition refers to the sum of airborne material transferred to the earth's surface by both wet and dry deposition. The primary gases involved with inorganic nitrogen deposition include ammonia, nitrogen oxides, and nitric acid, while the primary particles are nitrate and ammonium. Agricultural sources are the most common source of ammonium. Total nitrogen deposition is calculated by summing the nitrogen portion of wet and dry deposition of nitrogen compounds, and total sulfur deposition is calculated by summing the sulfur portion of wet and dry deposition of sulfur compounds.

Total deposition has been measured at Canyonlands National Park from 2011–2020 (NPS 2022b). Total nitrogen deposition has ranged from 0.7–1.7 kg/hectare-year between 2011–2020. Total nitrogen deposition of 3 kg/hectare-year represents the total pollution loading where acidification is unlikely and "below which a land manager can recommend a permit be issued for a new source unless data are available to indicate otherwise" (Fox 1989). Nitrate deposition to terrestrial systems can cause chemical alterations to soil, affecting microorganism and native vegetation.

The air quality trend at Bryce Canyon shows no significant change for sulfate concentrations between 2011–2020 (NPS 2022b).

5.14.3 Forecast

The forecast for the planning area includes increased tourism and recreation. With the increased travel to the area there will be increased fuel consumption with the trend for increased levels of VOCs, carbon monoxide, ground-level ozone, and sulfur oxide emissions. With increased OHV recreation in the region, fugitive dust will likely increase across the planning area. Fugitive dust will also increase if climate change yields warmer and drier conditions. If, as some predict, increased precipitation accompanies climate change, the increase in precipitation might help to mitigate temperature increases, resulting in a reduced increase in fugitive dust.

5.15 CLIMATE CHANGE

5.15.1 Current Conditions

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as "a change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC 2018).

Ongoing scientific research has identified the potential impacts of greenhouse gas (GHG) emissions (including carbon dioxide, methane, nitrous oxide, and several trace gases) on global climate. Through complex interactions on a regional and global scale, these GHG emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused carbon dioxide equivalent (CO_2e) concentrations to increase dramatically and are likely to contribute to overall global climatic changes.

In the planning area, like in most of the United States, GHG emissions come primarily from the combustion of fossil fuels in energy use. Energy use is largely driven by economic growth, with short-

term fluctuations in its growth rate created by weather patterns that affect heating and cooling needs, and changes in the fuel used in electricity generation. In 2020, carbon dioxide emissions from combustion of fossil fuel for energy production in the United States were equal to 73 percent of total US anthropogenic GHG emissions) (USEIA 2022). Other major GHGs that are caused by human activity include methane and nitrous oxide. Methane, which largely comes from landfills, coal mines, oil and natural gas operations, and agricultural operations, accounted for up to 11 percent of total GHG emissions in 2020. Nitrous oxide, created primarily from using certain industrial and waste management processes, nitrogen fertilizers, and burning fossil fuels made up about 7 percent of total anthropogenic US GHG emissions (USEIA 2022).

GHG emissions are offset to some degree by carbon that is sequestered in terrestrial ecosystems. Terrestrial ecosystems on federal lands were estimated to have sequestered an average of 195 million metric tons of CO_2e per year nationally between 2005 and 2014; in Utah, the annual average sequestration was 8.6 million metric tons of CO_2e per year (Buursink et al. 2018).

The planning area is primarily within the Colorado Plateau ecoregion. Eco-regions are large areas of similar climate where ecosystems recur in predictable patterns. The Colorado Plateau ecoregion covers the southeastern half of Utah, western Colorado, northern New Mexico, and northwestern Arizona.

The climate of most of the Colorado Plateau is classified as semiarid and varies from north to south and from low to high elevations. In the north, the climate is closely tied to that of the Great Basin, where summers are hot with infrequent afternoon thunderstorms that tend to occur mostly in higher-elevation areas. In the south, peak precipitation occurs in the winter and again in the summer during a distinct wet period characterized by intermittent but often intense monsoonal storms from southern weather patterns. Spring and fall are generally the driest periods. Annual precipitation amounts are less than 10 inches at the mid and lower elevations, while areas above 8,000 feet receive over 20 inches of precipitation. The few and highly scattered mountains that reach elevations near or over 11,000 feet can receive nearly 3 feet of precipitation (Bryce et al. 2012).

Temperatures also vary considerably in the ecoregion. In the southern ecoregion and at lower elevations, temperatures range from approximately 20 to 25 degrees Fahrenheit (°F) (-4 to -6°C) in the winter to approximately 95°F (35°C) in the summer. At mid and upper elevations, temperatures range from the low 60s and 70s °F (15 to 21 °C) in the summer, to the single digits and low teens Fahrenheit (-17 to -7°C) in the winter (Bryce et al. 2012). Based on records from long-term stations, average temperatures (1991–2020) in the mountains of Utah are around 20 °F during the winter months, while lower elevations in the southern portion of the state experience days over 100°F (37°C) during the summer (Frankson et al. 2022). Normal mean average annual temperature and precipitation (1991–2020) in the planning area are shown in **Figures 5-26** and **5-21, Appendix B**, respectively.

5.15.2 Trends

GHGs are necessary to life as we know it because they keep the earth's surface warmer than it otherwise would be. However, as the concentrations of these gases continue to increase in the atmosphere, the earth's temperature is climbing above past levels. Continuing a long-term warming trend, globally averaged temperatures in 2021 were 1.5°F (0.85 °C) warmer than the 1951–1980 baseline average, and 1.9°F (1.1°C) warmer than late nineteenth century levels, representing the start of the Industrial Revolution (NASA 2022). All, 8 years leading up to 2021 were the warmest years since

1880, when modern record keeping began (NASA 2022). Other aspects of the climate, such as rainfall patterns, extreme drought, snow and ice cover, and sea level, are also changing.

Within the Southwest region of the US, the average annual temperature increased 1.6°F (0.9°C) between 1901–2016 (**Diagram 5-5**). The region recorded more warm nights and fewer cold nights between 1990–2016, including an increase of 4.1°F (2.3°C) for the coldest day of the year (Gonzalez et al. 2018). Temperatures in Utah have risen more than 2.5°F (1.4°C) since the beginning of the twentieth century. The period since 2012 has been the warmest on record for Utah, with 8 of the 10 warmest recorded years. The highest number of extremely hot days in the historical record occurred during 2000–2004. The state has experienced a dramatic increase in the number of very warm nights and a decrease in the number of very cold nights.

As the state has warmed, the percentage of precipitation falling as snow during the winter has decreased, as have snow depth and snow cover (Frankson et al. 2022). **Diagram 5-6** shows changes in snowpack for Western United States between 1955 and 2020 and bears out this trend.

Diagram 5-5
Change in temperature across the Southwest region of the US (1901–2016; Gonzalez et al. 2018).

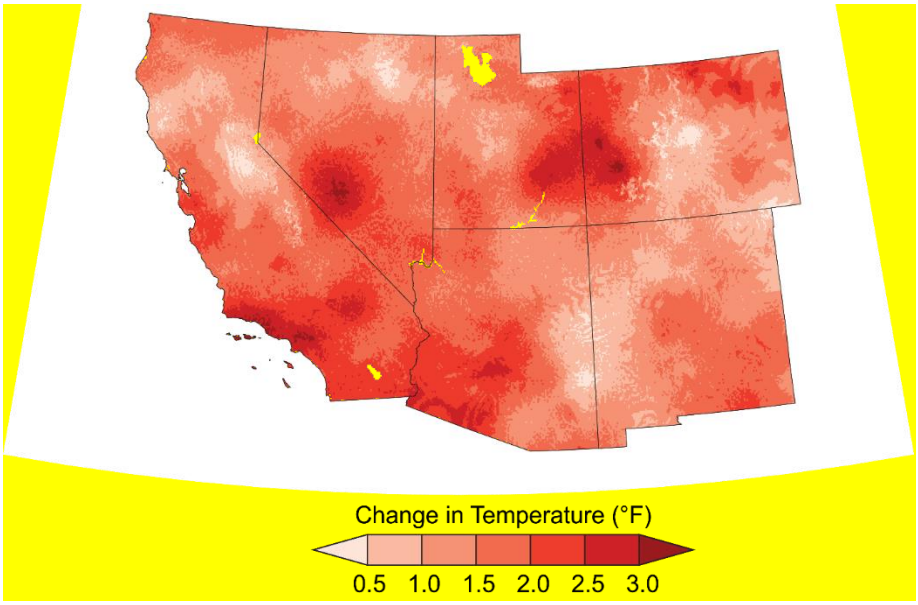
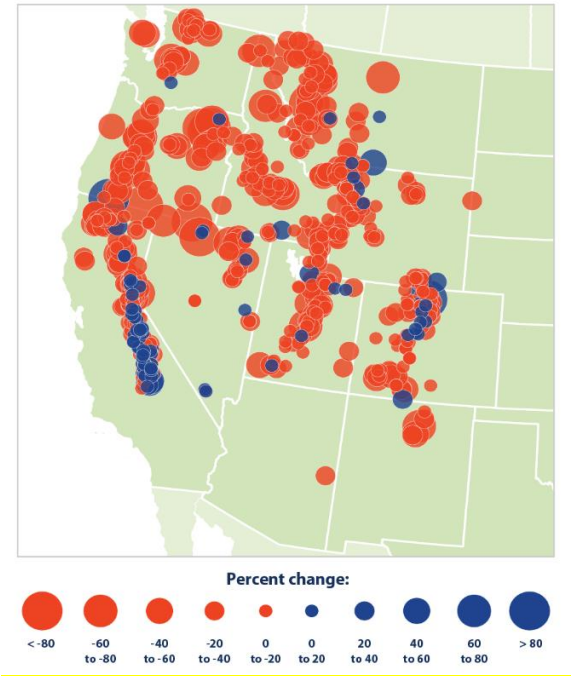


Diagram 5-6
Change in snowpack across the Southwest region (1995 to 2020; EPA 2022)



5.15.3 Forecast

According to the IPCC Sixth Assessment Report, compared with 1850–1900, global surface temperature averaged over 2081–2100 will very likely be higher by 1.8 to 3.2°F (1.0 to 1.8°C) under the very low GHG emissions scenario, by 3.8 to 6.3°F (2.1 to 3.5°C) under the intermediate GHG emissions scenario, and by 5.9 to 10.3°F (3.3 to 5.7°C) under the very high GHG emissions scenario (IPCC 2021).

The annual average temperature of the contiguous United States is projected to rise throughout the century. Increases for 2021–2050 relative to 1976–2005 are projected to be about 2.5°F (1.4°C) for a lower GHG scenario and 2.9°F (1.6°C) for a higher GHG scenario (Vose et al. 2017). Within the Southwest region, annual average temperatures are projected to increase by 3.72°F (2.07°C) and 4.80°F (2.67°C) by midcentury (2036–2065) under low and high GHG scenarios, respectively (compared with 1976–2005), and by 4.93°F (2.74°C) and 8.65°F (4.80°C) by late century (2071–2100) under low and high GHG scenarios, respectively (Vose et al. 2017). The frequency and intensity of cold waves is projected to decrease while the frequency and intensity of heat waves is projected to increase throughout the century (Vose et al. 2017).

Climate change modeling predictions show that the Colorado Plateau ecoregion is expected to undergo general warming over the entire region, with the greatest warming occurring in the southern portion of the ecoregion and with average winter temperatures increasing more than average summer temperatures. Climate change modeling predicts up to a 1.08°F (0.6°C) increase (2015–2030) and 1.8°F (1°C) increase (2045–2060) in average summer temperatures in the northern portion of the ecoregion and up to a 1.44°F (0.8°C) increase (2015 to 2030) and 2.16°F (1.2°C) increase (2045 to 2060) in the southern portion of the ecoregion (Bryce et al. 2012). Precipitation is expected to decline throughout

much of the year during the 2015– 2030 period (except for a couple months in the fall), with severe drought likely to occur in some areas. The 2045–2060 period would remain drier (or comparable to historical conditions) during most of the year, but sporadic wetter months (for example, February, June, and October) could result in overall increases in annual precipitation in some areas (Bryce et al. 2012).

Overall, the southern portion of the ecoregion is expected to experience more extreme long-range climate change effects than the northern portion of the ecoregion. This is because the northern portion of the ecoregion is north of the influence of the summer monsoon; it may also be considered transitional to the mid- and northern latitudes, where climate change predictions may differ from those for the southwestern region (Bryce et al. 2012). Some models predict that winters in mid-latitudes will be wetter as well as warmer (Miller et al. 2011).

The long-term potential for climate change in GSENM ranges between moderate-low to very high. The southern portions of GSENM comprise the largest area with very high potential for climate change. The Escalante Canyons area shows moderate-low to moderate potential for long-term change and the Kaiparowits area shows mostly moderate potential with some areas of moderate-low, moderate-high, and very high potential (BLM 2018).

5.16 Environmental Justice and Social and Economic Values

The following subsections discuss current conditions, trends, and forecasts of socioeconomic and environmental justice values associated with uses of BLM-managed lands for the socioeconomic analysis area (Kane and Garfield Counties, Utah), the environmental justice analysis area (Kane, Garfield, Beaver, Iron, Piute, San Juan, Washington, and Wayne Counties in Utah and Coconino and Mohave Counties in Arizona), and, where available, the decision area. The discussion focuses on information that is most relevant to the scope of the current BLM planning effort for GSENM.

5.16.1 Current Conditions

Environmental Justice

Executive Order 12898 requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (59 *Federal Register* 7629, February 16, 1994). Fundamental principles of environmental justice require that federal agencies:

- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- Ensure the full and fair participation by all potentially affected communities in the decision-making process.
- Prevent the denial of, reduction in, or significant delay in the receipt of benefits of the project by minority and low-income populations.

An evaluation of environmental justice impacts requires identification of minority and low-income populations (including Tribal Nations) within the affected area and evaluation of the potential for the alternatives to have disproportionately high and adverse impacts on such populations.

This section provides the first step in the environmental justice analysis: a screening analysis of the environmental justice analysis area for the planning action to identify the presence and location of any environmental justice populations. Evaluation of potential adverse impacts on these populations will take place during the impacts analysis phase of the planning process.

Subsequent to the publication of Executive Order 12898, the CEQ, part of the Executive Office of the President, issued guidance for considering environmental justice within the NEPA process (CEQ 1997). This guidance defines minorities as individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. The guidance further defines a minority population as follows: "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis" (CEQ 1997).

The guidance also makes clear that Tribal Nations in the affected area should also be considered in the environmental justice screening analysis. The CEQ guidance does not specify how to identify a "low-income population," but in practice the same approach used for minority populations can be followed: where persons in poverty status are greater than 50 percent of the area's total population, or where the percentage in poverty is equal to or greater than the percentage in the general population or an appropriate comparison area (the reference population). The CEQ guidance does not define what constitutes meaningfully greater. The BLM recommends using 10 percentage points as the threshold of 'meaningfully greater.' The BLM defines low-income population as being present if the poverty rate of the region is greater than or equal to the poverty rate of the reference area.

This threshold is based on experience evaluating environmental justice indicators and the sense that this threshold represents a significant difference between the affected and reference populations. For the purposes of this screening, the thresholds stated above, from the CEQ and the BLM, are used to identify any low-income or minority communities in the environmental justice analysis area.

Table 5-37 shows data for potential environmental justice populations in the environmental justice analysis area. The reference group for whether an environmental justice population exists is the state of Utah or Arizona.

Table 5-37
Environmental Justice Screening for Environmental Justice Analysis Area (2020)

Geography	Low Income (%)	Minority (%)	Native American (%)
Utah Counties			
Garfield County	16.4	11.4	4.8
Kane County	13.1	9.3	3.3
Beaver County	4.1	15.7	1.6
Iron County	16.4	14.6	2.5
Piute County	19.1	4.2	0.2
San Juan County	22.8	55.7	48.8
Washington County	10.0	16.0	1.7
Wayne County	10.1	8.3	1.0
Reference area (Utah)	9.1	22.1	4.8

Geography	Low Income (%)	Minority (%)	Native American (%)
Arizona Counties			
Coconino County	17.1	46.2	28.3
Mohave County	16.2	23.3	3.3
Reference area (Arizona)	14.1	45.9	5.6

Source: US Department of Commerce 2022

The percentage of minority populations in Garfield and Kane Counties (11.4 percent and 9.3 percent, respectively) are below the average percentage for Utah (22.1 percent). The percentage of low-income population in Garfield and Kane Counties (16.4 percent and 13.1 percent, respectively) is above the average for Utah (9.1 percent). Therefore, Garfield and Kane Counties meet the threshold for a low-income population and an environmental justice community (US Department of Commerce 2022).

Several adjoining counties in Utah and Arizona were screened for potential environmental justice populations, since it is possible that nearby communities may have a cultural or historical link to the planning area. Based on this screening of surrounding counties, San Juan County in Utah has a Native American population of 48.8 percent and has a minority population percentage (55.7 percent) above the 50 percent threshold as well as the state average threshold. Coconino County in Arizona has a Native American population of 28.3 percent. Both Coconino and Mohave Counties have low-income populations slightly exceeding the low-income threshold in Arizona. All counties in Utah, except for Beaver County, have low-income populations slightly above the reference average for Utah (US Department of Commerce 2022).

Social and Economic Demographics and Values

A variety of groups and communities of interest are stakeholders in the use and management of BLM-managed lands, including tribal and cultural resource stakeholders, habitat and resource conservation stakeholders, recreation stakeholders, mineral development and production stakeholders, visual resource stakeholders, and local residents and communities. These stakeholder organizations and individuals have varying interests in the use and management of BLM-managed public resources. Different types of stakeholders have distinct sets of attitudes, beliefs, values, opinions, and perceptions about BLM-managed public resources and the effects of various management policies and actions. These views reflect different cultural and economic linkages that people have to BLM-managed lands. Individuals may belong to or share values with more than one stakeholder group.

Tribal and cultural resource stakeholders value GSENM for its cultural and even spiritual significance. For these stakeholders, protecting cultural resources, combined with maintaining access to traditional cultural sites, is extremely important. These cultural sites include areas of past occupation and also areas where traditional practices, such as plant gathering and woodland harvest, have occurred. The cultural importance of springs, lakes, and rivers is well documented for the Tribal Nations in and around GSENM (Sabata 2018). See **Section 5.7**, Cultural Resource Management, Native American Religious Concerns, and Tribal Use, for more details.

Habitat and resource conservation stakeholders have a number of conservation objectives, but most believe broadly that protecting at-risk species and maintaining habitats and ecosystems for all species are fundamental values that should be a high priority in public policy. Most believe in the intrinsic value of

wildlife, well-functioning ecosystems, and pristine areas. Some advocate resource conservation for human and wildlife needs, pointing to the beauty and solitude values of unspoiled areas in the planning area. For example, some conservation stakeholders highly value preserving dark skies by reducing light pollution, or excessive artificial light that diminishes the visibility of the stars as well as can negatively impact wildlife and the environment. A major concern is the potential for oil, gas, coal, and mineral development, especially on lands that were eliminated from GSENM's boundary and opened to mineral location and entry under Presidential Proclamation 9682. This is because of the impacts associated with infrastructure such as roads, drilling pads, and pipelines. Additional resource conservation topics that are of interest to these stakeholders include water, air, soil resources, and vegetation and riparian zone management. Persons and organizations concerned with protecting paleontological, cultural, and historic sites also generally fit into this category of resource conservation stakeholders.

There are many types of recreational activities in the analysis area. A concern for many recreation stakeholders is the potential degradation and loss of recreational use values from potential mineral resource development. These stakeholders typically believe that resource development has permanent impacts on recreation values. They seek protection of areas with high recreation values so that future generations can enjoy these values. For many recreationists, maintaining recreation values and habitat or ecosystem values go hand-in-hand; these stakeholders say that healthy ecosystems support positive recreation experiences. For many recreation stakeholders, preservation of natural soundscapes and dark skies is also important in order to provide users with adequate opportunities for quiet recreation and better views of the night sky. These stakeholders see resource development and new roads as antithetical to this objective.

Recreation stakeholders believe the region relies on tourism and recreation as its primary economic driving force. They point out how expenditures by mountain bikers, rafters, hunters, anglers, OHV riders, and other recreationists help support local businesses, provide local jobs and income, and generate sales taxes and other public revenues. They maintain that the recreation and tourism industry has proven a stable and an increasing economic engine for the area. They often compare this to local historical experience with and future potential for downturns in commodities-based industries. See **Section 5.5**, Recreational Use and Visitor Services, for more details.

Mineral development and production stakeholders believe mineral development is a vital component of national, state, and local economies. They believe mineral development creates jobs, generates income, and contributes tax and royalty payments to all levels of government. Throughout the West, many of these stakeholders also believe mineral development and production are socially important because they have been part of the social fabric of some communities for years, and because they support the social systems of local communities by providing private sector livelihoods and government revenue. With respect to oil and gas production, these stakeholders believe that domestic development and production are important to national energy security. These stakeholders urge the BLM to recognize the industry's ability to responsibly develop mineral resources and protect critical landscapes, habitat, and species. They believe that many years of compatible development have been achieved in the area, providing significant benefits to the local and regional economies. See **Section 5.12**, Minerals, for more details.

Visual resource stakeholders focus on the area's scenic qualities. Although they share many of the perspectives of habitat and resource conservation stakeholders and recreation stakeholders, they emphasize the role of visual resources as the fundamental asset underlying both direct recreational use

of public lands and general tourism in the region. They believe that the scenic quality of the landscape in and around the planning area is world renowned. They also believe the national parks and other federally and state-managed lands are a huge economic draw to southern Utah and the area in and around the planning area because of their scenic qualities. Dark skies are also valuable to visual resource stakeholders. Based on this view of visual resources as a unique and valuable asset, these stakeholders emphasize that the visual integrity of the area needs to be maintained. See **Section 5.17**, Landscape Characteristics, for more details.

Intertwined with the above stakeholder groups are local residents and their communities. Some residents of Garfield and Kane Counties seek to preserve the historical agricultural setting of the community and are reluctant to embrace change in the form of increased recreation and tourism. They are concerned about changes in the character of the community. They also are concerned about increased demands on local government services and infrastructure. Others welcome the opportunities that increased recreation and tourism may provide. These could be in the form of increased employment and earnings, including increased business opportunities. These could include increased opportunities for BLM-permitted activities, such as guiding and outfitting services. Some see increased opportunities for the sizable Native American population, through any or all of the above. Still others see increased fiscal revenues for local governments through tourism-related taxes.

Table 5-38 shows the basic demographic makeup within the socioeconomic analysis area and Utah. Garfield County has a population of about 5,000, and Kane County has a population of almost 8,000 people. Within counties in the socioeconomic analysis area, per capita, median, and mean incomes generally are reported as lower than those for Utah. Per capita income is higher in Kane County in the other areas of comparison. This may be due to a smaller household size. As is true nationally, nonlabor income is a significant portion of total personal income in Garfield and Kane Counties; however, it is a lower share in Utah as a whole. This is likely because the state has an overall younger median age and likely a larger share of the population in the workforce (see **Table 5-39**).

Table 5-40 shows poverty rates for different categories of the population. These rates vary across the socioeconomic analysis area and the comparison region. In general, poverty rates are higher in Garfield and Kane Counties than in the state. When evaluated by race and ethnicity, poverty rates within the analysis area are similarly complex and varied. No clear patterns emerge when compared with the United States. This is an indication that economic conditions in the analysis area do not uniformly mirror national trends or statistics. However, poverty rates for certain categories within the analysis area are markedly higher than the poverty rates for Utah.

Table 5-38
Population Demographics and Household Income (2020)

Geography	Population	Median Age	Per Capita Income ($)	Median Household Income ($)	Mean Annual Household Income ($)
Garfield County	5,050	42.0	23,926	44,279	61,633
Kane County	7,914	42.0	47,192	50,517	60,030
Utah	3,249,879	30.3	30,986	74,197	93,010

Source: US Department of Commerce 2022

Table 5-39
Components of Household Income (2020)

Geography	Labor Earnings (%)	Dividends, Interest, and Rent (%)	Age-related Transfer Payments (%)	Hardship-related Payments (%)	Other Transfer Payments (%)
Garfield County	52.0	14.9	7.0	3.4	2.5
Kane County	51.2	23.7	15.8	4.4	5.0
Kane and Garfield two-county region	51.5	21.9	15.2	5.3	6.1
Utah	64.5	20.2	7.1	4.0	4.2

Source: US Department of Commerce 2021

Table 5-40
Percentage of People in Poverty (2020)

Percentage of People Who are Below the Poverty Line	Garfield County (%)	Kane County (%)	Kane and Garfield Two-County Region (%)	Utah (%)
People	16.4	13.1	14.4	9.1
Families	11.3	6.0	8.3	6.3
People under 18 years	24.5	12.7	13.1	9.9
People 65 years and older	13.3	5.5	7.3	6.2
Families with related children under 18 years	22.4	8.3	10.7	11.7
Married couple families	4.4	4.4	4.8	8.7
Married couple families with children under 18 years	8.2	3.6	7.7	4.0
Female householder, no husband present	52.9	21.2	24.1	4.9
Female householder, no husband present with children under 18 years	69.0	29.9	32.6	20.3

Sources: US Department of Commerce 2022, 2021

Table 5-41 shows total employment by industry in 2020 for both counties and for Utah. Due to the small populations of the two counties, much of the sector data are estimates to protect smaller firms from disclosure requirements. As is the case in most of the nation, service-related jobs dominate those in nonservice-related sectors. In both counties, accommodations and food services are the largest employers, followed by government.

Table 5-41
Jobs by Industry (2020)

Industry	Garfield County	Kane County	Kane and Garfield Two-County Region	Utah
Total number of jobs	3,253	5,232	8,485	2,079,706
Nonservices related	479*	599*	—	327,007
Farm	287	169	456	20,925
Forestry, fishing, and agricultural services	—	—	—	4,299

Industry	Garfield County	Kane County	Kane and Garfield Two-County Region	Utah
Mining (including fossil fuels)	—	19*	19*	11,542
Construction	122	260	382	144,764
Manufacturing	70	151	221	145,477
Services related	2,033*	3,896*	5,929*	1,487,503
Utilities	32	—	32*	4,919
Wholesale trade	20	54*	74*	59,796
Retail trade	252	532	784	211,052
Transportation and warehousing	60	135*	195*	86,115
Information	—	37	37*	43,646
Finance and insurance	46	105	151	138,597
Real estate and rental and leasing	134	375	509	114,435
Professional and technical services	85	232*	317*	169,367
Management of companies	0	27*	27*	31,623
Administrative and waste services	49	198	247	114,885
Educational services	45*	10	55*	71,356
Health care and social assistance	239*	212	451*	178,534
Arts, entertainment, and recreation	82*	164	246*	40,024
Accommodation and food services	884*	1,090	1,974*	121,770
Other services, except public administration	105*	725	830*	101,384
Government	543	757	1,300	265,196

Source: US Department of Commerce 2021
Note: All employment data are reported by place of work. Columns may not add up to reported totals due to rounding.
* = Estimates for data that were not disclosed
— = Data not available

Local residents are interested not only in which sectors create the jobs, but also in the relative pay in those sectors. **Table 5-42** shows relative pay by sector.

Table 5-42
2020 Wages by Industry ($2021)

Industry	Kane County ($)	Garfield County ($)	Utah ($)
All nonservices related	40,908	39,378	62,957
Natural resources and mining	54,095	37,258	68,817
Agriculture, forestry, fishing, and hunting	—	—	39,508
Mining (including fossil fuels)	—	—	89,111
Construction	37,142	44,270	60,166
Manufacturing (including forest products)	38,176	35,928	64,701
All services related	36,345	37,684	56,364
Trade, transportation, and utilities	30,734	28,924	51,658
Information	77,887	—	101,452
Financial activities	40,705	42,343	83,520
Professional and business services	48,312	45,694	71,513
Education and health services	34,712	46,248	50,101
Leisure and hospitality	30,593	23,365	22,588
Other services	48,247	—	41,348
Unclassified	—	—	86,809
All government	45,157	44,406	55,537

Industry	Kane County ($)	Garfield County ($)	Utah ($)
Federal government	69,345	59,584	76,010
State government	52,513	41,226	61,526
Local government	41,280	37,759	45,570

Source: US Department of Labor 2021
— = Data not available

BLM-managed lands and federal mineral estate managed within the socioeconomic analysis area affect government budgets at local (county, city, town, school district, and special district), state, and federal levels based on revenues from sales taxes, property taxes, payment in lieu of taxes (PILT), mineral royalties, severance taxes, fees, and other funding sources. Likewise, lands and federal mineral estate in the socioeconomic analysis area result in government expenditures for management, law enforcement, and other activities.

The federal government's Office of Natural Resources Revenue collects and rents from leases of federal lands for the production of coal, oil, gas, and other minerals. Federal mineral lease payments to the state are a function of royalties received from production on federal lands, as well as lease payments for parcels leased but not in production. Royalties are the major source of federal receipts and can vary broadly based on energy prices and production. After the "Great Recession" in 2008, mineral receipts declined sharply; however, since 2016, they have risen (excluding 2020 data due to factors such as the COVID-19 pandemic that caused this year to be often considered an outlier). The sources of these revenues to the federal government, and their inherent uncertainty based on market factors, make it difficult to forecast payments to counties and other recipients of state mineral lease payments.

The federal government returns 49 percent of the total collected revenues to the state where the mineral production occurred. In fiscal year 2021, payments to Utah totaled $55,144,537 (ONRR 2022). These payments are then distributed by the state by appropriation or statutory formula (Utah Code 59-21-1).

The BLM field offices collect fees and other revenue for a variety of other uses of BLM-managed lands. These revenue sources include ROW rents, recreation fees, grazing fees, various permit fees, and more. Revenues from the sales of land and vegetation and mineral materials, along with ROW rents, mostly go to the federal treasury, whereas the BLM field office generally retains recreation fees. Grazing permit fees generate revenue for the US Treasury. Of this, 12.5 percent is returned to the local Grazing Board in the state where the grazing lands are located. Per Section 10 of the Taylor Grazing Act, this money is then disbursed to local ranchers through the local Grazing Board, using a 40/60 matching-funds formula, for use in range improvements and maintenance projects. The above payments totaled $103,769 to Kane and Garfield Counties in fiscal year 2019 (primarily fees under the Taylor Grazing Act; BLM 2021).

In addition to BLM payments, Utah counties receive money from the DOI. The DOI, which compensates county governments for nontaxable federal lands within their borders via PILT. PILT is based on a maximum per-acre payment reduced by the sum of all revenue-sharing payments. These payments are subject to a population cap. PILT to Kane and Garfield counties in fiscal year 2022 from PILT totaled $1,063,643 and $988,493, respectively. (US Department of the Interior 2022).

In Kane and Garfield Counties, local revenues from recreation and tourism, natural resources, and land ownership comprise an important portion of total local government revenues. **Table 5-43** summarizes the tourism- and minerals-related local government revenues obtained from these sources.

Table 5-43
Local Government Revenues from Tourism- and Minerals-related Sources (2020)

Revenue Source	Kane County ($)	Garfield County ($)
Tourism-related Revenues[1]		
Tourism-related tax revenue (primarily sales and property taxes)	20,900,000	9,500,000
County transient room tax	3,783,371	1,749,876
Municipal transient room tax	227,218	322,447
Resort communities sales tax	1,188,764	1,012,027
Restaurant tax	292,481	193,845
Total tourism-related revenues	*26,391,834*	*12,778,195*
Minerals-related Revenues		
Natural resources property taxes (minerals-related property)	159,963	149,071
Total natural resources-related revenues[2]	*159,963*	*149,071*

Sources: Kem C. Gardner Policy Institute 2022; Utah State Tax Commission 2021
[1] Many of these were down significantly from 2019 due to COVID-19 pandemic-related travel decreases.
[2] Utah mineral severance tax revenues and oil and gas conservation fee revenues distributed to local governments are not included. These revenues would be difficult to quantify because most of these revenues are placed in the state's General Fund (some are set aside to benefit Tribal Nations). There is no direct correspondence between a particular county's natural resource production and the amount (if any) of severance tax revenues flowing back to the county or other local governments in the county.

It is important to note that the sectoral estimates in the tables above are not specific to BLM-managed resources, or even to public lands generally. Tourism-related revenues are based on all tourism, which includes some activities on private property, as well as activities on state lands and other federal lands, including local national parks and monuments. However, much of the tourism in both counties is based on the large public lands base that is unique to the area. The natural resources-related revenues include revenues from private property, as well as public resources. Again, public lands and minerals are the basis for much of the activity in these industries in the counties.

Kane and Garfield Counties are rich in outdoor recreational resources enjoyed by local residents and many nonresidents alike. Visitation for outdoor recreation—whether passive pursuits like scenic drives or high-energy active sports like rock climbing and OHV riding—supports an active tourism industry. This industry is an important economic base for the socioeconomic analysis area. See **Section 5.5**, Recreation Use and Visitor Services, for more details.

Livestock grazing is an important use of BLM-managed lands in GSENM. Forage is important to many ranchers in the socioeconomic analysis area. Grazing on this forage puts weight on calves and sustains producing heifers. Forage on BLM-managed lands may be the only forage available to some ranchers during parts of the year. In addition to its economic benefits for local ranchers and the local economy, grazing on BLM-managed lands has important social and cultural significance. Some ranching families have been using these lands for generations. These lands help support a ranching culture that is a key part of the social fabric among analysis area communities. Although the economy and culture of ranching have a less prominent role today than in years past, their historical and continuing cultural significance is clear to many in the region. See **Section 5.4**, Rangeland Health and Livestock Grazing Management, for more details.

5.16.2 Trends

Environmental Justice

Table 5-44 shows the low-income population percentage for all counties in the environmental justice analysis area over time. Only Kane County showed an increase in low-income percentage from 2015 to 2020 (5.2 percentage points). The other counties and the reference areas of Utah and Arizona all saw a reduction in low-income percentage, ranging from 1.5 percentage points in Piute County to 8.4 percentage points in Beaver County.

Table 5-44
Low-Income Population Percentage for Environmental Justice Analysis Area (2010–2020)

Geography	2010 (%)	2015 (%)	2020 (%)
Utah Counties			
Garfield County	—	18.0	16.4
Kane County	—	7.9	13.1
Beaver County	—	12.5	4.1
Iron County	—	21.0	16.4
Piute County	—	20.6	19.1
San Juan County	—	28.1	22.8
Washington County	14.3	15.0	10.0
Wayne County	—	15.4	10.1
Reference Area (Utah)	**13.2**	**12.3**	**9.1**
Arizona Counties			
Coconino County	25.9	22.7	17.1
Mohave County	17.7	19.8	16.2
Reference area (Arizona)	**17.4**	**18.2**	**14.1**

Sources: US Census Bureau 2010, 2015, 2020

The minority population percentage saw an increase in all counties and reference areas from 2010 to 2020, ranging from 0.9 percentage points in Wayne County to 4.9 percentage points in Beaver County. The exceptions were in Piute and San Juan Counties (see **Table 5-45**). The percentage of Native American population remained roughly the same throughout the environmental justice analysis area from 2010 to 2020 (see **Table 5-46**).

Table 5-45
Minority Population Percentage for Environmental Justice Analysis Area (2010–2020)

Geography	2010 (%)	2015 (%)	2020 (%)
Utah Counties			
Garfield County	7.6	9.8	11.4
Kane County	6.3	8.0	9.3
Beaver County	10.8	11.1	15.7
Iron County	12.1	13.4	14.6
Piute County	9.9	6.8	4.2
San Juan County	55.8	54.2	55.7
Washington County	13.5	14.8	16.0
Wayne County	7.4	7.5	8.3
Reference Area (Utah)	**18.8**	**20.5**	**22.1**

Geography	2010 (%)	2015 (%)	2020 (%)
Arizona Counties			
Coconino County	44.6	45.3	46.2
Mohave County	19.9	21.8	23.3
Reference area (Arizona)	**41.3**	**43.5**	**45.9**

Sources: US Census Bureau 2010, 2015, 2020

Table 5-46
Native American Population Percentage for Environmental Justice Analysis Area (2010–2020)

Geography	2010 (%)	2015 (%)	2020 (%)
Utah Counties			
Garfield County	4.5	1.4	4.8
Kane County	2.2	3.6	3.3
Beaver County	0.2	0.2	1.6
Iron County	3.4	3.0	2.5
Piute County	1.4	0.8	0.2
San Juan County	51.3	48.2	48.8
Washington County	1.7	2.2	1.7
Wayne County	0.4	0.6	1.0
Reference area (Utah)	**1.7**	**1.7**	**1.8**
Arizona Counties			
Coconino County	28.6	28.3	28.3
Mohave County	3.5	3.9	3.3
Reference area (Arizona)	**5.3**	**5.4**	**5.6**

Sources: US Census Bureau 2010, 2015, 2020

Social and Economic Demographics and Values

Table 5-47 shows the basic demographic makeup in the socioeconomic analysis area for Garfield and Kane Counties and for Utah. From 2000 to 2020, at 6.4 percent and 29.9 percent, respectively, population growth in Garfield and Kane Counties was lower than in Utah, which experienced 44.8 percent growth during the same period. With a median age of 42.0 years in 2020, both Garfield and Kane Counties had an older population than Utah as a whole (0.3 years median age). Both counties and the state show an increasing median age over time; a trend that is national in scope. Most of the region's population growth has been internal, through births exceeding deaths, rather than from migration from outside the region.

Table 5-47
Demographic Trends (2000–2020)

	Garfield County	Kane County	Kane and Garfield Two-County Region	Utah
Population (2020)	5,050	7,914	12,964	3,249,879
Population percentage change (2000–2020)	6.4%	29.9%	19.6%	44.8%
Median age (2020)	42.0	42.0	N/A	30.3
Median age (2010)	39.8	45.3	N/A	28.8
Average annual population change, 2000–2020 from natural change	20	19	19	34,119

	Garfield County	Kane County	Kane and Garfield Two-County Region	Utah
Average annual population change, 2000–2020 from net migration	-35	48	6	12,928

Source: US Department of Commerce 2021

Table 5-48 shows changes in employment by industry from 2001–2020. Service-related jobs have shown the most growth over the last 2 decades, with accommodations and food services leading the way. Non-service industries in the same period have shown little growth, and they have shown actual decline in some sectors. For the socioeconomic analysis area, the growth in some sectors, especially accommodations and food services, may be due to the area's increasing popularity for recreation and tourism.

Table 5-48
Jobs by Industry Trends (2001–2020)

	Garfield County	Kane County	Kane and Garfield Two-County Region	Utah
Total change in jobs	348	1,499	1,847	687,949
Nonservices related	-23*	80*	57*	72,895
Farm	0	12	12	369
Forestry, fishing, and agricultural services	—	—	—	1,724
Mining (including fossil fuels)	—	3*	3*	2,670
Construction	-1	62*	61*	49,679
Manufacturing	-22	3	-19*	18,453
Services related	483*	1,579*	2,062*	556,921
Utilities	1	-	1*	590
Wholesale trade	-4*	21*	17*	13,809
Retail trade	29	112	141	51,491
Transportation and warehousing	32*	90*	122*	37,889
Information	—	12*	12*	6,697
Finance and insurance	43*	41	84*	57,596
Real estate and rental and leasing	93*	228	321*	58,951
Professional and technical services	44	213*	257*	89,831
Management of companies	0	1*	1*	9,314
Administrative and waste services	31*	134	165*	36,389
Educational services	43*	-2	41*	40,315
Health care and social assistance	67*	133	200*	78,320
Arts, entertainment, and recreation	41*	-180	-139*	12,296
Accommodation and food services	53*	452	505*	34,526
Other services, except public administration	10*	324	334*	28,907
Government	-50	11	-39	58,133

Source: US Department of Commerce 2021
Note: All employment data are reported by place of work. Columns may not add up to reported totals due to rounding.
* = Estimates for data that were not disclosed
— = Data not available

5.16.3 Forecasts

The population is expected to increase in Garfield and Kane Counties for the next 40 years. By 2065, Garfield County's population is projected to increase by 45 percent, and Kane County's population is projected to increase by 57 percent. The two counties have a lower forecasted percent increase than the state of Utah, which is projected to increase 94 percent by 2065 (see **Table 5-49**).

Table 5-49
Population Forecasts (2015–2065)

Geographic Area	2015	2025	2035	2045	2055	2065	Percentage Change (2015–2065)
Garfield County	5,164	5,845	6,405	6,697	7,083	7,509	45%
Kane County	7,271	8,684	9,611	10,179	10,736	11,446	57%
Utah	2,997,404	3,615,036	4,178,317	4,745,057	5,285,767	5,827,810	94%

Source: Perlich et al. 2017

Table 5-50 shows the forecasted employment for Garfield County, Kane County, and Utah. The percentage increase for all three geographic areas from 201 –2065 is similar to the percentage increase in population, over the same period. However, Garfield County is projected to have a slightly higher percentage increase in employment than Kane County.

Table 5-50
Total Employment Forecasts (2015–2065)

Geographic Area	2015	2025	2035	2045	2055	2065	Percentage Change (2015–2065)
Garfield County	3,420	4,063	4,461	4,814	5,144	5,453	59%
Kane County	4,799	5,554	6,106	6,591	7,016	7,375	54%
Utah	1,863,692	2,373,675	2,728,541	3,056,754	3,368,205	3,658,710	96%

Source: Perlich et al. 2017

Table 5-51 shows the projected employment by industry for Utah. The industries with the biggest forecasted percentage growth are construction, professional and technical services, and administrative and waste services. Compared with the historical trends in employment by industry (**Table 5-51**), the industries that saw the largest historical growth for Garfield and Kane Counties (real estate, health care, and accommodation and food services) also are expected to increase in employment over the next 40 years.

Table 5-51
Total Utah Employment by Industry Forecasts (2015–2065)

Industry	2015	2025	2035	2045	2055	2065	Percentage Change (2015–2065)
Agriculture	5,375	6,139	6,680	7,261	7,878	8,527	58.7
Mining	10,371	14,594	14,842	13,603	11,955	10,810	4.2
Utilities	3,915	3,396	2,853	2,746	2,729	2,707	-30.8

Industry	2015	2025	2035	2045	2055	2065	Percentage Change (2015–2065)
Construction	84,679	139,236	189,393	245,869	313,012	394,184	365.5
Manufacturing	123,742	138,616	144,029	148,167	152,890	156,397	26.4
Retail	157,969	179,273	189,685	201,068	211,428	220,018	39.3
Transportation and warehousing	51,122	65,317	64,180	60,221	53,381	44,673	-12.6
Wholesale	50,004	61,934	66,637	69,321	71,380	73,100	46.2
Information	34,443	43,727	52,475	63,234	74,976	85,930	149.5
Finance and insurance	60,386	74,663	84,591	95,522	105,455	113,366	87.7
Real estate	18,643	21,591	24,105	26,032	27,040	26,307	41.1
Professional and technical services	88,018	137,359	181,517	222,857	260,580	292,024	231.8
Management	20,203	19,539	17,860	16,383	14,673	12,541	-37.9
Administrative and waste services	85,999	130,583	162,265	191,742	220,526	248,263	188.7
Education	42,128	61,471	70,392	75,231	80,101	86,199	104.6
Health	140,163	190,858	232,200	261,278	280,145	289,890	106.8
Arts, entertainment, and recreation	21,111	30,207	36,676	43,465	50,219	55,756	164.1
Accommodations and food	112,549	137,441	143,292	147,809	151,409	154,388	37.2
Other services	38,697	37,176	40,101	41,403	39,984	35,587	-8.0
State and local government	198,676	233,844	264,700	296,485	328,071	358,892	80.6
Federal government, civilian	34,958	40,581	43,789	46,583	49,215	51,831	48.3
Federal government, military	16,166	15,296	15,277	15,320	15,350	15,356	-5.0
All other employment	464,381	590,834	681,001	765,152	845,806	921,964	98.5
State total	**1,863,692**	**2,373,675**	**2,728,541**	**3,056,754**	**3,368,205**	**3,658,710**	**96.3**

Source: Perlich et al. 2017

5.17 LANDS AND REALTY

5.17.1 Current Conditions

Land Use Authorizations

There are 137 active ROWs and other land use authorizations (LUAs) encumbering approximately 8,700 acres of the BLM-managed land throughout the decision area. These are primarily access road ROWs and grants for other facilities, such as power lines, irrigation and water pipelines, communication sites, fiber optic lines, and material sites. There are very few grants for oil and gas, mining, or renewable energy. Many authorizations predate the national monument designation, and they continue under the valid existing rights language in the current Proclamation 10286, while others were authorized under the 2000 MMP (BLM 2000), the 2020 GSENM RMP (BLM 2020a), or the 2020 KEPA RMP (BLM 2020b) for uses such as communication facilities, utilities, and access roads. These post-national monument

designation authorizations are subject to various terms and conditions to provide protection of GSENM's objects and values or other applicable resources, as specified in the relevant plan under which they were authorized.

There are 12 pending ROW/LUA applications or renewals in GSENM, according to the BLM Case Recordation (BLM LR2000 2022b). Most have not been resolved due to other priority workloads or a lack of realty staff to work on them.

There are roughly six active trespass cases at any given time, as new cases are discovered, and old cases are resolved. A few current cases are complicated and long-standing, and will need special attention from BLM managers and additional resources to address.

Utility Corridors

There are 11,378 acres of utility corridors within the decision area (BLM 2020b). The first is a congressionally designated utility corridor. PL 105-355 designated a utility corridor along US Highway 89 in Kane County, Utah, including the portion of US Highway 89 in GSENM. The utility corridor extends 240 feet north and 500 feet south from the highway centerline. If approved, the proposed Lake Powell Pipeline would be within this utility corridor, as well as two other pending fiber optic line ROWs. Aside from the highway itself, several other utilities, including a recently constructed buried fiber optic line and several above ground power lines, are within this route. One of the aboveground power lines is being upgraded; the existing line will be decommissioned and removed. Under the 2020 KEPA RMP (BLM 2020b), projects within a portion of this corridor are subject to a timing restriction that provides protection for seasonal mule deer migration while facilitating future projects in the corridor.

The second utility corridor is under Section 368 of the Energy Policy Act of 2005 (PL 109-58). Energy Corridor 68-116 spans portions of northern Arizona and southern Utah, including an area south of US Highway 89 (**Figure 5-27, Appendix B**). This segment is part of the regional West-wide Energy Corridor project and hosts a segment of the Navajo-McCullough 500-kilovolt power line, which previously transmitted electricity from a coal-fired power plant outside Page, Arizona, to Las Vegas, Nevada, and California. The BLM is currently processing a renewal application for the Navajo-McCullough power line ROW, and use is expected to continue within this corridor.

Several de facto utility corridors have also emerged along main transportation routes and adjacent gateway communities in the decision area, including the Johnson Canyon Road/Skutumpah Road corridor east of Kanab; the State Route 12 corridor in eastern Garfield County; Cottonwood Road, which hosts large power transmission lines operated by local power companies transmitting power from the Glen Canyon Dam Hydroelectric Power Plant; and the communities of Big Water, Tropic, Cannonville, Henrieville, Escalante, and Boulder, where utilities often occupy adjacent GSENM lands to serve these communities.

Communication Sites

The BLM typically issues communication use leases for communication facilities on the BLM-managed land. There are two communication sites in the decision area: Buckskin Ridge in Kane County, east of Kanab between US Highway 89 and the Arizona border, and the 50 Mile Head of the Rocks in Garfield County, east of Escalante along the State Route 12 corridor. The 50 Mile Head of the Rocks communication site is approximately 1 acre in size, and the Buckskin Ridge communication site is

approximately 2.5 acres in size. Glen Canyon also holds a lease for a stand-alone repeater site near Warm Butte, northeast of Big Water in Kane County. The Glen Canyon communication site is approximately 1 acre in size. See **Table 5-52**, for more detail.

Table 5-52
Communication Sites

Site	Number of Users	Location	Site Management Plan
50 Mile Head of the Rocks	4	T. 35 S., R. 4 E., sec 22	September 12, 2014*
Buckskin Ridge	6	T. 42 S., R. 2 W., sec 27	September 26, 2017
Glen Canyon	1	T. 42 S., R. 4 E., sec 31	None

Source: BLM 2018; BLM GIS 2022
*The site management plan is being revised to reflect recent changes approved at the site.

Land Tenure (Ownership)

The September 18, 1996, proclamation establishing GSENM stated that, "All federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from entry, location, selection, sale, leasing, or other disposition under the public laws, other than by exchange that furthers the protective purposes of the monuments." Presidential Proclamation 10286, signed October 8, 2021, carried forward this same language.

The 2000 GSENM MMP (BLM 2000) considered land exchanges and acquisitions as long as the current owner was a willing participant, and the action was in the public interest and in accordance with other management goals and objectives. As such, the BLM consolidated land ownership patterns in GSENM through a relatively large-scale land exchange with School and Institutional Trust Lands Administration (SITLA) under PL 105-335 and completed several other acquisitions of inholding parcels.

The 2020 KEPA RMP (BLM 2020b) and 2020 GSENM RMP (BLM 2020a) specified criteria to be considered prior to pursuing any form of land tenure action. The BLM continues to pursue the acquisition of inholdings in GSENM.

Apart from exchanges and acquisitions, however, the withdrawal of lands in GSENM prohibits other types of land tenure actions allowed under FLPMA Title II, including Section 203 sales and other current disposal actions such as the Recreation and Public Purposes Act or the Desert-land Entry Act.

There are 14,800 acres of private lands not managed by the BLM in the planning area.

5.17.2 Trends

Land Use Authorizations

In the last 4 years (December 4, 2017–December 4, 2021), after Proclamation 9682 removed national monument designation from some parts of the planning area, 42 ROWs or LUAs have been requested in the planning area, encompassing approximately 5,800 acres. Of these, 28 of the 42 requests and over 5,700 acres were for minimum-impact filming requests. For the 4 years before Proclamation 9682 (December 4, 2013–December 4, 2017), 49 ROWs or LUAs were requested, encompassing approximately 2,400 acres; 39 of the 49 requests and most of the acres were for minimum-impact filming permits. These trends show a slight increase in ROW requests, with a noticeable decrease in LUA requests for film permits over the last 4 years. This decrease in requests follows a change to the BLM filming guidance after the Price v. Barr court decision, which has moved more filming projects into

the "casual use" category that does not require permits. A lack of BLM staff has been a chronic problem in addressing the existing lands and realty caseload.

Utility Corridors

In the last 4 years (December 4, 2017–December 4, 2021), no new utility corridors have been approved in the planning area. During this period, all major ROW requests in the planning area have been located within existing designated corridors or communication sites.

Communication Sites

In the last 4 years (December 4, 2017–December 4, 2021), no new communication sites have been established in the planning area. There has been only one new communication site lease authorized in the planning area during this period. An EA was completed in September 2020 to approve changes at the 50 Mile Head of the Rocks communication site that would move the existing facilities off a highly visible hilltop and screen much of the new facilities from view.

Land Tenure (Ownership)

Under the September 18, 1996, proclamation, sales and land disposal actions, other than exchanges and acquisitions, were prohibited. In December 2017, President Trump announced Proclamation 9682, which reduced the GSENM boundaries by approximately 50 percent and opened much of the former GSENM at the time to extensive discretionary uses. Sales and other disposal actions were allowed on lands removed from GSENM, but specific eligible parcels were not identified under the 2020 KEPA RMP (BLM 2020b) so that such actions could be considered. Between September 1996 and December 2017, 434 acres of land were purchased from willing sellers in the GSENM boundaries, and approximately 180,000 acres were acquired in a land exchange with the State of Utah. Between December 2017 and October 2021, no land was either disposed of or acquired in the decision area. However, in October of 2021, President Biden announced Proclamation 10286, which restored GSENM to its original 1996 boundaries. The BLM is once again pursuing the acquisition of inholdings in GSENM from willing sellers.

5.17.3 Forecasts

Land Use Authorizations

The number of ROW applications will likely remain constant or increase slightly, with renewals, new applications, and the few remaining backlog cases at 10 to 12 per year. Even this relatively small number will be a challenge for the part-time realty staff that the BLM's shares with the Kanab Field Office.

The decreased number of commercial film permit applications will likely continue, unless filming policy changes. These will increasingly be small-scale projects designed for websites and other social media platforms, rather than more traditional television, motion picture, and advertising shoots. Under current BLM policy, many of these projects fall into gray or undefined policy areas regarding whether they are casual use or require a film permit. Most projects currently are considered casual use, but each project proposal still must be reviewed to determine whether a permit is required. Most current filming proposals include the use of small drones, although the policy for drone use on BLM-managed lands is limited. The DOI is appealing the Price v. Barr decision that initiated the filming policy changes; however, until a decision is reached on the appeal and updated national guidance is released, it may be worthwhile for GSENM to consider addressing current filming issues in this planning effort or local policy guidance.

Lack of sufficient staff remains a problem, and current workloads exceed staffing levels. This means many trespass cases, applications, and compliance work may not be completed.

Utility Corridors

The Page, Arizona, coal plant closed in 2019, which put the future of the 500-kilovolt Navajo-McCullough power line in doubt. However, according to power company officials, there is still a need for continued operation of the transmission line and the Section 368 corridor. Due to its relatively isolated location, however, other new facilities will likely continue to be concentrated within the designated US Highway 89 corridor and other de facto corridors throughout the decision area. The number of ROW projects in existing utility corridors will likely increase over time.

Communication Sites

There are two formal communication sites and one single-use site. Only the Head of the Rocks and Buckskin Ridge communication sites have communication site plans. The single-use Glen Canyon communication site does not include a site plan.

The Head of the Rocks plan needs to be amended based on a recent BLM EA that addressed permit changes regarding safety and visual resources concerns. Much of the planned development at the Buckskin Ridge site is already completed, and a site plan was completed on June 24, 2004. However, the site plan was amended on November 14, 2013, and again on September 26, 2017, to address increasing communication within the Paria Wilderness by increasing the tower height at Buckskin Ridge and other new proposed uses. Any future development would continue incrementally and in an orderly fashion, as outlined in the recently updated Buckskin Ridge Communication Site Management Plan.

Land Tenure (Ownership)

The BLM is likely to pursue an increase in the acquisition of inholdings at GSENM from willing sellers. The main source of funding for land acquisitions in GSENM is the Land and Water Conservation Fund, whose funding has increased recently and is expected to remain steady or to increase in the near future. With the increase in funding, the BLM is pursuing additional realty staff, including staff that could support GSENM with future acquisitions.

However, at some point, it is expected that identifying willing sellers of GSENM inholdings may become increasingly difficult. Land exchange could be another possible way to acquire land from landowners who may not be interested in selling inholdings. Land exchanges have been proposed that could possibly further the protective purposes of GSENM, and these may be pursued in the future to improve management of GSENM. The BLM will manage land tenure actions in the decision area on a case-by-case basis, in accordance with criteria developed in this planning effort, and as personnel and priority workload allow.

5.18 LANDSCAPE CHARACTERISTICS

5.18.1 Visual Resources

Regulatory/Policy Framework for Visual Resources

The visual (or scenic) resources of GSENM as noted in Proclamation 10286 encompass the entire landscape as well as specific areas and routes are highlighted. The Proclamation describes the visual landscape this way: *High, rugged, and remote, the vast and austere Grand Staircase-Escalante landscape is*

characterized by bold plateaus and multihued cliffs that run for distances that defy human perspective. This inclusion in the Proclamation establishes the requirement to manage lands in GSENM to protect the visual resources and values.

Additionally, the BLM is required to manage lands in a manner that will preserve scenic values by a broad range of authorities. The FLPMA and NEPA include federal mandates for scenic and aesthetic resources. Other guidance includes BLM Manual 8400 Visual Resource Management, BLM Manual H-8410-1 Visual Resource Inventory, and BLM Handbook H-1601-1 Land Use Planning (BLM 2005a).

The BLM VRM system consists of three phases: the visual resource inventory (VRI); the establishment of management classes and corresponding objectives through the land use planning process; and the analysis of site-specific management action implementation to ensure compliance with the objectives established in the land use plan. The intent is to minimize the visual impacts of all ground-disturbing activities, regardless of the management class in which they occur.

VRI classes are determined by documenting the following:

- ***Scenic Quality***—A measure of visual appeal whose scenic quality classes are:
  - Class A: Distinctive, high degree of visual variety
  - Class B: Common or typical, moderate degree of visual variety
  - Class C: Indistinctive, low degree of visual variety
- ***Viewer Sensitivity***—A measure of the public's tolerance for change in the visual environment:
  - Maintenance of Visual Quality has High Value
  - Maintenance of Visual Quality has Moderate Value
  - Maintenance of Visual Quality has Low Value
- ***Distance Zones***—From where the public views the landscape:
  - Foreground/middleground zone: From viewing platform to 3–5 miles out
  - Background zone: From the edge of the foreground/middleground zone to 15 miles out
  - Seldom-seen zone: Areas not visible in the foreground/middleground or background zones and areas beyond the background zone

VRM classes are established during the land use planning process by balancing inventoried visual values with other resource values and land use allocations. These VRM classes establish defined objectives for future management of BLM-managed lands:

- ***Class I Objective*** is to preserve the landscape's existing character. The level of change to the characteristic landscape should be very low and must not attract attention. (Wilderness, WSAs, wild sections of Wild and Scenic Rivers (WSRs), and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape are assigned VRM Class I per policy clarification in IM No. 2000-096.)
- ***Class II Objective*** is to retain the landscape's existing character. The level of change to the characteristic landscape should be low.

- ***Class III Objective*** is to partially retain the landscape's existing character. The level of change to the characteristic landscape should be moderate.
- ***Class IV Objective*** is to provide for management activities that require a major modification of the landscape's existing character. The level of change to the characteristic landscape can be high.

Current Conditions

The visual resources of GSENM are highly scenic, highly valued by the public, exceedingly undeveloped, and intact. Many areas in GSENM possess a high degree of scenic quality and a high level of sensitivity to change. GSENM contains internationally recognized scenic destinations and draws an increasing number of visitors who come to the area to recreate and sightsee. The *GSENM Recreation Experience Baseline Study* (Casey 2018) documented that "Scenic Quality" was selected more than any other quality (60.9 percent) by focus group participants when asked "What are the qualities of the place that make it special?". Additionally, the "wild, unspoiled and natural" (58.6 percent) and "remote and rugged" (42.5 percent) characteristics were also highly valued. In general, high scenic quality in GSENM is a result of the area's diverse vistas, extraordinary topography, dramatic, colorful and unusual geology, abundance of canyons and waterways, varieties of vegetation, cultural history features, and lack of development.

The VRI for GSENM was completed in 2018 (BLM 2019). Almost 50 percent of GSENM inventoried as High Scenic Quality and less than 1 percent inventoried as Low Scenic Quality. The highest rated scenic quality rating unit inventoried on Utah BLM-administered lands is the Upper Escalante Unit (score of 28) that includes the upper reaches of the Escalante River, Calf Creek, and the lower reaches of Death Hollow. Almost 60 percent of GSENM inventoried as the public being highly sensitive to change in GSENM's landscape character, only 2 percent of the area inventoried had low public sensitivity to change in the landscape character. About half the area inventoried as being in the frontcountry/middle country distance zone (visible areas up to five miles from common viewing platforms – primary travel routes, communities, viewpoints), and about half of the area inventoried as being in seldom seen locations due to landform screening or distance from viewing platforms (beyond 15 miles).

Almost 50 percent of the lands in GSENM are in WSAs and are classified as VRI Class I. Without the automatic VRI I classification of WSAs, more than 60 percent of the lands in GSENM inventoried as VRI Class II, the highest classification that results from combining scenic quality, public sensitivity, and proximity to viewing platforms like commonly used roads. Slightly more than 20 percent inventoried as VRI Class III. Less than 20 percent inventoried as VRI Class IV.

To underscore the undeveloped nature of GSENM, one of the scenic quality scoring factors is Cultural Modifications and can be assigned in both positive and negative values to rate whether modifications add favorably to the visual environment or create levels of strong disharmony with the natural, characteristic landscape. There are 48 Scenic Quality Ratings Units (SQRUs) in the inventory area. Ten of the 48 SQRUs have slight negative Cultural Modification scores of -1.0 or -0.5 of a possible -4.0 score. These 10 units comprise less than 10 percent of the inventory area.

Table 5-53 to Table 5-58 depict the different components of the BLM VRI as well as the current BLM RMP classes for GSENM. Further, a series of maps display these data in GSENM's boundaries, as follows:

- **Figure 5-28**: Visual Resource Inventory
- **Figure 5-29**: Visual Resource Inventory Classes without VRI Class I
- **Figure 5-30**: Scenic Quality Rating Unit
- **Figure 5-31**: Sensitivity Level Rating
- **Figure 5-32**: Distance Zones
- **Figure 5-33**: Visual Resource Management

Table 5-53
BLM VRI Classes with VRI Class I Shown

VRI Class	Acres
Class I	881,100
Class II	550,300
Class III	235,400
Class IV	198,500

Source: BLM 2019

Table 5-54
BLM VRI Classes without VRI Class I Shown

VRI Class	Acres
Class II	1,154,800
Class III	378,700
Class IV	331,900

Source: BLM 2019

Table 5-55
BLM VRI Scenic Quality

Scenic Quality	Acres
Class A	870,100
Class B	985,700
Class C	9,600

Source: BLM 2019

Table 5-56
BLM VRI Sensitivity Levels

Sensitivity Level	Acres
Maintenance of visual quality has high value	1,119,000
Maintenance of visual quality has moderate value	704,900
Maintenance of visual quality has low value	41,600

Source: BLM 2019

Table 5-57
BLM VRI Distance Zones

Distance Zone	Acres
Foreground-middleground	896,600
Background	62,400
Seldom seen	906,400

Source: BLM 2019

Table 5-58
BLM Visual Resource Management Classes

VRM Class	Acres
Class I	881,100
Class II	422,300
Class III	346,900
Class IV	215,300

Source: BLM 2020

Trends

Most of GSENM is undeveloped and exhibits intact natural visual characteristics due to the remote, rugged, and inaccessible qualities of the area. Though not dominant, development imprints on the land include transmission lines, roads, livestock grazing infrastructure, vegetation managements, and recreational developments. Prior GSENM management decisions that limited large-scale development projects, sparse population density, and a large contiguous tract of BLM-administered lands with inholdings have resulted in a stable trend for maintaining scenic quality since GSENM's 1996 designation.

The BLM analyzes all proposed projects in GSENM for their visual impacts and compliance with VRM class objectives. Projects are planned and designed to meet or exceed VRM class objectives so that projects blend in with the natural landscape character and impacts to the visual environment are minimized. This approach has been and continues to be effective in maintaining GSENM's scenic quality.

Forecasts

It is forecasted that VRI values will remain mostly stable into the future. Viewer sensitivity to landscape change is more likely to increase than scenic quality ratings or distance zones are likely to change. In other words, while regulatory classifications may remain unchanged in response to alterations on the visual landscape, visitors will still see and feel that impact in their experience of visual resources. As undeveloped, naturally intact lands become scarcer throughout the country, as development locally pushes closer to GSENM's boundaries, and as inholdings are developed, it is likely that national and local publics will become increasingly sensitive to changes in the landscape character in GSENM to the degree that sensitivity ratings will shift in some inventoried areas of moderate and low sensitivity. Increases in sensitivity are anticipated to rise due to both the increasing number of visitors and visitation expanding into lesser-known areas as popular destinations become overcrowded. The BLM assumes these factors will cause more of the landscape to be explored and valued by more visitors, compared with the existing condition. Distance zones are established on important viewing platforms, such as primary travel corridors, communities, trails, and viewpoints. Though development along the edges of local communities is likely to occur, and some internal GSENM travel corridors may become more popular

with increased travel counts, the viewing platforms are assumed to remain mostly the same as were used in the inventory.

Anticipated future visitation increases will result in additional recreational infrastructure (trailheads, campgrounds, and trails). Additional livestock grazing infrastructure (fencing, water developments, etc.) and vegetation restoration projects will likely be implemented based on past trends. A modest number of local- and regional-scale utility ROWs (buried and aboveground) will likely be authorized if past trends continue. This range of development within the BLM's jurisdiction could result in modest increases in visual contrast throughout the planning area, especially in foreground scenes. However, these types of facilities are not forecasted to be implemented in locations or at scales or densities that would cause scenic quality ratings to shift.

Causal factors that could also impact GSENM scenic quality that are outside the BLM's influence or control are climate change and the development of adjacent and inheld non-BLM-managed lands. The development of inholdings and properties along GSENM's boundary for residential, commercial, and other uses is likely to continue and increase, resulting in changes to the landscape character in those interface zones. The intensifying drought and severe wildfires associated with climate change are forecasted to change vegetation (for example, dead and/or burnt stands of trees, reduced shrub and grass cover, increasing insect and disease pressure, and reduced water availability), especially in shrubland, riparian, and pinyon-juniper woodland vegetation communities. They are also forecasted to reduce the presence of surface water, potentially to the degree that inventoried scenic quality values would shift.

5.18.2 Dark Night Skies

Regulatory Framework for Dark Night Sky Resources

The dark night skies resources of GSENM are noted in Proclamation 10286 and described this way: "The Grand Staircase-Escalante's large, isolated, and, at times, impenetrable landscape is one of the most naturally dark outdoor spaces left in America, providing views of the cosmos that are nearly unrivaled in the contiguous United States, and an opportunity for visitors to encounter a landscape at night, undisturbed by electric lights, in the same way people have experienced the West for most of America's history." This inclusion in the proclamation establishes the requirement to manage lands in GSENM to protect the dark night sky resources.

In response to increased interest from the public regarding protection of dark night skies, the BLM is currently developing best management practices (BMPs) to provide comprehensive technical guidance on practical methods for reducing the impacts from artificial outdoor lighting from proposed projects or implementation of activities. The BLM has not yet developed policy regarding the management of dark night skies.

Current Conditions

In 2016, an inventory conducted by a Weber State University and International Dark Skies team working under a GSENM science permit (UT-16-035-05-S) using satellite imagery and on-the-ground readings revealed that GSENM is one of the most naturally dark outdoor spaces left in the lower 48 states. Based on light escaping to space, measurements from the Visible Infrared Imaging Radiometer Suite instrument aboard the Suomi National Polar-Orbiting Partnership satellite suggest that the night skies in over 90 percent of the planning area qualify under the descriptive term "pristine." In such conditions, only

natural sources of light, such as starlight, airglow, and aurora and zodiacal light, are visible to the human eye. Ground measurements of zenith (directly above observer[s]) sky luminance (brightness) in GSENM supported that conclusion; excluding measurements around populated places around the edges of GSENM, the mean zenith luminance was 21.8±0.06 magnitudes per square arcsecond, which is comparable with the lower limit of 21.9–22.0 magnitudes per square arcsecond established by natural night sky phenomena (IDA 2016).

Table 5-59 depicts the acres of GSENM where different thresholds of existing sky glow currently exist.

Table 5-59
Existing Sky Glow (Ratio to Natural Brightness)

Ratio to Natural Brightness	Acres
0.00–0.01	1,863,500
0.01–0.02	2,100

Source: Falchi et al. 2016

According to Falchi et al. (2016), only 30.4 percent of the US land area (much of it in Alaska) experiences this degree of natural darkness on a regular basis. The routinely seen "pristine" night skies in GSENM are now a rarity across the contiguous US, however. **Figure 5-34, Appendix B**, displays the existing light pollution in GSENM.

A 2016 inventory of fixed artificial light sources on developed structures in GSENM's boundaries revealed that fewer than 30 total lights exist in three locations (Citation Oil facility with 18 lights [6 poles with 3 lights/per pole], Calf Creek Campground with 2 lights under the porches of the restroom and 2 lights inside each restroom, and 7 lights on the Paria Contact Station buildings). This inventory did not include lighting on private property inholdings.

Trends

Development in the western US is projected to continue to increase in coming decades. The nearest metro area of more than 150,000 population is St. George Utah. Situated about 125 straight miles from the core of the planning area, it is currently one of the fastest-growing cities in the country (Spectrum 2021). The nearest large metropolitan areas are Las Vegas, Nevada, (about 225 straight miles to the southwest) and Salt Lake City, Utah (about 300 straight miles to the north). Increasing development typically results in increased levels of sky glow so additional sky glow from peripheral and adjacent development areas is likely to be detected in GSENM. With increasing development throughout the western US, it is anticipated that light pollution would continue to increase in the periphery of GSENM with further encroachment of sky glow into the edges of GSENM.

With 24 dark sky designations, Utah surpassed Texas in 2015 with more International Dark Skies dark sky designations than any other state. GSENM is surrounded by several designations protecting night skies at a variety of scales, including Capitol Reef, Bryce Canyon, and Canyonlands National Parks; Kodachrome Basin State Park; and Torrey Town.

Gateway communities to areas with dark night skies are seeing increasing visitation and economic development opportunities associated with astrotourism, such as dark sky festivals hosted by the region's national parks. Such activities are currently hosted in the Bryce area to the west, in the Torrey

area to the northwest, and in the Page, Arizona area to the southeast. The communities of Kanab and Boulder have both passed ordinances that seek to protect against light pollution.

Night sky resources are increasingly of public concern and noted during scoping for planning efforts and review of proposed projects on BLM lands. At least two BLM national monuments (GSENM and Bears Ears) recognize dark night skies as objects for protection in their proclamations.

Forecasts

Outside GSENM, the towns and cities on the immediate periphery and those farther away, such as St. George and Las Vegas, are anticipated to continue to expand with residential, commercial, and industrial development and associated artificial lighting. This growth is forecast to increase the encroachment of sky glow into the edges of GSENM. Based on existing trends, the BLM projects that public concerns for protecting dark sky resources on public lands will continue and increase.

5.18.3 Natural Soundscapes

Regulatory Framework for Natural Soundscape Resources

The natural soundscape of GSENM is noted in Proclamation 10286 and described this way: "The Grand Staircase-Escalante area also provides a remarkable natural soundscape with infrequent human-caused sounds." This inclusion in the proclamation establishes the requirement to manage GSENM to protect soundscape resources.

Protection of ambient soundscapes has received growing attention over the past four decades, with legislation dating back to the Noise Control Act of 1972. Subsequent nation-wide legislation has described the importance of the acoustical environment for resource protection and visitor experience in protected natural areas including for NPS units, the National Parks Air Tour Management Act of 2000. Because of the abundant noise found in urban and suburban areas, the majority of visitors to protected natural areas come seeking respite from ambient stressors such as noise. Natural quiet is important for visitors, ecosystem health, and the welfare of the non-human species that reside in protected natural areas.

Current Conditions

From 2014 to 2017, Southern Utah University documented the acoustic baseline using sound level meters and digital audio recorders in various locations across the planning area based on acoustic/biological/geographic zones, visitor use areas, and WSAs. The highest percentages of human-caused noise in GSENM are created by high-altitude jets and visitors at popular recreation sites. Several monitored sites were found to be within the range of the quietest locations monitored in the lower 48 states, based on exceedingly low decibel levels. Recorded decibel levels were approaching the noise floor at several monitored locations requiring sensitive acoustic equipment to accurately document the sound level.

One such location was at the Dry Forks site. As a comparison, the natural quiet in the planning area was recorded at 5.7 dBA, whereas two very quiet national parks, Great Sand Dunes National Park (8.7 dBA) and Haleakala National Park (10 dBA), had higher decibel readings. Additionally, the NPS has developed data depicting existing soundscapes for the lower 48 states. A large portion of GSENM is very quiet (less than 30 dBA which equates to a quiet whisper or rustling leaves) with several areas being some of the

quietest locations that have been monitored in the lower 48 US as identified in an existing condition acoustic baseline study conducted by Southern Utah University (Southern Utah University 2020).

The following table depicts the acres of GSENM where different thresholds of existing sound levels currently exist. These are based on L50, a descriptor of loudness, which represents the existing ambient noise levels where the sound level is exceeded 50 percent of the time. **Table 5-60** and **Figure 5-35, Appendix B,** displays these existing sound levels in GSENM.

Table 5-60
Existing L50 Sound Levels (dBA)

Sound Level (dBA)	Acres
Less than 25 dBA	884,500
25–30 dBA	978,700
More than 30 dBA	2,500

Source: NPS 2021

Trends

Natural soundscape resources are increasingly of public concern and noted during scoping for planning efforts and review of proposed projects on BLM lands. Increases in noise are anticipated to continue as recreational visitation and air travel increase. Scenic overflights in places like nearby Grand Canyon National Park, and the use of drones for recreational and scientific purposes have increased in recent years.

Forecasts

With increasing recreational use and air travel (identified as the main generators of human-caused noise in GSENM based on the GSENM 2020 Acoustic Baseline Report), as well as other noise producing activities (for example, vehicle travel including OHVs, scenic overflights, etc.) it is anticipated GSENM's acoustic environment would become less quiet over time, especially along primary and secondary travel corridors, though not to significant degree across the entirety of the landscape because of the inaccessibility of a significant percentage of it. The demand for scenic overflights on nearby national parks suggests that the demand for that use could occur at GSENM resulting in less quietness. The demand for use of drones for recreational and scientific purposes is forecast to continue. In accordance with the National Parks Air Tour Management Act of 2000, the NPS is currently developing air tour management plans to reduce noise impacts over the parks including the portion of GSENM within a 0.5 mile of Bryce Canyon NP (northwest corner of GSENM adjacent to Cannonville and Henrieville), Capitol Reef NP (northeast corner of GSENM), and Glen Canyon NRA (east and southeast edges of GSENM).

5.19 LANDS WITH WILDERNESS CHARACTERISTICS

Although the BLM's authority under FLPMA Section 603 (43 USC 1782, *et seq.*) expired in 1991, Congress gave the BLM broad authority and discretion under other sections of the FLPMA, aside from Section 603, to identify lands with wilderness characteristics and, if appropriate, to manage lands to protect such characteristics. Under FLPMA Section 201 and later per guidance outlined in BLM Manual 6310 (BLM 2021a), the BLM began updating findings for lands with wilderness characteristics in 1996 and completed findings in early 1999 (BLM 1999). This inventory was updated in 2020 to further identify which GSENM lands contain wilderness characteristics.

5.19.1 Current Conditions

There are approximately 559,600 acres outside of existing WSAs that the BLM has identified as having wilderness characteristics (see **Table 5-61** and **Figure 5-36, Appendix B).** The 2020 Approved RMP directed the BLM to not manage any lands within the former KEPA for the protection, preservation, or maintenance of wilderness characteristics; however, lands previously identified as having wilderness characteristics may have retained those characteristics, and their management may be re-evaluated during this planning process.

Table 5-61
Lands with Wilderness Characteristics

Unit Name	Acres with Wilderness Characteristics*
Box Canyon	2,900
Burning Hills	16,200
Burning Hills C	700
Carcass Canyon	34,800
Carcass Canyon A	600
Carcass Canyon B	200
Cave Point	5,200
Colt Mesa	28,300
Death Ridge	3,800
Death Ridge A	100
Death Ridge B	200
Fiftymile Mountain	56,800
Fiftymile Mountain A	90
Fiftymile Mountain B	900
Horse Mountain	21,300
Horse Spring Canyon	31,500
Hurricane Wash	9,000
Lamp Stand	3,500
Little Egypt	22,400
Mud Spring Canyon	24,100
Mud Spring Canyon W	40
Muley Twist Flank	2,200
N Escalante Canyons/Gulch	7,000
N Escalante Canyons	26,100
Nipple Bench	27,700
Nipple Bench Area	3,400
Paria Canyon A	100
Paria Canyon B	80
Paria Canyon C	2,400
Paria Canyon D	100
Paria-Hackberry	50,300
Phipps-Death Hollow	7,100
Pioneer Mesa	11,200
Scorpion	14,900
Squaw Canyon	14,800
Steep Creek	11,700
Studhorse Peaks	24,800
Sunset Arch	5,500
The Blues	2,300

Unit Name	Acres with Wilderness Characteristics*
The Blues B	200
The Blues C	600
The Cockscomb	1,500
The Cockscomb A	100
The Cockscomb C	10
The Cockscomb D	70
Upper Kanab Creek	5,100
Upper Kanab Creek B	100
Wahweap	10,300
Wahweap A	500
Wahweap B	300
Wahweap-Death Ridge	42,200
Warm Creek	24,200
Total	**559,600**

Source: BLM GIS 2022
*Acres rounded to the nearest 100. If less than 100, rounded to the nearest 10 acres

In addition to the approximately 559,600 acres with recent findings on record, there are 54,400 acres of former SITLA sections that are surrounded by WSAs within the decision area. These lands were previously "inholdings" within WSAs managed by the State of Utah that were legislatively exchanged to the BLM through the Utah Schools and Lands Exchange Act of 1998 (Public Law 105-335). Under Utah BLM IM-UT-2005-003, the BLM formally determined that, "The FLPMA land exchange regulations at 43 CFR 2200.0-6(f) and (g) and 43 CFR 2201.9(b) do not apply" to the lands acquired through the Exchange Act of 1998. The BLM concluded that "none of the lands acquired by the United States through the Exchange Act of 1998 are WSAs or managed as WSAs." Instead, management of these WSA inholdings is subject to land use plan decisions.

The BLM has updated inventory findings for former SITLA inholdings. However, the BLM did not update formal findings for lands with wilderness characteristics for these inholdings. These parcels are remote, are generally inaccessible, except by foot or pack stock, and could not be field verified during the time frame associated with this planning effort. Instead, the BLM conducted a GIS analysis of these lands to consider whether there was a reasonable probability that these lands contain wilderness characteristics. The BLM concluded that there is a reasonable probability that these approximately 10,300 acres generally contain the same apparent naturalness and outstanding opportunities for solitude or primitive and unconfined recreation as the contiguous WSA. The BLM must consider an appropriate range of alternatives for the management of these lands.

5.19.2 Trends

Recreational use is increasing throughout GSENM and will alter the landscape over time through increased human presence, vehicle use, and road use in certain areas. With these alterations, comes a need for reoccurring updated inventories of lands with wilderness characteristics to evaluate if the wilderness characteristics are still being met.

5.19.3 Forecasts

Interest in wilderness resources throughout the decision area has local, regional, and national significance. Public interest in the BLM's inventory determinations, as well as management actions for

these areas, has increased dramatically in the past 20 years, and is expected to continue increasing. Should areas that currently meet the definition of lands with wilderness characteristics found in BLM Manuals 6310 and 6320 (BLM 2021a and 2021b, respectively) become negatively impacted, the BLM may have to determine allocations of use to preserve wilderness characteristics. Conflicts between development interests and preservation interests are expected to increase into the future.

5.20 Special Land Designations for Conservation and Protection

5.20.1 Areas of Critical Environmental Concern, Outstanding Natural Areas, and Research Natural Areas

Areas of critical environmental concern (ACECs) are areas where special management attention is required to protect and prevent irreparable damage to important historical, cultural, or scenic values; fish and wildlife resources or other natural systems or processes; or to protect life and safety from natural hazards. To be designated an ACEC, the area must meet criteria for both relevant and important values, as defined in 43 CFR 1610.7 and as defined in BLM Manual 1613, Areas of Critical Environmental Concern (BLM 1988).

ONAs are designated areas that exhibit outstanding scenic splendor, natural wonder, or scientific importance.

Research natural areas (RNAs) are established and maintained for research and education because the land has one or more of the following characteristics: (1) a typical representation of a common plant or animal association; (2) an unusual plant or animal association; (3) a threatened or endangered plant or animal species; (4) a typical representation of common geological, soil, or water features; or (5) outstanding or unusual geological, soil, or water features (43 CFR 8223).

Current Conditions

There are currently no designated ACECs in GSENM.

The BLM will call for new ACEC nominations in the NOI for this planning effort. The BLM will use the criteria found at 43 CFR 1610.7-2 in considering designation of new ACECs.

ONAs and RNAs that existed prior to initial monument designation, and that have been retained since designation, are:

- Devils Garden ONA
- Escalante Canyons ONA
- North Escalante Canyon ONA
- The Gulch ONA
- Phipps-Death Hollow ONA
- No Mans Mesa RNA
- Wolverine Petrified Wood Natural Environmental Area

Figure 5-37, Appendix B shows ONAs and RNAs within the decision area.

Trends

Increased temperatures, impacts on vegetation diversity, and increased nonnative, invasive species resulting from climate change could impair the relevant and important values of potential ACECs. The 2000 MMP evaluated nominated ACECs, but it was determined that management would be equivalent under either GSENM authority or ACEC designation.

As part of the 2020 planning effort, ACEC nominations were again received and evaluated. The BLM evaluated approximately 1,193,100 acres (including some overlapping acreages) that were nominated as ACECs. Of these, 14 areas totaling approximately 309,000 acres were determined to meet the relevance and importance criteria and eligible for consideration as ACECs in that land use planning process. The BLM determined that the protections provided by the national monument designation were adequate to protect the values identified and that no special management was required. As such, there are no existing ACECs in the decision area.

Forecasts

The BLM anticipates ACEC nominations and will evaluate them as part of this effort.

5.20.2 National Trails

National trails include congressionally designated historic and scenic trails and administratively designated recreation trails. Scenic trails are established "for maximum outdoor recreation potential, and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass"(BLM 2012c). Historic trails are "extended trails which follow as closely as possible and practicable the original route or routes of travel of national historical significance" and are designated for "the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment" (BLM 2012c). National Recreation Trails are established for "a variety of compatible outdoor recreation uses in or reasonably accessible to urban areas or high-use areas" (BLM 2012d). While similar to historic and scenic trails, they are designated through the BLM and do not require congressional approval.

Current Conditions

The OSNHT, designated on December 4, 2002, by the Old Spanish Trail Recognition Act of 2002, is a 2,700-mile-long trade route extending from Santa Fe, New Mexico, to Los Angeles, California. It passes through Colorado, Utah, Arizona, and Nevada. The trail splits into three routes prior to entering Utah and continues through Utah within the planning area. The OSNHT was designated by a congressional act after the designation of GSENM by presidential proclamation in 2000. In 2012, the BLM released Manuals 6250, National Historic Trails Administration (BLM 2012c), and 6280, Management of National Scenic and Historic Trails and Trails under Study or Recommended as Suitable for Congressional Designation (BLM 2012a). In 2016, the NPS and BLM, as co-administrators, published the OSNHT Final Comprehensive Administrative Strategy (BLM and NPS 2016) detailing procedures for this trail.

There are 36 miles of the Armijo Route, a segment of the OSNHT, within the decision area (**Figure 5-38, Appendix B**). Twenty-four miles of the OSNHT along the Armijo Route's Box of the Paria segment are recognized as a "high potential route segment." This term is used in the National Trails System Act for segments of a trail that afford high-quality recreation experiences along a portion of the route having greater-than-average scenic values or affording an opportunity to share vicariously the experience of the original users of a historical route (16 USC 1241, *et seq.*). To the east and west, the

remaining 12 miles of the OSNHT cross and parallel Highway 89 and electrical distribution lines in the area formerly known as the KEPA.

Several other trails in GSENM are not currently designated; however, they have the potential for proposal as national recreation trails. These include the Hole-in-the-Rock Trail, Boulder Mail Trail, and Great Western Trail.

Trends

The OSNHT has historically been underutilized as a recreation and cultural resource. The trail was designated after the designation of GSENM; as a result, the previous RMP did not include up-to-date trail data or comprehensive management actions for the trail. However, the OSNHT has been growing in popularity over the past several years. A recent Recreation and Development Strategy was conducted by the Old Spanish Trail Association. It identified numerous sites and locations for development along the trail. The availability of technology such as apps and online mapping tools that follow and interpret the trail are also becoming more popular; recreationists can find a trail resource and post information online which instantly raises public awareness to the trail feature. Trail resources can be found and accessed without proper management protections in place. Additionally, increases in the levels of road and pipeline development along the OSNHT could impact the nature and purpose of the trail.

Forecasts

National historic and scenic trails are likely to remain the same, pending congressional designation. National recreation trails are likely to remain the same, pending BLM proposal and designation.

5.20.3 National Monument

Current Conditions

GSENM was originally established by Proclamation 6920 of September 18, 1996 and included approximately 1.8 million acres of BLM-managed surface land at designation. After its designation, Congress modified GSENM's boundaries on three occasions, the Utah School and Land Exchange Act (Pub. L. No. 105-355, 112 Stat. 3139 (1998)), the Automobile National Heritage Area Act, and Section 2604 of the 2009 Omnibus Public Land Management Act, that in total, added approximately 180,000 acres to the designation. On December 4, 2017, President Trump issued Proclamation 9682 modifying the boundaries of GSENM. On October 8, 2021, President Biden announced Proclamation 10286, which restored the boundaries and conditions of GSENM as they existed prior to the 2017 Proclamation.

The Antiquities Act of 1906 grants the president authority to designate national monuments to protect "objects of historic or scientific interest." Since 1906, presidents and Congress have designated more than 129 national monuments, 28 of which are maintained by the BLM. The BLM's monuments are managed as part of the National Landscape Conservation System, whose mission is to conserve, protect, and restore nationally significant landscapes recognized by the president or Congress for their outstanding ecological, cultural, or scientific resources and values. As noted in Chapter 3, GSENM is managed to protect the objects and values for which the area was designated and only activities and uses that are compatible with such projection may be allowed.

The BLM's objective in managing a national monument is to:

- Comply with the presidential proclamations by conserving, protecting, and restoring the objects and values for which a monument was designated for the benefit of present and future generations
- Effectively manage valid existing rights and compatible uses within a monument
- Manage discretionary uses within a monument to ensure the protection of the objects and values for which it was designated
- Use science, local knowledge, partnerships, and volunteers to effectively manage a monument
- Provide appropriate recreational opportunities, education, interpretation, and visitor services to enhance the public's understanding and enjoyment of a monument

The decision area encompasses approximately 1.87 million acres of BLM-managed surface land, including lands originally designated under proclamation. Several subsequent federal laws have affected the size of GSENM, but the most recent Proclamation 10286 has restored GSENM to its original size.

The BLM is required to manage monuments for the proper care and management of the objects of historical and scientific interest for which they were designated. Identifying the specific objects in a proclamation is critical in order to properly manage a national monument and to determine the management actions necessary to implement the law and manage monuments for the purposes for which they were designated. While deference is always given to the specific text in the proclamations, the BLM must clearly identify the objects and values for the agency to properly undertake land use planning or other analyses to ensure proper management of a national monument.

Land use planning decisions for NLCS units, such as GSENM, must be consistent with the purposes of the designating proclamation or act of Congress (BLM Manual 6100, pp. 1–6). In addition, land use plans must clearly identify GSENM objects and values described in the designating proclamation (BLM Manual 6220, pp. 1–12).

The Antiquities Act makes multiple references to "objects," which include "objects of antiquity" and "objects of historic or scientific interest." Objects are listed in the proclamation or enabling legislation and generally include cultural artifacts or features, historical structures, paleontological or geological features, specific plant or animal species or habitats, and other resources. The BLM has generally interpreted objects as discrete physical items. A national monument may also have less-tangible values, such as the provision of opportunities for research.

Courts have upheld that the BLM has discretion to determine, to a certain degree and within reason, which items listed in a proclamation are the actual objects to be protected. The BLM has not established a process or policy on identification of monument objects. In practice, interdisciplinary teams analyze the proclamation and determine the objects, usually as part of a land use planning process or in advance of an analysis under NEPA.

The text of Presidential Proclamations 6920, 9682, and 10286 describe numerous objects and supporting information about the values and opportunities in GSENM.

5.20.4 Scenic Routes

Current Conditions

National Scenic Byways

The National Scenic Byways Program is part of the US Department of Transportation, Federal Highway Administration. The program was developed to help recognize, preserve, and enhance selected roads throughout the US by designating certain roads as National Scenic Byways or All-American Roads based on their intrinsic qualities (archaeological, cultural, historical, natural, recreational, and scenic). To be designated a National Scenic Byway, a road must possess characteristics of regional significance within at least one of the intrinsic qualities. All-American Roads must possess characteristics of national significance in at least two of the intrinsic qualities. An All-American Road, State Route 12 (SR-12), occurs within the decision area, and is a 124-mile scenic byway. Scenic Byway SR-12 is one of only 39 All-American Roads in the United States, and the only All-American Road in Utah.

No roads designated as National Scenic Byways are present in the decision area. The following routes are State-designated routes that the BLM helps maintain as they cross through GSENM (**Figure 5-38, Appendix B**).

All-American Road – SR-12

From US 89 south of Panguitch, SR-12 winds east through some of the most varied scenery in Utah. Beginning in Red Canyon, SR-12 traverses through the northern portion of Bryce Canyon National Park and Dixie National Forest; past Kodachrome Basin State Park; crossing over aspen-covered Boulder Mountain; and ending in Torrey, just 5 miles west of Capitol Reef National Park. Throughout its length, SR-12 passes within the decision area several times. In addition, the byway's scenic viewshed includes BLM-managed lands away from the roadway.

Mormon Pioneer National Heritage Area (Boulder Loop and Under the Rim Districts)

Congress established the Mormon Pioneer National Heritage Area in 2006 to preserve "the rich heritage and tremendous achievements of the Mormon Pioneers." In 2010, a management plan was finalized and has been used to fund restoration and revitalization projects in the heritage area. The Boulder Loop is one of five districts in the National Heritage Area; it follows SR-12 in the GSENM area.

Utah Scenic Backways

State Scenic Backways have been designated by office State declaration for their scenic, historical, and recreational qualities but are roads that do not generally meet federal safety standards for safe year-round travel by passenger cars. Backways often require four-wheel-drive vehicles, and road conditions can vary due to season and weather. There are seven Utah Scenic Backways in the decision area, which are discussed below (**Figure 5-38, Appendix B**):

Burr Trail Road

The Burr Trail is one of the most picturesque drives in Utah. Paved and graded, this gravel and dirt road extends from Boulder to Bullfrog Marina passing through GSENM for approximately 30 miles before crossing into Capitol Reef National Park and then into Glen Canyon. Burr Trail Road also connects with Notom Road in the Waterpocket Fold backcountry of Capitol Reef National Park.

Posey Lake Road

This 40-mile backway heads north out of Escalante and climbs Escalante Mountain in Dixie National Forest. It provides access to Posey Lake and Campground as well as many forest roads ideal for exploring by an OHV or mountain bike.

Cottonwood Canyon Road

The 47-mile Cottonwood Canyon Road connects the All-American Road SR-12 north of GSENM with US 89 south of GSENM. It passes Kodachrome Basin State Park and offers numerous opportunities to explore GSENM, ranging from short hikes to backpacking excursions. Popular destinations include Cottonwood Narrows and Grosvenor Arch.

Johnson Canyon/Alton Road

This 32-mile scenic route in south-central Utah begins 9 miles east of Kanab on US 89 and heads north, rejoining US 89 at Glendale, Utah. An alternate route extends north to Alton, Utah, 9 miles north of Glendale. The backway travels through much of the eastern part of the decision area, forming a portion of the boundary with GSENM.

Hole-in-the-Rock Road

This route is a 62-mile drive one way and follows the general route of the pioneer Hole-in-the-Rock Expedition to search for a route across the river (what is now Lake Powell). The last approximately 5 miles are within the boundaries of Glen Canyon. Devils Garden, Dance Hall Rock, and Dry Fork Slot Canyons are popular day-use destinations along this route. It also provides access to many popular overnight routes in the Escalante Canyons.

Paria River Valley Road

This short track descends from the junction with US 89 (milepost 31) into a valley with the remains of the Paria ghost town and the site of a 1930s movie set; both are surrounded by colorful rocks. The road is 6 miles long and becomes steep and twisting near the end, as it crosses the undulating banded hills that cover this area. The cliffs at either side are equally layered and multicolored, with alternating red, white, purple, and grayish-blue strata; they are part of the Petrified Forest Member of the Chinle Formation.

Smoky Mountain Road

This backway winds for 78 remote miles connecting SR-12 and US 89. It offers unparalleled views of Navajo Mountain and the Kaiparowits Plateau as it passes through stretches of GSENM. Travelers along the backway can occasionally see smoke smoldering from 100-year-old coal fires deep beneath the aptly named Smoky Mountain.

BLM Back Country Byways

The BLM developed its Back Country Byway Program to complement the National Scenic Byway Program. These byways highlight the spectacular nature of the Western landscapes. Back Country Byways vary from narrow, graded roads, passable only during a few months of the year, to two-lane paved highways providing year-round access. There are no BLM Back Country Byways or backways in the planning area.

Trends

Travel along scenic routes has increased in the last 20 years, dramatically so along certain routes like Hole in the Rock Road. During that same time, the development of new or the improvement of existing recreational infrastructure along most scenic routes has occurred. The non-paved scenic routes are being travelled by an increasing mix of vehicle types (for example, such as, cars, trucks, 4x4s, camper vans, UTVs, etc.). Additionally, climate change effects, such as increased flooding events and impacts to biodiversity, are being felt throughout the routes and their viewsheds.

Forecasts

Existing scenic route designations are forecast to remain. Travel is forecast to increase along all scenic routes in correlation with tourism and recreational visitation increase in the area. More recreational infrastructure is forecast to be developed along most of the scenic routes. The wide mix of vehicle types using scenic routes is forecast to continue.

5.20.5 Wild and Scenic Rivers

WSRs are streams or segments of streams designated by Congress under the authority of the Wild and Scenic Rivers Act of 1968 (PL 90-542, as amended; 16 USC 1271–1287) for the purpose of preserving the stream or stream section in its free-flowing condition, preserving water quality, and protecting its outstandingly remarkable values. Outstandingly remarkable values are identified on a segment-specific basis and may include scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values. Section 5(d)(1) of the Wild and Scenic Rivers Act directs federal agencies to consider potential WSRs through their land use planning process.

During planning efforts, the BLM reviews all streams within its jurisdiction and evaluates their eligibility, suitability, and tentative classification. The three types of tentative classification are wild, scenic, and recreational. The tentative classification is based on the degree of human development currently along an eligible river and is used as a guide for future management activities.

Current Conditions

Beginning in 1994, BLM interdisciplinary teams gathered information regarding all river segments and watersheds in the Escalante and Kanab resource areas. In cooperation with the adjacent federal agencies, the study area was expanded during the development of the 2000 MMP to include river segments that extended into Dixie National Forest, Bryce Canyon National Park, and Glen Canyon. That way, the entire watersheds were evaluated. Eligible river segments are described in the 2000 Wild and Scenic Eligibility Findings and the GSENM Final EIS, Appendix 4 (BLM 2000).

All streams determined eligible were then assessed for suitability in the 2000 MMP. In total, approximately 230.5 miles of the Escalante and Paria River systems within the decision area were deemed suitable for inclusion in the National Wild and Scenic Rivers System. The BLM is managing these river corridors (0.25 miles above the mean high-water mark on either side of the river) to prevent degradation of the identified outstandingly remarkable values and the tentative classification assigned to each segment (BLM 2000, Appendix 4). Suitable river segments are identified in Table 5-62 and **Figure 5-39, Appendix B**.

Table 5-62
Suitable River Segments (Miles)

Suitable Wild and Scenic River Segments	Tentative Classification	Total
Calf Creek	Wild	3.5
Calf Creek	Scenic	3.0
Calf Creek	Recreational	1.5
Coyote Gulch #2	Wild	0.7
Death Hollow Creek	Wild	9.9
Deer Canyon Creek	Wild	5.2
Escalante River	Wild	32.9
Escalante River	Recreational	0.3
Hackberry Creek	Wild	20.1
Hackberry Creek	Recreational	1.6
Harris Wash	Wild	1.1
Hogeye Creek	Wild	6.3
Kitchen Canyon	Wild	1.3
Lower Boulder Creek	Wild	13.5
Lower Deer Creek	Wild	7.0
Lower Deer Creek	Recreational	2.0
Lower Paria River-1	Recreational	3.3
Lower Sand Creek	Wild	10.6
Mamie Creek and West Tributary	Wild	9.2
Upper Paria River-1	Wild	21.7
Upper Paria River-2	Recreational	14.4
Scorpion Gulch	Wild	0.8
Sheep Creek	Wild	1.5
Slickrock Canyon	Wild	2.8
Snake Creek	Wild	4.7
Starlight Canyon	Wild	4.9
Steep Creek	Wild	6.4
The Gulch	Wild	24.0
The Gulch	Recreational	0.6
Twentyfive Mile Wash #2	Wild	6.8
Willow Patch Creek	Wild	2.6
	Total	**224.1**

Source: BLM GIS 2022

Trends

The outstandingly remarkable values identified in the suitable river segments include scenic, recreational, historical, cultural, geological, fish, wildlife, and paleontological. Increased visitation and damage from overuse and improper use within the river segments and corridors can affect all values. Climate change impacts can affect values across the river, including viewsheds, fish and wildlife habitat, vegetation, and recreation opportunities.

Forecasts

Suitable WSRs are likely to remain the same, pending congressional action.

5.20.6 Wilderness Study Areas

With the passage of the FLPMA in 1976, Congress directed the BLM to inventory, study, and recommend which public lands under its administration should be designated as wilderness. The Utah Statewide Wilderness Study Report, published in October 1991 (BLM 1991), reported the results of the study in Utah and made recommendations to Congress about which areas should be designated as wilderness. The final recommendations for wilderness designation were forwarded to Congress on June 22, 1992. Congress has not yet acted on the recommendations.

Section 603(c) of the FLPMA provides direction to the BLM on the management of WSAs. It states that, with some exceptions, "the Secretary shall continue to manage such lands according to his authority under this Act and other applicable law in a manner so as not to impair the suitability of such areas for preservation as wilderness." This language is referred to as the "non-impairment" mandate. ISAs are natural areas that existed at the passage of the FLPMA and were identified under the FLPMA for accelerated wilderness review. They are managed the same way as WSAs.

Current Conditions

Sixteen WSAs and ISAs were identified in the decision area (**Figure 5-40, Appendix B**). A description of wilderness characteristics and other resource values and uses found in each WSA and ISA can be found in the Utah Statewide Wilderness Study Report (BLM 1991). These 16 WSAs and ISAs account for approximately 881,100 acres (47 percent) of the decision area Table 5-63 provides a breakdown of each WSA and ISA and their acreages in GSENM.

Table 5-63
Wilderness Study Areas and Instant Study Areas

WSA/ISA Name	Total
Burning Hills WSA	62,500
Carcass Canyon WSA	47,400
Death Ridge WSA	62,400
Devils Garden ISA	600
Escalante Canyons Tracts ISA	1,200
Fiftymile Mountain WSA	148,500
Mud Spring Canyon WSA	38,200
North Escalante Canyons Tracts 1, 5/The Gulch ISA	119,800
Paria/Hackberry	136,800
Paria/Hackberry 202 WSA	400
Paria/Hackberry 202 WSA	400
Phipps-Death Hollow ISA	42,700
Scorpion WSA	36,000
Steep Creek WSA	22,000
The Blues WSA	18,800
The Cockscomb WSA	9,900
Wahweap WSA	133,900
Total	**881,100**

Source: BLM GIS 2022

Pursuant to the BLM's non-impairment standard, the BLM manages WSAs to prevent impairment of the suitability of such areas for preservation as wilderness, until Congress passes legislation to either

designate them as part of the National Wilderness Preservation System or release them from further study or protection. Activities permissible within WSAs include temporary uses that create no new surface disturbance and do not involve permanent placement of structures. Temporary, non-disturbing activities, as well as valid existing rights or activities that meet the exception to the non-impairment standard (described in Section 1.6.C.2 of BLM Manual 6330; BLM 2012d), may generally continue in WSAs.

Most WSAs in the decision area also contain inholdings that were formerly managed by the School and Institutional Trust Lands Administration and have since been acquired by the BLM. The Utah Schools and Lands Exchange Act of 1998 involves lands acquired and managed by GSENM. Because this was a legislative exchange, the FLPMA land exchange regulations at 43 CFR 2200.0-6(f) and (g) and 43 CFR 2201.9(b) do not apply. In addition, none of the lands acquired through the Utah Schools and Lands Exchange Act of 1998 fit any of the categories of land to which the *Utah v. Norton* settlement does not apply as provided in IM No. 2003-275 – Change 1[13]. Although the Utah Schools and Lands Exchange Act of 1998 ratified an agreement between the Secretary of the Interior and the governor to exchange lands, both the agreement and the act itself are silent regarding how lands acquired by the BLM within existing WSAs are to be managed. Therefore, none of the lands acquired by the United States through the Utah Schools and Lands Exchange Act of 1998 are WSAs or managed as WSAs.

Trends

Visitation to GSENM has steadily increased since the successful 2013 Mighty Five tourism campaign, which highlighted five national parks surrounding GSENM. With visitation numbers increasing, threats to WSAs and ISAs include improper OHV usage, illegal incursions into the WSAs and ISAs, and graffiti defacing WSA and ISA features.

Forecasts

WSAs are likely to remain the same, pending congressional action.

5.21 WILD HORSES

5.21.1 Current Conditions

There are two wild horse herd areas in GSENM: the Moody-Wagon Box Mesa Herd Area (71,500 acres) and the Harvey's Fear Herd Area (18,100 acres) (**Figure 5-41, Appendix B**). Neither is designated as a herd management area, and the BLM has not set appropriate management levels. Wild horses are not managed in herd areas; therefore, the appropriate management level in each area is zero.

The Moody-Wagon Box Mesa Herd Area is in the northeastern portion of GSENM, the Harvey's Fear Herd Area is in the southeastern portion of GSENM. There are currently no wild horses in the Moody-Wagon Box Mesa Herd Area. The Harvey's Fear Herd Area contains a small population (10–25 head) of isolated wild horses since the passage of the Wild Horse and Burro Act in 1971. The small population and remote nature prevents the herd from exposure to other horses and reduces genetic variability in the herd. Due to the extreme remoteness of the herd area, no wild horses have been gathered and removed since the passage of the Wild Horse and Burro Act in 1971. This population is kept in check by

[13]IM No. 2003-275 – Change 1 refers to the IM providing guidance regarding the consideration of wilderness characteristics in the land use planning process. It set forth policy to comply with *Utah v. Norton* and applied the terms Bureau-wide, excluding Alaska.

predators, natural death loss, and limited resources. No management action or change is recommended for the herd area at this time.

5.21.2 Forecasts

No change in the current condition or trends is anticipated for the life of the RMP. No wild horse gathers are planned for the existing wild horse herd. However, surveys of the existing horses would provide useful data and updated estimates of wild horse populations to inform future BLM decisions for herd management, including objectives to manage wild horse populations toward natural ecological balance, if needed.

Chapter 6. Issues and Analytical Framework

This chapter of the AMS outlines the planning criteria associated with the development of the GSENM RMP/EIS. Section 6.1 describes preliminary management concerns which serve as part of the foundation of the analytical framework outlined in Section 6.2.

6.1 PRELIMINARY MANAGEMENT CONCERNS

At this early phase of the planning effort, the BLM has identified preliminary management concerns that will support development of a range of alternatives. Management concerns involve a resource management activity and/or land use. An integrated management approach will be used to address interactions of different resources and supports development of integrated management objectives. Most of these concerns are long-standing and reflect aspects of both agency and stakeholder perspectives. These concerns, in various forms, have arisen in the planning efforts that resulted in both the 2000 MMP and 2020 RMP. The preliminary management concerns below are grouped into broad and overarching topics but are not exhaustive and may not address specific concerns that could be included in the plan.

The management concerns below were developed to align with Presidential Proclamation 10286, various BLM guidance, and management challenges of GSENM since its inception in 1996. Identification of the following management concerns ensures that the RMP is tailored to the associated issues identified by the BLM through public and agency participation, and will evolve based on additional data, ongoing internal scoping, and public engagement.

1. **Climate Change:** GSENM's large landscape, diverse resources, and objects and values may have potential to be affected by climate change and to affect climate change.

    - Broadly, how would the BLM management address effects of climate change on GSENM objects and values?
    - What management is necessary to ensure landscape resiliency in the face of prolonged and intensifying drought conditions and climate change? Specifically, how can climate change, drought, and novel weather patterns be accounted for in landscape-level planning?
    - How might RMP-level decisions affect project-level planning, which may interplay with natural events such as wildfire and flooding?
    - How might climate variability impact the land-based livelihoods (for example, livestock grazing) and traditional subsistence practices, if any, within the planning area?

2. **Cultural Resource Management, Native American Religious Concerns, and Tribal Use:**

    - How should the area's cultural resources and traditional cultural properties be protected and restored, while still allowing for appropriate information/education efforts?

- What management measures are needed to ensure Tribal Nations retain continued traditional use of sacred sites and/or properties of traditional religious or cultural importance?

3. **Environmental Justice, and Social and Economic Values:** Communities in the planning area might be affected by public land management decisions. Many management concerns relate to environmental justice and social and economic values. (See, for example, 11. Paleontological Resources and Geology, 12. Rangeland Health and Livestock Grazing Management, and 13. Recreation Use and Visitor Services, below.)

    - What management considerations might meaningfully affect Tribal Nations, low income, or minority populations?
    - What economic values are substantially tied to specific resource management decisions (for example, recreation tourism and grazing management)?

4. **Wildfire and Fuels Management , and Forestry and Woodland Products:** Management of healthy rangelands and woodlands has many indirect effects on other resources and values (for example, wildlife habitat and personal woodlands use). Currently, due to past management efforts that included fire suppression, there are artificially high fuel loads across broad, remote landscapes. Within the context of GSENM's management objectives per Proclamation 10286 and 6920, 6-2his poses unique management challenges in terms of methods that could be used to address high fuel loads and fuel load and wildfire outcomes, including the potential for establishment or spread of noxious and invasive species. Management of human safety during wildfire response and/or treatments is also an important consideration.

    - How can wildfire management techniques be matched to conditions and locations to best protect ecosystem function and resilience, and to provide for human safety?
    - What role should active fuels management play to address fuel loads and wildfire management?
    - What is the appropriate use of woodlands (e.g., personal firewood collection) and how can the use be managed to support fuels management and protect, restore, and/or increase resiliency of GSENM objects and values?

5. **History, Historical Resources, and Sense of Place:** In addition to traditional use of GSENM by Tribal Nations and their ancestors, GSENM has a rich history of human habitation since European settlements.

    - What level of management should the BLM apply to protect, restore, and increase resiliency of historical resources from the time period since the arrival of European settlers?
    - To what extent should the BLM seek to enhance the condition of historical properties as opposed to maintaining their current condition?
    - What factors relate to "sense of place" (both natural and human-made), and what management decisions should be made to preserve, interpret, or display them?

- How will the Old Spanish National Historic Trail be managed to further the protection, restoration, and increased resiliency of GSENM objects?

6. **Hydrology** (**Groundwater, Surface Water, Wetlands, Riparian Areas, Floodplains, and Water Quality):** Proper and resilient hydrologic function is foundational to biological resources and other resources with a nexus to hydrology (for example, visual resources and scenery, wildlife, and recreational uses such as hunting and backpacking). Similarly, water quality, especially in in water bodies with potential risks (e.g., areas of high recreation and/or livestock use, or water bodies with important fisheries), is important to the protection, restoration, and increased resiliency of GSENM objects and values.

    - Where should the BLM seek to acquire new water rights following Utah State water law and assert claims for federally reserved (PWR 107) as necessary to protect water-dependent objects and values?
    - management is needed to ensure proper hydrologic functions, processes, and resilience of springs, riparian areas, subsurface flows, and floodplains, etc.?
    - What types of management approaches should be place to ensure that GSENM objects and values are property supported by functioning and resilient hydrological resources?
    - How will water quality (and water quality standards set by the State of Utah) and protection of resources be ensured by GSENM's management?

7. **Lands and Realty:** Per BLM policy, the RMP will review and identify all lands and interests in lands for retention, disposal, and acquisition, as well as for the management and consideration of ROWs. Some specific questions include:

    - Will all lands be retained in public ownership, or will any lands be considered for disposal?
    - How should private inholdings be addressed?
    - What criteria or guidelines are needed to identify access priorities and address public access-related needs?
    - What areas in GSENM should be designated as ROW open, exclusion, and avoidance areas?
    - What management decisions are needed regarding valid existing rights, including those related to previously acquired parcels.?

8. **Landscape Characteristics including Visual Resources, Scenery, Dark Night Skies, Natural Soundscapes, and Air Quality:** The large, remote, isolated, and rugged or primitive character of GSENM's landscape and its associated objects and values is foundational to its designation. Qualities such as soundscapes and air quality are integral parts of the landscape itself.

    - To what extent should the BLM provide specific management to maintain, restore, or improve resource conditions related to values such as remoteness, solitude, and primitive character?

- What are the characteristics of this remote and rugged landscape itself that should be explicitly managed (for example, natural soundscapes and air quality)?
- What parameters and thresholds should be used relative to the landscape characteristics listed in this subsection, to ensure retention of (and avoid incremental degradation to) GSENM's character. In other words, how will visual resources, scenery, dark night skies, natural soundscapes, and air quality be managed?

9. **Minerals:** The original 1996 designation withdrew GSENM from operation of the mining law, subject to valid existing rights. In the time between Proclamation 9681 and Proclamation 10286, portions of the current GSENM were open to mineral entry. During this period, 10 to 15 mining claims for alabaster were located, and the BLM received two Plans of Operation for potential alabaster mining operations. Forty-seven mining claims for cobalt were also located during the period between Proclamations 9682 and 10286, but the BLM has not received any proposals to conduct operations on these mining claims. Proclamation 10286 subsequently restored these lands to GSENM and withdrew them from location, entry, and patent under the mining laws, subject to valid existing rights. In National Monuments, any proposed operations, regardless of type or extent, must be submitted as a plan of operations, pursuant to 43 CFR 3809.11©(7). Prior to processing a plan of operations and conducting the associated NEPA analysis, the BLM will require a validity examination and prepare a mineral examination report to determine whether the mining claim was valid as of the date of withdrawal and whether it remains valid (i.e., a validity exam; 43 CFR 3809.100(a)). BLM will proceed with processing a plan of operations on withdrawn lands only if it determines that the mining claims are valid. In addition to locatable minerals, there is a pending hydrocarbon lease application for tar sands, as well as seven production wells and two injection wells in GSENM, southwest of the Town of Escalante, associated with active oil and gas leases in the Upper Valley Oil Field. Finally, the abandoned Montezuma Mine is located in Johnson Canyon. Risk of collapse or subsidence is lower than in entirely human-made mines and the mine does not have many of the typical abandoned mine land issues such as toxic tailings piles or acid mine drainage.

    - How will BLM ensure that any mining operations pursuant to valid existing rights (after approval of a plan of operations and compliance with NEPA) prevent unnecessary or undue degradation?
    - What considerations are needed related to the valid existing oil and gas rights?
    - How will environmental investigation and cleanup of Montezuma Mine be accomplished?

10. **Noxious Weeds and Invasive Nonnative Plants:** Management of noxious and invasive vegetation is central to ecosystem health, with effects on many resources. GSENM addresses noxious weeds and invasive plants in accordance with noxious weed and invasive plant management decisions made following a 2015 programmatic analysis (BLM 2015).

    - How should GSENM inventory and monitor noxious and invasive vegetation?
    - What treatment types should be used to reduce both the introduction and spread of noxious and invasive species and disease?
    - What criteria (for example, location, geographic scale, and land designations) should be used to determine treatment types?

- What factors should be considering when designing treatments to ensure the protection, restoration, and/or increased resiliency of GSENM objects and values?
- How should the BLM manage Russian olive, tamarisk, and other large, woody invasives to maintain or repair hydrologic function? (See 6. Hydrology [Groundwater, Surface Water, Wetlands, Riparian Areas, Floodplains, and Water Quality].)

11. Paleontological Resources and Geology: GSENM contains exceptional paleontological resources, with ongoing related science that involves excavations and discoveries.

- How should paleontological resources be protected, curated, and otherwise managed and transacted?
- How can the BLM provide opportunities for research, consistent with the protection of objects and values, as part of promoting the landscape as a living laboratory?

12. Rangeland Health and Livestock Grazing Management: Since the original proclamation in 1996, there has been a high level of controversy related to rangeland and grazing management. The 2000 MMP (pp. 40–43) outlines the mandates and direction for subsequent grazing management planning, but it defers planning to a separate NEPA review process. Several internally developed EISs were attempted in the early 2000s; however, these were not completed due to controversy and procedural difficulties. Subsequently, a contractor was engaged for a grazing EIS plan amendment (to the 2000 MMP), but this process was ultimately set aside. The most recent land use plan process, resulting in the two 2020 RMPs that cover the lands under the 1996 monument proclamation, addressed some grazing management concerns.

Proclamation 10286 states the "Secretary shall manage livestock grazing as authorized under existing permits and leases…" subject to "appropriate terms and conditions in accordance with existing laws and regulations consistent with the care and management of the objects identified [in Proclamation 10286] and in Proclamation 6920…". Additionally, it provides the following: "Should grazing permits or leases be voluntarily relinquished by existing holders, the Secretary shall retire from livestock grazing the lands covered by such permits or leases…" and forage will not be reallocated for livestock grazing unless it advances the purposes of GSENM.

In addition to general provisions for rangeland health and grazing management, the following will be addressed:

- How will the BLM manage retirement of grazing permits and leases, as provided for under Proclamation 10286?
- Should supplementary adaptive management tools for rangeland health and grazing management be adopted under drought conditions?
- How will the BLM address climate change and seasonal drought effects on long-term vegetation community changes and forage?
- How will the BLM manage existing and new range improvements?

13. Recreation Use and Visitor Services: Appropriate management of recreational use is a central concern the RMP must address. Continual and substantial increases in recreational use, mostly related to travel tourism throughout southern Utah (including GSENM and proximate

USFS and NPS parks), pose challenges that cannot be addressed by simple dispersal of visitors. Increases in visitation potentially degrade the quality of the visitor experience and heighten demand for 1) developed facilities (for example, campgrounds and trailheads) within the context of proclamation directives related to preserving a largely undeveloped landscape and fundamental GSENM objects and values (for example, soundscapes, dark night skies, and solitude), 2) balanced management (for example, use quotas, designated backcountry use areas and campsites, and signage), and 3) opportunities for primitive recreation.

Past land use planning for GSENM consigned step-down planning (for example, SRMA and ERMA plans) and associated implementation to future (post-RMP decision) NEPA reviews. Due to complex recreation management challenges, lack of associated BLM staff, and political controversy related to planning in GSENM, such step-down recreation planning and implementation has never occurred. More detailed sidebars for recreation management are needed within the RMP to serve efficient creation of SRMA, ERMA, and similar plans.

There are substantial challenges in finding a balance between proclamation objectives and rapidly rising visitation levels. Therefore, the following will be addressed:.

- How can the RMP provide the most breadth and depth for recreation and visitor services management direction?
- How will SRMAs, ERMAs, and other recreational use designations (for example, zones) be considered as tools to help balance trade-offs between recreational use demand, visitor experience, and GSENM purposes?
- How should SRPs be managed given increasing recreational use in GSENM?

14. Science: Proclamations 6920 and 10286 establish that GSENM's main purpose is to serve as a valuable outdoor science laboratory for the study of diverse scientific and historical subjects and resources. However, clarification and optimization of this purpose is needed.

- How can basic and applied science research be supported using guidelines on balancing trade-offs between resource protection, project-level proposals, and GSENM purposes?
- How and when should applied science be used as a tool to optimize resource management and protect GSENM objects and values?
- How much of the need for use of applied science should be in the RMP versus a monument science plan (for example, for informing vegetation restoration, recreation management, and livestock grazing administration)? Specific needs may vary over short periods, and a mechanism may be needed for updating needs within a monument science plan.
- How will the RMP ensure meaningful and proper use of GSENM for basic and applied science?
- How should the RMP provide for reasonable access (procedurally and on the ground) for scientific study of remote landscapes in GSENM, including consideration of factors such as permitting, travel routes, and human safety?

- How will timely preparation of a monument science plan be ensured?
  - What content, beyond that required in NLCS science plans, should be included in a GSENM science plan?
  - How will the RMP adequately provide management direction for a monument science program if a monument science plan is not in place?

15. Soils and Biological Soil Crusts: Biological soil crusts have been a resource of interest to stakeholders since the first monument proclamation in 1996. Although there are no known points of dispute regarding management of this resource, it is a fragile resource and will warrant clear consideration in the planning process.

- What parameters should be used to ensure proper consideration of biological soil crusts in subsequent project-level planning?
- Should areas of relic biological soil crusts be identified for special management?

16. Special Land Designations for Conservation and Protection: The planning area has a history of controversy around conservation and protection designations. The entirety of GSENM is within the NLCS.

- Area of critical environmental concern (ACEC): No ACEC designations were made in either the 2000 MMP or the 2020 GSENM RMP, because it was determined that the protections provided by the national monument designation, as part of the NLCS, were sufficient protection. In recent planning that resulted in the 2020 RMPs for GSENM and KEPA lands, stakeholders had a high level of interest regarding ACEC designations and made nominations. Nominations will be considered and designated based on guidance in BLM Manual 1613.
  - What areas have relevant and important values that might need special management attention for their protection?
- National Scenic and Historic Trails (NSHT) System: NSHTs are congressionally designated. The BLM has guidelines for inventory, assessment, and monitoring of such existing and potential trails. Currently, the Old Spanish National Historic Trail is the only trail in GSENM with such a designation. However, GSENM contains other travel ways and trails with noteworthy historical associations. (See 5. History, Historical Resources, and Sense of Place, above.)
- Research natural area (RNA): RNAs are established and maintained for the primary purpose of research and education, because of one or more of the following characteristics: 1) A typical representation of a common plant or animal association, 2) An unusual plant or animal association, 3) A threatened or endangered plant or animal species, 4) A typical representation of common geological, soil, or water features, or 5) Outstanding or unusual geological, soil, or water features. GSENM's primary purposes are science-related, so consideration of RNAs will be part of the planning process.
  - What areas are appropriate for research and education as a primary purpose? Was management is needed to ensure the areas are protected for that purpose?
- Outstanding natural area (ONA): ONAs are protected areas within the NLCS. GSENM contains various ONAs, including the Gulch, Devil's Garden, North-Escalante Canyon,

and Phipps-Death Hollow, which were established through congressional designation in 1970.

  - How will the BLM ensure protection of the ONA while accommodating recreation?

- Wild and scenic river (WSR): WSRs are managed to protect and enhance rivers' values, including free-flow, water quality, and outstandingly remarkable values. GSENM contains approximately 250 miles of suitable rivers, and segments of rivers that are eligible and suitable to be managed as WSRs.
  - How can WSR values be protected while accommodating uses in GSENM that may incur some adverse effects on waterways (for example, grazing, heavy recreational use, existing rights, and inholdings)?
  - How will rivers' values (that is, free-flow, water quality, and outstandingly remarkable values) be enhanced and protected?
- Wilderness study area: WSAs play a key role in the BLM's task to protect potential wilderness values by maintaining non-impairment standards until Congress determines the permanent status of these lands. GSENM contains 16 WSAs, totaling approximately 882,000 acres. These WSAs were identified in a 1978–1980 inventory as having wilderness characteristics and worthy of further study to determine their suitability for designation as part of the National Wilderness Preservation System. (See 7. Lands and Realty, above, for a discussion about acquired SITLA lands within WSAs.)
  - What factors (for example routine recreational use and vegetation management) affect the wilderness characteristics of WSAs?
  - How would adverse effects on WSAs be limited? For example, should management of recreational use include creating more managed access (for example, new trails) or more controlled access (for example, use quotas)?
- Lands with wilderness characteristics: Lands with wilderness characteristics are not part of the NLCS, nor are they considered a special land designation. However, the BLM has identified nearly 560,000 acres of lands with wilderness characteristics outside of WSAs. In addition, approximately 54,400 acres of former SITLA parcels are surrounded by WSAs but are not managed as part of the surrounding WSA.
  - What consideration needs to be given to management of lands with wilderness characteristics?

17. Terrestrial Habitat, and Vegetation Resilience and Conservation (Large-scale and Local Ecotypes): Vegetation and habitat management affects other resources, including wildlife, noxious and invasive vegetation management, rangeland management, recreational uses, and more. Consideration will be given to general vegetation, federal- and state-listed species, and Natural Heritage Program plants and plant communities.

- What management is necessary to maintain and improve diverse terrestrial habitats?
- What role should vegetation management play to preserve ecosystems previously maintained through periodic burning and other natural or human-caused events (for example, Native American burning and introduction of nonnative species)?

- What management of climate refugia, relic plant communities, and habitats and vegetation will optimize GSENM lands for 1) resilience to environmental change and challenges (for example, drought) and 2) meaningful science in both times of climatic change and stasis?
- What management is needed to reduce potential for noxious and invasive species proliferation? (See 10. Noxious Weeds and Invasive Nonnative Plants.)
- How will the BLM decisions and policies ensure management protection of water resources (for example, through RMP management actions, proposal-specific monitoring, and BLM participation in planning by adjacent jurisdictions and Utah Division of Water Quality)? (Water rights are commonly related to water-related decisions for livestock grazing and wildlife management.)

18. **Travel, Transportation, and Access Management:** Since the first proclamation in 1996, stakeholder positions on travel management have spanned the spectrum, from those advocating for closures to those advocating for more or continued access. Current route designations were established in the 2000 MMP, and several additional open routes were designated in the 2020 RMP. GSENM contains scenic byways and backways, as well as potential for future designations.

    - The 2020 GSENM RMPs designated two routes as open, although BLM guidance is to keep travel management planning separate from RMP processes. Special permission was granted by the Office of the Secretary of the Interior to make these implementation-level decisions. Proclamation 6920 is not specific about travel management route designations, but it does emphasize retention of an undeveloped landscape, and the 2000 MMP based on this proclamation states that "Motorized access will also be limited. The Plan designates a road network, which will be left largely in its presently unimproved condition." Are these two route designations from the 2020 GSENM RMP in conformance with Proclamations 6920 and 10286?
    - Where should the BLM now apply closed motorized use area designations across the planning area? Are there any areas that are appropriate for cross-country OHV use?
    - How will the BLM manage areas along and in view of Scenic Byways 12 (the main paved corridor through GSENM) and 89 (which bisects the southern part of GSENM)? How will the BLM coordinate such management with the Utah Department of Transportation and other relevant state entities?
    - Should the BLM designate additional Scenic Byways in GSENM as part of the current RMP process?
    - How will the BLM manage off-road trespass and travel infractions?
    - Where and with what rationale will travel management areas be assigned for future travel management planning?
    - How will step-down travel management plans be developed? What criterion are needed within the travel management planning section of the RMP to adequately direct subsequent travel management plans?

19. **Wildlife and Fisheries:** Consideration of wildlife through habitat management (for example, management needed to restore; maintain; or enhance priority species, including

special status species and their habitats) poses challenges, because some stakeholders have historically opposed habitat modification, especially vegetation management. Such resistance has historically been tied to concern that 1) wildlife management might inappropriately alter or increase forage or water supplies for livestock, and 2) vegetation management (intended for wildlife habitat improvement) might adversely alter lands with wilderness characteristics, which await congressional determination for potential Wilderness designation.

Standard management directives for wildlife and fisheries are anticipated include issues such as: 1) general wildlife and fisheries, and 2) listed, unique, and special status species. The RMP, in conformance with current DOI and BLM direction, will consider and plan for wildlife and habitat connectivity corridors, including work with other jurisdictions; corridors were established without controversy in the 2020 RMP.

- What management is needed to properly conserve species?
- How should wildlife management be coordinated with vegetation management?
- How should wildlife management consider location, geographic scale, land designations, and other conditions?
- How will the BLM ensure that water resources for wildlife corridors are considered as part of the designation and selection process, including commitments for best ensuring sustainability? (See 6. Hydrology [Groundwater, Surface Water, Wetlands, Riparian Areas, Floodplains, Water Quality].)

20. Other: In addition to the above preliminary resource management concerns and associated issues, the following programs and resources will be analyzed in the RMP (BLM Land Use Planning Handbook 2005), to establish goals, objectives, and management actions. No controversy is anticipated:

- Renewable energy
- Wild horses

6.2 ANALYTICAL FRAMEWORK

6.2.1 Terrestrial Habitat, Vegetation Resilience and Conservation (Large-scale and Local Ecotypes)

How would existing and proposed land use allocation (such as livestock grazing, recreation, and lands and realty actions) and discretionary uses affect terrestrial vegetation, including special status plant species?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- Current drought trends will continue

Analysis Methodology and Techniques

- Qualitative discussion and/or modeling of relationships between soils, vegetation, climate, and discretionary uses

- Qualitative discussion and/or modeling of the effects of discretionary uses on vegetation metrics (for example, the variance of existing from desired vegetation, using ecological site groups and AIM data, in areas of certain discretionary uses)

Units of Measure

- Acres or miles of land use allocations in each alternative

Relevant Data and Information to Be Used

- Inventories and data related to the effects of discretionary uses on vegetation metrics
- Studies and metrics that correlate with 1) projections of use patterns and levels, and 2) the potential for development of additional infrastructure and facilities related to discretionary uses
- GSENM data, relevant studies related to vegetation management, ecological site groups, and existing climate modeling
- Acres of vegetation types (LANDFIRE existing vegetation types or ecological site groups, or both)
- LANDFIRE Vegetation Condition Classes across the decision area
- Acres by species of potential and occupied special status plant species in the decision area

Analytical Conclusions to Be Answered

- Discuss the interrelationships of a suite of vegetation-related resources in terms of broadscale vegetation management objectives; these vegetation-related resources will include vegetation, noxious weeds and invasive plants, soils, hydrology, fuels and fire, and woodlands and forestry.
- Qualitatively discuss how each alternative would affect conditions and trends in vegetation communities (including specials status species) in the decision area, including variations based on active or passive vegetation management approaches.
- Discuss the interplay and outcomes of vegetation management and restoration approaches based on each alternative's prescriptions for discretionary uses.

Analysis Display

- Table of acres or miles of land use allocations overlaid within different vegetation types and conditions in each alternative
- Mapping of ecological site groups and vegetation health trends overlaid with discretionary uses and use levels
- Mapping of natural and developed surface and groundwater presence and need related to 1) vegetation requirements versus climate projections, and 2) discretionary uses versus use projections in each alternative

How would vegetation management and restoration approaches affect landscape-scale ecological functioning, terrestrial vegetation, and special status plant species?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- Current drought trends will continue.

Analysis Methodology and Techniques

- Describe past management approaches and current vegetation conditions to make a preliminary assessment of successful restoration methods.
- Describe and compare short-term and long-term effects of management approaches (for example, the duration of benefit).
- Qualitatively describe potential effects of active and passive management approaches on both landscape and local scales.
- Compare types of vegetation management proposed under each alternative.

Units of Measure

- Acres of vegetation types and conditions
- Vegetation health and resiliency metrics
- Climate-related metrics

Relevant Data and Information to Be Used

- GSENM data, relevant studies related to vegetation management, ecological site groups, and existing climate modeling
- Acres of vegetation types (LANDFIRE existing vegetation types or ecological site groups, or both)
- LANDFIRE Vegetation Condition Classes across the decision area
- Types of vegetation restoration in each alternative
- Acres by species of potential and occupied special status plant species in the decision area

Analytical Conclusions to Be Answered

- Qualitatively discuss outcomes and projected trends for vegetation health, diversity, and resiliency for each alternative, with consideration of the projected success of restorations based on each alternative's countervailing aspects (for example, certain discretionary use patterns) and climate change.
- Qualitatively discuss how to assess the appropriateness of various approaches based on vegetation health, soil ESGs, and hydrological considerations.
- Provide major vegetation communities with a likely condition under each alternative with a brief qualitative summary. Briefly compare the likely condition of each major vegetation community under each alternative.
- Qualitatively discuss how each alternative would contribute to trends in the extent of different vegetation communities in the decision area.
- Qualitatively discuss key vegetation-related nexuses (for example, soils, vegetation types, and hydrologic conditions and functioning) and how they will inform management decisions.

Analysis Display

- Mapping of ESGs overlaid with 1) metrics describing vegetation and 2) past vegetation management approaches (both passive and active)
- Tables relating the types of vegetation management tools to applicability, function, and feasibility

6.2.2 Noxious Weeds and Invasive Nonnative Plants

How would land use allocations affect noxious and invasive nonnative plants?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- Invasive plant species are more likely to become established and spread in areas where the ground surface has been recently disturbed.
- Invasive plant species tend to become established along developed roads, trails, and ROWs; at recreational destinations; at livestock developments; and in other congregation areas.

Analysis Methodology and Techniques

- Qualitatively discuss the effects of land uses on noxious and invasive plant species' establishment and spread.
- Compare which alternatives would have the greatest impacts on noxious and invasive plant species' establishment and spread based on acres or miles of land use allocations.

Units of Measure

- Acres of noxious and invasive plant species infestations
- Counts of noxious and invasive plant species observations
- Acres or miles of land use allocations by alternative

Relevant Data and Information to Be Used

- BLM corporate spatial data for noxious and invasive plant species
- BLM terrestrial AIM Strategy data for monitoring plots in the decision area

Analytical Conclusions to Be Answered

- Compare the likely impact of each alternative on the establishment and spread of invasive plant species. Draw conclusions about which alternatives would likely result in the greatest and least invasive plant species' establishment and spread in GSENM.

Analysis Display

No analysis display will be included.

How would proposed vegetation management affect noxious and invasive plants?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- Noxious and invasive plant species are more likely to become established and spread in areas where the ground surface has been recently disturbed.
- Natural (such as wind, water, and wildlife) and human (such as recreationists, motor vehicles, and livestock) sources will continue to introduce noxious and nonnative, invasive plant species to the decision and overall planning areas.
- Noxious and invasive plant species tend to become established along developed roads, trails, and rights-of-way; at recreational destinations; at livestock developments; and in other congregation areas. Fire and the lack of proper rehabilitation also contribute to weed spread.
- Cooperative noxious weed management would continue to be carried out with Kane and Garfield Counties in the Color Country Cooperative Weed Management Area.
- Vegetation management will include implementing BMPs to minimize noxious and invasive plant spread.
- Vegetation restorations will be monitored for the establishment and spread of noxious and invasive plant species, and control methods will be carried out, as needed.

Analysis Methodology and Techniques

- Assess the likely establishment and spread of invasive plants by alternative based on the estimated acres of ground disturbance and allowable treatment type by alternative.
- Describe the likely effectiveness of treatments (for example, herbicides or no herbicides) on controlling invasive plant species by alternative.

Units of Measure

- Acres of noxious and invasive plant species infestations
- Counts of noxious and invasive plant species observations
- Percentage of nonnative and noxious cover in monitoring plots

Relevant Data and Information to Be Used

- BLM corporate spatial data for noxious and invasive plant species
- BLM terrestrial AIM Strategy data for monitoring plots in the decision area
- Acres of disturbance by alternative
- Data and literature on the effectiveness of treating invasive plants with proposed treatment methods

Analytical Conclusions to Be Answered

- Compare the likely impact of each alternative on the spread and treatment of invasive plant species. Draw conclusions about which alternatives would likely result in the greatest and least invasive plant species spread in GSENM.

Analysis Display

- Table presenting AIM Strategy data in past vegetation management areas
- Table of disturbance acreage by alternative, if available

6.2.3 Soils and Biological Soils Crusts

How would proposed management affect biological soil crusts?

Geographic and Temporal Scale of Analysis

The analysis area for biological soil crusts covers the decision area and includes all land not covered by a waterbody or exposed bedrock, as soils are generally ubiquitous. The analysis includes current conditions (where current data are available) or more recent available data sets. The temporal scale of the analysis is the life of the RMP.

Relevant Assumptions

- Soils occur on all land within the decision area, except those covered by a body of water or exposed bedrock.

Analysis Methodology and Techniques

- Evaluate the changes to the management of activities and the trends in land use and qualitatively and quantitatively assess the level of potential impact on biological soil crusts to identify areas where protection or restoration is needed.

Units of Measure

- Acres and locations of biological soil crust types (throughout the decision area)
- Acres and locations of biological soil crusts currently impacted by or that are projected to be impacted by discretionary uses

Relevant Data and Information to Be Used

- Maps of biological soil crust types from BLM data sources
- Maps or reports of surface disturbance or land use activities and trends
- BLM AIM Strategy data for site-specific interpretations that have applicability across larger areas

Analytical Conclusions to Be Answered

- Locations of biological soil crusts and a specific delineation of areas in need of special attention for protection or restoration

Analysis Display

The display will include a map delineating areas of biological soil crust types and specific locations that require special attention, protection, or restoration. This will be supplemented with BLM AIM Strategy data to support a narrative regarding trends in biological soil crust conditions.

How would proposed management affect sensitive soils?

Geographic and Temporal Scale of Analysis

The analysis area for soils covers the decision area and includes all land not covered by a waterbody or exposed bedrock, as soils are generally ubiquitous. The analysis includes current conditions (where current data are available) or more recent available data sets. The temporal scale of the analysis is the life of the RMP.

Relevant Assumptions

- Soils occur on all land within the decision area, except those covered by a body of water or exposed bedrock.

Analysis Methodology and Techniques

- Evaluate the changes to the management of activities and the trends in land use to assess the level of potential impact qualitatively and quantitatively on sensitive soils.

Units of Measure

- Acres and locations of sensitive soil types throughout the decision area
- Acres and locations of sensitive soils currently impacted by or projected to be impacted by discretionary uses

Relevant Data and Information to Be Used

- Maps of soil types (including sensitive soil types such as biological soil crusts) derived from USDA NRCS Soil Survey Geographic Database data (Order 3 mapping) or from BLM data sources (such as ecological site groupings)
- Maps or reports of surface disturbance or land use activities and trends
- BLM AIM strategy data for site-specific interpretations that have applicability across larger areas

Analytical Conclusions to Be Answered

- Locations of sensitive soils and specific delineation of sensitive soil areas in need of special attention for protection or restoration

Analysis Display

The display will include a map delineating areas of sensitive soil types and specific locations that require special attention, protection, or restoration. This will be supplemented with BLM AIM Strategy data to support narrative regarding trends in sensitive soil conditions.

How would proposed management affect soil health and ecological function?

Geographic and Temporal Scale of Analysis

The analysis area for soils covers the decision area and includes all land not covered by a waterbody or exposed bedrock, as soils are generally ubiquitous. The analysis includes current conditions (where current data are available) or more recent available data sets. The temporal scale of the analysis is the life of the RMP.

Relevant Assumptions

- Soils occur on all land within the decision area, except those covered by a body of water or exposed bedrock.

Analysis Methodology and Techniques

- Evaluate how changes to data collection (including increased data collection) could be applied to better protect or improve management of soil resources.

- Qualitatively and quantitatively evaluate how protection of soil resources and restoration of soils could impact soil health and function.

Units of Measure

- Identify locations and acres where data collection changes could occur and what proposed data collection methods would be recommended for those areas.
- Evaluate semi-quantitatively the acres of impact and volume of soil resource impacts (if applicable) that could result from land use allocations or vegetation management.

Relevant Data and Information to Be Used

- Compilation of all existing data sets for soils, including location-specific information
- Maps of soil types (including biological soil crusts) derived from USDA NRCS Soil Survey Geographic Database data (Order 3 data) or from BLM data sources
- Map of areas of concern where protection or restoration may be needed
- Reports on efficacy of various management practices and actions, including restoration and protection

Analytical Conclusions to Be Answered

Identify the types and locations of 1) recommended changes to data collection (inventory and monitoring) and 2) land use allocations or vegetation management that would protect soil resources and improve soil health and function.

Analysis Display

- Description of inventory and monitoring practices and locations of where changes to inventory are most needed
- Maps of potential protection and restoration areas and outcomes of implementing those actions

6.2.4 Rangeland Health and Livestock Grazing Management

How would proposed management impact rangeland conditions, as well as livestock grazing and ranching operations under existing permits and leases?

Geographic and Temporal Scale of Analysis

The analysis area includes all BLM-managed livestock grazing allotments in the decision area, as well as those that overlap Glen Canyon, the BLM Kanab Field Office, and the BLM Arizona Strip Field Office. Two allotments that overlap the decision area are administered by the BLM Arizona Strip Field Office and will not be analyzed. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- There may be minor discrepancies between the actual acres of allotments in GSENM and the GIS layers. This because the GIS data were determined using GPS units with varying accuracy and also drawn on a computer screen with aerial imagery from a series of flights georeferenced slightly differently.
- Campground development, recreation site development, ROW development, and other development may make areas unsuitable for livestock grazing because this would reduce the areas where livestock are able to graze.

- After a prescribed burn or other treatments which remove a significant volume of vegetation, it may take up to two growing seasons to rehabilitate vegetation to a level that would be appropriate for grazing.

Analysis Methodology and Techniques

The analysis of the alternatives' effects on rangelands and livestock grazing are based on the following:

- Changes in forage availability
- Changes in rangeland capability
- Extent of vegetation management in GSENM
- Extent of land use allocations

Units of Measure

- Number and size (acres) of allotments that are administered by the BLM, including those that overlap another agency-managed surface
- Acres available and unavailable for grazing
- Total permitted AUMs
- Acres of land use allocations
- Acres of anticipated vegetation management

Relevant Data and Information to Be Used

- Types of discretionary uses proposed in each alternative
- Acres and miles of land use allocations in each alternative

Analytical Conclusions to Be Answered

- Analyze which alternatives would have the most or least potential impacts on livestock grazing operations.
- Analyze impacts on livestock operations from management decisions for other resource areas.
- Analyze impacts on rangeland health from vegetation management and livestock grazing.

Analysis Display

- Tables illustrating acres of proposed vegetation management and acres of land use allocations by alternative.

6.2.5 Recreational Use and Visitor Services

How would proposed management affect the BLM's ability to provide recreation opportunities and infrastructure while protecting GSENM objects of historical and scientific interest?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

- Trends in recreational demands, as indicated by visitor use, will continue.

- Changing access to BLM-administered lands may increase recreational demand in some areas, while decreasing demand in other areas by dispersing recreation throughout the decision area.

Analysis Methodology and Techniques

- Designation of recreation management areas: Quantitatively compare acres of recreation management areas to characterize recreation opportunities and types for the alternatives.
- Land use allocations and discretionary uses: Quantitatively and qualitatively compare disturbance acres to characterize impacts to recreation opportunities and access for the alternatives.
- Visitor health and safety: Qualitatively compare user conflicts for the alternatives.

Units of Measure

The analysis will examine recreation management areas under each alternative, as measured by acres and types of recreation. The analysis will also examine how acres of land use allocations and discretionary uses affect recreation and visitor services, by alternative.

Relevant Data and Information to Be Used

- GIS data of land use polygons for recreation management areas, including acres of existing areas and those areas proposed under each alternative
- Information on existing recreation opportunities within the planning area for recreation service providers other than the BLM
- Road and trail networks for areas where designated travel for recreation (such as OHV, ATV/UTV, and mountain bike) use is occurring

Analytical Conclusions to Be Answered

Alternatives will be compared, discussing the effects on recreation management areas, permits, and types of recreation that would result from implementing the alternatives' management actions and allowable uses.

Analysis Display

The analysis will be presented through tables and maps that show existing and proposed land use land use allocations for the areas listed above in *Relevant Data and Information to Be Used*.

6.2.6 Travel, Transportation, and Access Management

How would proposed management affect the travel and transportation system in GSENM?

Geographic and Temporal Scale of Analysis

The geographic scale of the analysis will be the decision area, and the temporal scale will be the life of the plan.

Relevant Assumptions

- Trends in demand for travel routes will continue, especially near communities.
- Changing the size and distribution of land use allocations for OHV use has a direct effect on OHV use patterns, which influence OHV use opportunities, public safety, and user conflicts.

- The BLM will determine the final travel management network of routes and trails at the implementation level. The current travel plan will remain in effect until updated implementation level travel planning occurs.

Analysis Methodology and Techniques

To demonstrate current conditions, the analysis will use GIS data for the acres of OHV area designations and miles of designated routes. Also, the acres of OHV area designations and miles of designated routes will provide a baseline for areas that could be affected by possible changes to land use allocations for OHV use.

Units of Measure

The analysis will examine travel designations under each alternative as measured by miles of routes and their designations and acres of OHV area designations.

Relevant Data and Information to Be Used

- Route and trail networks for areas where OHV use is limited to designated routes
- Miles of trail by difficulty level and authorized vehicle use
- Miles of routes by authorized vehicle or mechanized use, including highways and county routes

Analytical Conclusions to Be Answered

Alternatives will be compared with a discussion of the effects on OHV areas, transportation, and access that would result from implementing management actions and allowable uses to meet resource and resource use objectives for the various programs.

Analysis Display

The analysis will use tables and maps that show existing and proposed route designations and existing and proposed OHV area designations.

6.2.7 Cultural Resources Management, Native American Religious Concerns, and Tribal Use

How will proposed management ensure continued traditional uses of religious or cultural importance to Tribal Nations and local communities?

Geographic and Temporal Scale of Analysis

The geographic scale for the analysis of impacts on traditional uses of religious or cultural importance to Tribal Nations and local communities includes the full GSENM decision area. The temporal scale for analysis includes current and reasonably foreseeable traditional uses of religious or cultural importance to Tribal Nations and local communities.

Relevant Assumptions

The types of traditional uses of religious or cultural importance to Tribal Nations and local communities (for example, plant collection) are known or can be inferred and can be shown on a map.

Analysis Methodology and Techniques

The analysis will include an overlay of land use allocations with mapped areas of known traditional use. It will also include a qualitative analysis of management actions with types of traditional uses.

Units of Measure

- Number of traditional use areas of religious or cultural importance to Tribal Nations and local communities subject to impacts from management alternatives and an identification and analysis of the types of traditional use subject to impacts from management alternatives

Relevant Data and Information to Be Used

Relevant data include the spatial extent of land use allocations by alternative and traditional use areas and a list of the types of traditional use.

Analytical Conclusions to Be Answered

The analysis will show which management alternatives would have the least and most potential impact on traditional use areas of religious or cultural importance to Tribal Nations and local communities.

Analysis Display

The number of known locations anticipated to be impacted by the land use allocations will be displayed in a tabular format and in a text description of anticipated impacts from management actions on the types of traditional use.

How will proposed management impact landscapes of religious or cultural importance to Tribal Nations and local communities?

Geographic and Temporal Scale of Analysis

The geographic scale for the analysis of impacts on landscapes of religious or cultural importance to Tribal Nations and local communities includes the full GSENM decision area. The temporal scale for the analysis includes current and reasonably foreseeable impacts on landscapes of religious or cultural importance to Tribal Nations and local communities.

Relevant Assumptions

Landscapes of religious or cultural importance to Tribal Nations and local communities are known or can be inferred and can be shown on a map.

Analysis Methodology and Techniques

The analysis will include an overlay of land use allocations with mapped landscapes of religious or cultural importance to Tribal Nations and local communities.

Units of Measure

- Number of landscapes of religious or cultural importance to Tribal Nations and local communities subject to impacts from management alternatives

Relevant Data and Information to Be Used

Relevant data include the spatial extent of land use allocations by alternatives and landscapes of religious or cultural importance to Tribal Nations and local communities.

Analytical Conclusions to Be Answered

The analysis will show which management alternatives would have the least and most potential impact on landscapes of religious or cultural importance to Tribal Nations and local communities.

Analysis Display

The number of known locations anticipated to be impacted by land use allocation will be displayed in a tabular format.

How will proposed management impact historic properties?

Geographic and Temporal Scale of Analysis

The geographic scale for the analysis of impacts on historic properties includes the full GSENM decision area. The temporal scale for the analysis includes current and reasonably foreseeable impacts on districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

The analysis will include an overlay of management actions with the locations of previously recorded cultural resources that are documented in the Utah Division of State History's database of documented archaeological and historic architectural locations.

Units of Measure

- Counts of known historic properties, archaeological sites, and historic architectural locations subject to impacts from management alternatives

Relevant Data and Information to Be Used

Relevant data include the spatial extent of land use allocations by alternatives and the locations of known historic properties, archaeological sites, and historic architectural locations.

Analytical Conclusions to Be Answered

The analysis will show which management alternatives would have the least and most potential impact on known historic properties, archaeological sites, and historic architectural locations.

Analysis Display

The count of known historic properties, archaeological sites, and historic architectural locations impacted by management alternatives will be displayed in a tabular format.

How will proposed management protect cultural resources, including cultural landscapes, traditional uses, and historical properties?

Geographic and Temporal Scale of Analysis

The geographic scale for the analysis of management alternatives to protect cultural resources, including cultural landscapes, traditional uses, and historic properties, includes the full GSENM

decision area. The temporal scale of the analysis includes those efforts to protect cultural resources occurring now and those that are reasonably foreseeable in the future.

Relevant Assumptions

The past and current types, scale, and relative distribution of efforts to protect cultural resources accurately reflect anticipated future efforts and use.

Analysis Methodology and Techniques

- Qualitative analysis of protection measures for cultural resources employed during past and current uses, and subsequent projects on those measures for reasonably foreseeable efforts and use

Units of Measure

- Qualitative assessment of protection measures

Relevant Data and Information to Be Used

Relevant data include descriptions of past and current protection measures used to protect cultural resources, and projections of reasonably foreseeable uses.

Analytical Conclusions to Be Answered

The analysis will apply past and present measures to protect cultural resources during use.

Analysis Display

The results of the analysis will be described in text.

How will proposed management provide appropriate information and education about cultural resources, including cultural landscapes, traditional uses, and historic properties, to the public?

Geographic and Temporal Scale of Analysis

The geographic scale for the analysis of management alternatives to provide appropriate information and education about cultural resources, including cultural landscapes, traditional uses, and historic properties, to the public includes the full GSENM decision area. The temporal scale of the analysis includes those efforts and uses occurring now and those that are reasonably foreseeable in the future.

Relevant Assumptions

The past and current types, scale, and relative distribution of information and education efforts accurately reflect anticipated future efforts and use.

Analysis Methodology and Techniques

- Qualitative analysis of information and education efforts for cultural resources employed during past and current information and education efforts and use, and subsequent projects on those measures for reasonably foreseeable efforts and use

Units of Measure

- Qualitative assessment of information and education efforts

Relevant Data and Information to Be Used

Relevant data include descriptions of past and current information and education efforts, and projections of reasonably foreseeable information and education efforts.

Analytical Conclusions to Be Answered

The analysis will qualitatively evaluate past and present information and education efforts.

Analysis Display

The results of the analysis will be described in text.

6.2.8 Forestry and Woodlands

How would vegetation management decisions affect woodland and forestry product harvest in the planning area?

Geographic and Temporal Scale of Analysis

The geographic scale of the analysis is the decision area. The temporal scale of the analysis is the life of the RMP.

Relevant Assumptions

- The levels of demand for woodland products will remain relatively stable over the life of the RMP.

Analysis Methodology and Techniques

To discern what effect proposed management decisions about vegetation management actions and areas open to woodland product harvest would have on forestry and woodland product harvests, specialists will first conduct a GIS analysis of the acres of woodland types in the decision area. Those woodland types and acreages determined to be available for woodland product harvest will be identified and compared with past and planned vegetation management. Those open acres that have received treatments will be reviewed to determine whether the impact was positive or negative in regard to woodland and forestry product harvest. Impacts on woodlands and forestry products from other resource management activities in the planning area, such as vegetation management and recreation, will also be taken into consideration.

Methodology and techniques for the analysis of forestry and woodland products are:

- Conduct the GIS analysis of acres of woodland types that occur in the decision area
- Conduct the GIS analysis of acres of woodland types that would be open or closed to woodland product harvest
- Conduct the GIS analysis of acres of woodland habitat that have received vegetation management
- Provide a qualitative analysis and discussion of planned forestry management and how it would impact woodlands
- Analyze impacts on woodlands from other resource management activities in the decision area

Units of Measure

- Acres of woodland types in the decision area (LANDFIRE and AIM Strategy data)
- Acres of woodland types that would be open to woodland product harvest
- Acres of woodlands that have received vegetation management
- Acres of proposed fuels or vegetation management actions in woodland types

Relevant Data and Information to Be Used

- LANDFIRE data for woodland types (such as pinyon-juniper, wooded riparian areas, conifer forest, and deciduous trees)
- GIS data for areas open or closed to woodland product harvest
- AIM Strategy data on the forest types within the decision area
- BLM data for the volume of woodland product sales and permits for the past 4 to 5 fiscal years, as available
- BLM woodland product data

Analytical Conclusions to Be Answered

How will decisions about vegetation management impact woodland and forestry harvest?

Analysis Display

The analysis display will consist of a map showing woodland types and areas open and closed to woodland product harvest and tables showing acres of forest type.

6.2.9 Wildfire and Fuels Management

How would land use allocations and discretionary uses affect fire and fuels?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

- Generalized descriptions of the major plant community types, including LANDFIRE Vegetation Condition Classes, are used to estimate fuels and potential fire risks.
- Qualitatively discuss the potential effects on the fire regime and fuels from discretionary uses.
- Qualitatively discuss how each alternative would contribute to changing the fire regime and fuels in the decision area.

Units of Measure

- Acres and miles of land use allocations alternative

Relevant Data and Information to Be Used

- LANDFIRE Vegetation Condition Classes

- Acres or miles of land use allocations overlaid with LANDFIRE Vegetation Condition Classes

Analytical Conclusions to Be Answered

- Qualitatively discuss how each alternative would contribute to trends in fire and fuels in the decision area.

Analysis Display

- Table of acres available for land use allocations in each LANDFIRE Vegetation Condition Class

How would vegetation management actions affect fire and fuels?

Geographic and Temporal Scale of Analysis

The geographic analysis scale is the decision area. The temporal analysis scale is the life of the plan.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

- Generalized descriptions of the major plant community types are used to estimate fuels and potential fire risks.
- Qualitatively discuss the potential effects on the fire regime and fuels from the various vegetation management and restoration actions.
- Qualitatively discuss how each alternative would contribute to trends in the fire regime and fuels in the decision area.

Units of Measure

- Qualitative discussion for each Vegetation Condition Class

Relevant Data and Information to Be Used

- Fire regime or LANDFIRE Vegetation Condition Classes, or both

Analytical Conclusions to Be Answered

- Qualitatively discuss the potential effects from vegetation management in each alternative.

Analysis Display

- Table showing decision area acres in each fire regime and/or LANDFIRE Vegetation Condition Class

6.2.10 Wildlife and Fisheries

How will proposed management affect wildlife and fisheries resources?

Geographic and Temporal Scale of Analysis

The geographic scale of analysis is the immediate habitat for key species found in GSENM. The temporal scale of analysis is the life of the RMP.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

Habitat for special status species will be overlaid with land use allocations to describe potential impacts on species displacement or migration based on species tolerance. An analysis of discretionary uses that may be authorized under each alternative will be described in the context of how such uses tend to impact species.

Units of Measure

- Acres of habitat types
- Acres of land use allocations

Relevant Data and Information to Be Used

- Critical habitat areas
- Occupied habitat areas
- Recreational use data

Analytical Conclusions to Be Answered

Discuss the impacts of land use allocations and discretionary uses on fish and wildlife species and their habitat.

Analysis Display

The analysis will be described in text, with a tabular presentation of acres overlapping of land use allocations that may impact fish and wildlife.

6.2.11 Hydrology (Groundwater, Surface Water, Wetlands, Riparian Areas, Floodplains, and Water Quality)

How would discretionary uses affect surface water hydrology, water quality, water quantity, and special status riparian plants?

Geographic and Temporal Scale of Analysis

The analysis area is the sub-basins (HUC 8) and sub-watersheds (HUC 10 and HUC 12) that cross into the decision area. The temporal scale of analysis is the life of the plan.

Relevant Assumptions

- Current drought trends will continue.

Analysis Methodology and Techniques

- The analysis will quantify floodplain and riparian areas that are open or closed to discretionary uses that cause surface disturbance.
- The analysis will quantify floodplain and riparian areas that are open or closed to discretionary uses that cause surface disturbance that are adjacent to 303(d)-listed impaired streams.
- The analysis will quantify watersheds within assessment units identified as impaired by the Utah Division of Water Quality (UDWQ) in 2022 that are open or closed to discretionary uses that

cause surface disturbance. The analysis will identify all impaired streams listed on the most recent 2022 Integrated Report, specifically within Utah's 303(d) list in the decision area and analysis area, and quantify perennial and intermittent waterbodies in the decision area and analysis area.

- The analysis will evaluate the trends in water quality throughout the analysis area using the 303(d) list of impaired waters from the past 20 years.
- The analysis will quantify the number, location, and types of water rights in the analysis area and decision area since 2000.
- The BLM will estimate potential changes in precipitation from climate change and include a qualitative discussion on how that would affect hydrology, water quantity, and water quality in the surface water and groundwater in the analysis area.
- The analysis will quantify changes in the streamflow since 2000.

Units of Measure

- Acres
- Miles of stream
- Number of springs and seeps
- Acre-feet per year for water use

Relevant Data and Information to Be Used

- Southwest Regional Gap Analysis Project for riparian areas
- Soil Survey Geographic Database Data
- National Hydrography Dataset for surface waters
- National Wetlands Inventory for wetlands
- BLM wetland mapping data
- UDWQ Ambient Water Quality Management System data for sites in GSENM
- Federal Emergency Management Agency mapped floodplains
- Data from the BLM on improved riparian areas
- GIS coverage of existing and proposed land use allocations
- BLM lotic AIM data
- BLM riparian and wetland AIM data
- Proper functioning condition (PFC)
- Range Improvement Project Database
- USGS Principal Aquifers
- USGS flow data
- Utah Geological Survey springs and wells

Analytical Conclusions to Be Answered

- Analyze the impacts on riparian areas, wetlands, and aquatic ecosystems from proposed management in the alternatives
- Analyze the changes in the water quantity from climate change and authorized consumption

Analysis Display

- Map to identify impaired stream reaches and HUC 8 watershed boundaries
- Table to summarize the acres of floodplains and riparian areas that are open or closed to discretionary uses that cause surface disturbance
- Table to summarize trends in 303(d) impaired waters
- Table to summarize the BLM's collected water quality data trends from 2018 to the present
- Table to summarize the number, location, and types of water rights in the decision area since 2000.
- Flowchart to summarize the BLM process for monitoring and reviewing water rights (current and new applications) and estimating impacts on the decision area
- Table or graphical figure to quantify the changes in the streamflow since 2000 inside the decision area

6.2.12 Minerals

How would proposed management affect valid existing rights for minerals in the decision area?

Geographic and Temporal Scale of Analysis

The geographic scale is GSENM. The temporal scale is the life of the plan.

Relevant Assumptions

Determining whether mining claims hold valid existing rights requires the completion of the validity examination process. BLM initiates a validity examination when it receives a proposal to operate, in the form of a plan of operations on mining claims that are on withdrawn lands. Claims filed after the issuance of Presidential Proclamation 9682 remain active as long as the claimants comply with the applicable annual maintenance requirements; however, they may be determined at a later date to be invalid through the validity examination process. Mining or exploration operations on any mining claims determined to be valid could begin only after BLM approves a plan of operations after completing NEPA analysis, and BLM approves the operator's financial guarantee adequate to cover the costs of reclamation. In all cases, operations would be required to prevent unnecessary or undue degradation of the lands. A plan of operations would be required for exploration of existing minerals claims in GSENM.

Analysis Methodology and Techniques

The analysis will examine lease and claim records from the BLM Mineral and Land Records System to determine acres of mineral resources claimed or leased.

Units of Measure

- Types and acres of mining claims and mineral leases with valid existing rights

Relevant Data and Information to Be Used

- Claim and lease data downloaded from the BLM Mineral and Land Records System

Analytical Conclusions to Be Answered

How many acres of mining claims and mineral leases with valid existing rights or potentially valid existing rights exist in GSENM?

Analysis Display

A table showing the number and acres of claims and leases in GSENM will be included.

How would proposed management affect public health and safety in the decision area?

Geographic and Temporal Scale of Analysis

The geographic scale is GSENM. The temporal scale is the life of the plan.

Relevant Assumptions

All known hazardous abandoned mines in GSENM were closed and reclaimed in the early 2000s. The only exception is Montezuma Mine in Johnson Canyon.

If any unknown hazardous abandoned mines are discovered, they would be closed and reclaimed.

Analysis Methodology and Techniques

Describe risks associated with abandoned mines and the process for reclamation and hazard reduction.

Units of Measure

- Number of known hazardous abandoned mine sites that have not been reclaimed

Relevant Data and Information to Be Used

- Number of hazardous mine sites that were sealed or reclaimed in the early 2000s (if records are available)

Analytical Conclusions to Be Answered

What are the current conditions of abandoned mine lands, and what process would be followed to safeguard public health and safety if new hazardous abandoned mine lands were discovered in GSENM?

Analysis Display

No analysis display will be included.

6.2.13 Paleontology and Geology

How would proposed management decisions regarding paleontological resource management (such as curation, protection, survey, collection, outreach, and interpretation) impact paleontological resources, research communities, local communities, and visitor experiences?

Geographic and Temporal Scale of Analysis

The analysis scale is the decision area for the life of the plan.

Relevant Assumptions

- Documentation and potential excavation would allow for research and interpretive uses.
- Public education would increase the public's awareness of the need for protection.
- Late Cretaceous fossils from GSENM are extremely important to researchers, are globally significant, and carry high public interest.

Analysis Methodology and Techniques

The analysis will qualitatively and quantitatively review existing data and current conditions and trends.

Units of Measure

The unit of measure will vary by alternative. It will include measures such as acres of PFYC system class 3, 4, and 5; the number of known localities; and the trends in survey, collection, and preservation.

Relevant Data and Information to Be Used

The data and information to be used will depend on the alternative and may include some of the following:

- Assessment of the significance of Kaiparowits vertebrate paleontology to the research community
- Number of acres in areas with significant fossil potential being proactively inventoried
- Number of fossils currently in collections being actively managed to curatorial standards
- Monetary/economic value of fossil resources to the regional economy
- Number of research papers or publications produced annually on significant resources
- Number of significant fossils collected and curated annually
- Available space for curation of future collections at interested approved repositories
- Number of partnerships formed to leverage resources and scientific expertise in management
- Number of in situ field sites monitored for resource condition and trend
- Number of paleontology-specific exhibits or other interpretive materials or events produced each year
- Number of in situ fossil sites dedicated for public visitation and supported by interpretation, signage, and other methods
- Number of visitors to field sites per year

Analytical Conclusions to Be Answered

The analysis will draw conclusions about the quantitative and qualitative changes to the above data and information under each alternative.

Analysis Display

The analysis will be displayed in a PFYC map and map with paleontological resource.

How would land use allocations and discretionary uses impact paleontological resources?

Geographic and Temporal Scale of Analysis

The analysis scale is the decision area for the life of the plan.

Relevant Assumptions

Ground disturbing activities in areas with high and very high PFYC ratings are likely to disturb significant fossils. Once impacted, paleontological resources cannot return to their original condition, and they lose important contextual data and scientific value.

Analysis Methodology and Techniques

The analysis will intersect PFYC units with land use allocations under each alternative. The analysis will quantify or qualitatively assess degrees of impact associated with different disturbance levels.

Units of Measure

- Number of sites with paleontological resources affected
- Acres of geological units with moderate to very high potential to contain important paleontological resources

Relevant Data and Information to Be Used

- GIS data of site locations and geological units with varying potential for containing important paleontological resources

Analytical Conclusions to Be Answered

The analysis will determine the differences in the number of sites with paleontological resources affected and/or the acres of geological units with moderate to very high potential to contain important paleontological resources impacted by each alternative. May be discussed qualitatively if exact areas and locations are not known.

Analysis Display

The analysis will be displayed in a PFYC map and map with paleontological resource.

How would land use allocations and discretionary uses impact unique geological features?

Geographic and Temporal Scale of Analysis

The analysis scale is the unique features of exposed bedrock for the life of the plan.

Relevant Assumptions

- Increased traffic to interpreted areas creates potential negative impacts on special geological features, including arches, canyons, hoodoos, and cliffs.
- Once impacted, geological features are not likely to return to their original condition.

Analysis Methodology and Techniques

The analysis will intersect select locations such as the Toadstools or Wahweap Hoodoos with defined alternative footprints or qualitatively discuss the potential for impacts by alternative.

Units of Measure

- Number of current locations of unique and interpreted geological features or with the potential to be interpreted and experience high visitation

Relevant Data and Information to Be Used

- Locations of unique and interpreted geological features or those with the potential for future interpretation
- Mapped geologic units to locate potential interpreted sites
- Estimates of visitor numbers

Analytical Conclusions to Be Answered

The analysis will determine the number of sites and anticipated impacts on those sites under each alternative.

Analysis Display

The analysis will be displayed in a map of geological units with point locations of unique geological features.

6.2.14 Air Quality

How would proposed management actions and land use allocations contribute to air pollutant emissions and affect air quality and visibility?

Geographic and Temporal Scale of Analysis

The analysis scale is the planning area air basins for the life of the plan.

Relevant Assumptions

- Demands for motorized use trends would continue.
- Prescribed burning would follow Utah Smoke Management Program regulations and permit conditions.
- Air quality and visibility trends would follow the trends estimated by the EPA in the most recent regional haze modeling.
- BLM-authorized activities would not result in exceedances of NAAQS.

Analysis Methodology and Techniques

- Discuss baselines and trends for criteria air pollutants and air quality related values such as visibility and deposition.
- Provide a quantitative discussion of the nature and type of air impacts based on management actions and land use allocations for each alternative.
- Provide a qualitative discussion of fugitive dust from natural processes.

Units of Measure

- Tons of criteria and hazardous pollutant emissions
- Tons of fugitive dust emissions

Relevant Data and Information to Be Used

- Trends in criteria air pollutant emissions and concentrations
- Trends in visibility in Class I areas
- Acres of land use allocations
- Emissions inventory data
- EPA emission factors

Analytical Conclusions to Be Answered

- How would the action alternatives affect air quality and visibility when compared with current management?

Analysis Display

- Existing criteria pollutant emissions by planning area county
- Air monitoring data for the past 3 years compared with the NAAQS
- Trends in ozone and particulate matter concentrations
- Trends in visibility in Class I areas
- Trends in deposition (that is, when compounds of various types of air pollution are deposited on the earth's surface through rain, clouds, snow, fog, or as dry particles)
- Table of emissions by BLM-authorized activity

6.2.15 Climate Change

What would be the BLM's expected contribution to greenhouse gas emissions from proposed management?

Geographic and Temporal Scale of Analysis

Climate change is a global issue, and the geographic analysis area for GHGs cannot be restricted to one region. For the purposes of the RMP/EIS, the GHG and climate change geographic analysis area is focused on Utah and the United States.

The temporal scale is both 20 years and 100 years to represent the differing effects from shorter- and longer-lived GHGs based on their 20-year and 100-year global warming potential.

Relevant Assumptions

- For cumulative effects analysis purposes, GHG emissions from other federal, state, and private lands would follow current trends.

Analysis Methodology and Techniques

- Quantitatively assess emissions of carbon dioxide, methane, and nitrous oxide from discretionary uses.
- For context, compare emissions from BLM-authorized activities with GHG emissions at other geographic scales (such as the BLM, state, US, and global) and other equivalency metrics (such as emissions from home energy use, emissions avoided by wind turbines, or carbon sequestered by acres of US forests annually).

Units of Measure

- Metric tons of carbon dioxide, methane, and nitrous oxide emissions and their CO_2e

Relevant Data and Information to Be Used

- PRISM Climate Group data sets (1991–2020) for the average annual temperature and precipitation
- National Oceanic and Atmospheric Administration State Climate Summary for Utah (Frankson et al. 2022)
- 2020 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends (BLM 2021)
- Fourth National Climate Assessment, Southwest Region (Gonzalez et al. 2018)

- Climate Change Vulnerability and Adaptation in the Intermountain Region (Halofsky et al. 2018)
- IPCC Climate Change 2021: The Physical Science Basis, (IPCC 2021)
- Colorado Plateau Rapid Ecological Assessment (Bryce et al. 2012)

Analytical Conclusions to Be Answered

- Would the action alternatives result in a change in GHG emissions compared with current management?

Analysis Display

- Graphical displays of annual temperatures and precipitation
- Tables of emissions

How would proposed management affect long-term carbon storage and sequestration in GSENM?

Geographic and Temporal Scale of Analysis

The analysis scale is the decision area for the life of the plan.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

- Describe the carbon sequestration potential of decision area lands and qualitatively discuss the potential changes based on management actions and the potential outcome vegetation management on carbon storage and sequestration over the long term.

Units of Measure

- Acres

Relevant Data and Information to Be Used

- National Assessment of Geologic Carbon Dioxide Storage Resources—Allocations of Assessed Areas to Federal Lands (Buursink et al. 2015)
- 2020 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends (BLM 2021)

Analytical Conclusions to Be Answered

- Would the action alternatives result in a change in carbon storage capacity compared with current management?

Analysis Display

None identified

6.2.16 Environmental Justice and Social and Economic Values

How would proposed management affect jobs and income in the socioeconomic analysis area?

Geographic and Temporal Scale of Analysis

The socioeconomic analysis area will include Garfield and Kane Counties. GSENM is located in these counties, and any impacts on the economy or employment will most likely occur in and around the population centers within these two counties.

Historical data will be averaged over 5 years (2015 to 2019). Where feasible, 2020 data will not be used, especially for tourism and recreation data; this is because the 2020 data are often considered to be an outlier due to the COVID-19 pandemic.

Relevant Assumptions

Expenditure and management inputs will be modeled as a direct, one-time shock to the economy to analyze the impacts. Actual spending levels and the associated contributions would vary by year. However, the model provides an estimate of the total economic contributions with the best information available.

Analysis Methodology and Techniques

Historical data will be averaged over 5 years (2015 to 2019). Where feasible, 2020 data will not be used, especially for tourism and recreation data; this is because the 2020 data are often considered to be an outlier due to the COVID-19 pandemic.

The BLM will estimate the economic impacts of the management alternatives for affected resource uses using the IMPLAN economic impact model. The IMPLAN model was originally developed by the USFS and is commonly used by the BLM, the USFS, and many other government and private sector organizations to estimate the total economic impacts of various activities and policies. The model tracks inter-industry and consumer spending in a local or regional economy; this allows an estimation of indirect and induced economic impacts in the economy that result from the original economic activity or change in economic activity. Indirect impacts result from the inter-industry transactions (for example, when a recreation outfitter buys supplies from a local grocery store). Induced impacts result from re-spending of household income (for example, when employees of the recreation outfitter buy goods for personal use at a local grocery store). Outputs of the IMPLAN model include employment, labor income, value added, and gross regional economic output.

Units of Measure

The units of measure for the direct, indirect, and induced output would be the number of employees (jobs) and 2022 dollars for labor income, value added, and gross regional economic output.

Relevant Data and Information to Be Used

- Permitted AUMs
- Visitor use data

Analytical Conclusions to Be Answered

The analysis will show the direct, indirect, and induced jobs, income, value added, and economic output that would be created from the proposed management.

Analysis Display

The input data used in the IMPLAN model will be provided in tables and discussed in paragraph form. The output data will also be displayed in a table and interpreted.

How would the proposed management impact the nonmarket benefits individuals receive from natural areas?

Geographic and Temporal Scale of Analysis

The geographic scale of the analysis is the decision area.

Historical data will be averaged over 5 years from 2015 to 2019. Where possible, 2020 data will not be used, especially for tourism and recreation data; this is because the 2020 data are often considered to be an outlier due to the COVID-19 pandemic.

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

Historical data will be averaged over 5 years from 2015 to 2019. Where possible, 2020 data will not be used, especially for tourism and recreation data; this is because the 2020 data are often considered to be an outlier due to the COVID-19 pandemic.

Nonmarket values are the benefits that individuals attribute to experiences of the environment or uses of natural and cultural resources that do not involve market transactions and, therefore, lack prices. There are many types of nonmarket values. Three nonmarket values are considered in the analysis: 1) the benefits to local communities from the amenity values provided by open space and scenic landscapes; 2) the benefits to individuals, such as the value to recreationists and visitors above and beyond the cost that they pay to recreate; and 3) ecosystem service values, which refer to the ways that healthy ecosystems support, enable, or protect human activity.

In examining nonmarket values, economists often distinguish between "use values" and "nonuse values." A use value refers to the benefits an individual derives from some direct experience or activity, such as climbing a spectacular peak, hunting, or viewing wildlife. In contrast, a nonuse value refers to the utility or psychological benefit some people derive from the existence of some environmental condition that may never be directly experienced, such as an unspoiled landscape or the continued presence of an endangered species. Estimating nonuse values for specific resources is difficult and often controversial. BLM guidance (BLM 2013) recommends that use values be emphasized rather than nonuse values.

Nonmarket values are important to consider because they help tell the entire socioeconomic story. Estimates of nonmarket values supplement estimates of income generated from commodity uses to provide a more complete picture of the economic implications of proposed resource management decisions. It is difficult to put a dollar number on those values, but the correct answer is not "zero." The BLM is increasingly asked to consider these nonmarket values (in effect, to replace that "zero" with a more useful number for planning and analysis purposes). In some cases, these values can be calculated if appropriate information is available. In other cases, this is not possible, but it may be helpful to discuss these values qualitatively or to provide examples of these values in analogous situations.

Proximity to open spaces can affect property values. This analysis will use literature to examine the economic benefits to local economies from this proximity to open spaces. Economic benefits to individuals will be measured using consumer surplus values to calculate the value of GSENM to recreationists and visitors. Consumer surplus is defined as the maximum dollar amount, above any actual payments made, that a consumer would be willing to pay to enjoy a good or service. For instance, hikers pay a market price for gasoline used to reach a trail but pay nothing to use the trail. Any amount that a recreationist would be willing to pay to use this otherwise free resource represents the nonmarket consumer surplus value of that resource to that consumer.

A 2016 report summarized the findings of consumer surplus values per person per day by recreational activity from 421 studies (totaling 3,192 different value estimates) covering the United States and Canada from 1958 to 2015 (Rosenberger 2016). These values, or a range of values from specific individual studies that are most comparable to the decision area, will be applied to recreational usage figures (for example, visitor days) to estimate the recreation-related nonmarket use value—the consumer surplus—for the decision area. Economic benefits from ecosystem services will be examined by providing an inventory of the ecosystem benefits from GSENM, including any applicable benefits from potable water from groundwater recharge, flood control from intact wetlands, and carbon sequestration from healthy forests and certain agricultural lands.

Units of Measure

The units of measure for the analysis will be the dollar increases in property values and dollar values of consumer surplus for recreational activities.

Relevant Data and Information to Be Used

Data will be collected on property value impacts from proximity to open spaces, as well as consumer surplus values for recreational activities. Data on recreational usage, such as visitor days, will be used. Information on ecosystem conditions from other resource areas will also be gathered.

Analytical Conclusions to Be Answered

The analysis will highlight the value that the proposed management offers to individuals from natural resources that cannot be quantified from the economic impact analysis or any other market mechanism.

Analysis Display

The results of the analysis will be displayed in a table and discussed quantitatively, when possible. When the BLM cannot quantify the values, a qualitative discussion will be provided.

Would the proposed management result in disproportionate or adverse impacts on environmental justice populations?

Geographic and Temporal Scale of Analysis

The environmental justice analysis area includes Garfield and Kane Counties, which are the counties that encompass GSENM. The proposed management would directly affect the populations in these counties, as well as the surrounding counties in Utah (Beaver, Iron, Piute, San Juan, Washington, and Wayne Counties) and Arizona (Coconino and Mohave Counties), which might have cultural or historical ties to the planning area. Reference areas will be used to set a threshold for comparing the percent of minority, low-income, and Native American populations in each county to the reference areas in order to identify

environmental justice communities. The reference areas will be the respective state averages (that is, Utah and Arizona).

Relevant Assumptions

None identified at this time.

Analysis Methodology and Techniques

Executive Order 12898 requires federal agencies to identify environmental justice communities in and around the planning area and determine whether there are disproportionate high and adverse impacts on these communities from the proposed action. Environmental justice communities are defined as communities that have high percentages of the population that identify as low-income, minority, and/or Native American

To identify environmental justice populations, the CEQ issued guidance for federal agencies. The CEQ states that minority populations are present where the percentage of people who identify as American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic of any ethnicity is greater than or equal to 50 percent or is meaningfully greater than the percentage of people who identify as a minority population in a reference area (CEQ 1997). The CEQ guidance does not specify how to identify a "low-income population." However, in practice a similar approach used for minority populations can be followed—where persons in poverty status are greater than 50 percent of the area's total population, or where the percentage in poverty is equal to or greater than the percentage in the general population or an appropriate comparison area (the reference population).

The CEQ guidance does not define what constitutes meaningfully greater. However, the BLM recommends using 10 percentage points as the threshold of "meaningfully greater" for a minority population. The BLM's guidance indicates that a low-income population is present if the poverty rate of a defined geographic area is at or above the poverty rate of the reference area.

For the purpose of this analysis, the thresholds stated above (from the CEQ and the BLM) will be used to identify any low-income or minority communities in the environmental justice analysis area. The reference areas are the respective states where the counties are located (that is, Utah and Arizona).

The CEQ explains, regarding disproportionately high and adverse effects, that the following factors should be considered when examining whether human health effects are disproportionately high and adverse (CEQ 1997):

- Are the health effects significant or above generally accepted normal rates or risks?
- Are the risks or rates of harm to environmental justice communities significant and greater than the risk or rate to the general public or comparison community?
- Are the environmental justice communities impacted by cumulative effects?

The CEQ states that the following issues should be considered when examining whether environmental effects are disproportionately high and adverse:

- Are the impacts on the environment significant and do they negatively harm environmental justice communities?

- Are the impacts on the environment more harmful to environmental justice communities than on the general population or comparison community?
- Are the environmental justice communities impacted by cumulative effects?

In the analysis, these issues will be examined with regards to impacts from the proposed management on the identified environmental justice communities.

Units of Measure

The units of measurement for the analysis, when possible, will be reported in dollar impacts on the environmental justice communities. When it is not possible to quantify the impacts, a qualitative discussion on the impacts will be provided.

Relevant Data and Information to Be Used

To determine whether environmental justice communities exist in the analysis area, county-level data will be collected from the US Census Bureau on the number of individuals who fall below the poverty line and the number of individuals who identify as one or more minority ethnicities or races (American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic) within the environmental justice area.

To determine potential adverse and disproportionate impacts on environmental justice communities in the analysis area, data on impacts from the proposed management will be collected from other resource topic areas, in addition to any impacts from proposed management on social and economic values.

Analytical Conclusions to Be Answered

The analysis will determine whether there are significant impacts from the proposed management, and whether those impacts are disproportionate and adverse on environmental justice communities.

Analysis Display

The results of the analysis will be displayed in a table, when possible, and discussed quantitatively and qualitatively. Maps will be provided on the environmental justice analysis area and will highlight any identified environmental justice populations.

6.2.17 Lands and Realty

How would proposed management affect land use authorizations and land tenure in the decision area?

Geographic and Temporal Scale of Analysis

The geographic scale of analysis is the decision area. The temporal scale of analysis is the life of the RMP.

Relevant Assumptions

The assumptions for the analysis of impacts on land use authorizations and land tenure are:

- The demand for new ROWs and other land use authorizations (for example, film permits) will remain stable or increase slightly throughout the life of the RMP.

- Expanding uses adjacent to GSENM or on private inholdings in GSENM, particularly residential and commercial development, increases the demand for ROWs on the BLM-managed lands to accommodate those uses.
- Land tenure adjustments, including acquisition of inholdings and land exchanges, improve land management efficiency by acquiring lands to consolidate federal ownership, providing connectivity of important resource values, and adjusting ownership patterns in a manner that furthers GSENM's protective purposes.

Analysis Methodology and Techniques

The analysis of impacts on land use authorizations and land tenure under each alternative would include the following steps:

1. Query the BLM's LR2000 database and conduct a GIS analysis to determine acres of ROWs and land use authorizations, ROW exclusion areas, and ROW avoidance areas within the decision area.
2. Conduct a GIS analysis of acres of designated and de facto (corridors with existing ROWs) utility corridors within the planning area.
3. Conduct a GIS analysis of acres of designated communication sites within the decision area.
4. Conduct a GIS analysis of acres of land not managed by the BLM within the planning area. The acres of land not managed by the BLM within the planning area would remain the same in all alternatives, but the criteria used to evaluate lands for potential acquisition may vary between alternatives. These acreages and criteria will help the responsible official understand the differences between the alternatives with regard to the ability of managers to issue land use authorizations and to acquire or exchange land within the planning area.
5. Using this data, conduct a quantitative analysis to compare a change in land use authorizations, utility corridors, and communication sites within each alternative. Conduct a qualitative analysis to describe impacts on lands and realty actions based on actions under other resource programs under each alternative. Analyze land tenure by comparing previous GSENM boundaries to the present decision area boundaries, comparing land tenure criteria within each alternative, and assessing the BLM's ability to engage in land exchanges.

Units of Measure

Acres will be used to measure impacts on land use authorizations and land tenure under each alternative.

Relevant Data and Information to Be Used

The data and relevant information to be used in the analysis consist of:

1. GIS data for the acres of ROW avoidance, exclusion, and utility corridors in the decision area under each alternative
2. Information from the 2000 MMP (BLM 2000), 2020 GSENM RMP (BLM 2020a) and 2020 KEPA RMP (BLM 2020b)

Analytical Conclusions to Be Answered

The acres available or unavailable for ROWs, utility corridors, and communication sites will be compared by alternative. Land tenure would be analyzed by comparing the land tenure criteria in each alternative and the opportunity those criteria will provide the BLM the ability to engage in land acquisitions and exchanges. A qualitative discussion about the extent to which management would or would not change opportunities for land use authorizations will be included.

Analysis Display

The analysis display will consist of maps showing ROW avoidance areas, ROW exclusion areas, designated utility corridors, and communication sites under each alternative. A table with acreages of these attributes will also be displayed for each alternative. Written criteria will be established to guide how the acquisition of inholdings will be considered.

6.2.18 Landscape Characteristics

How would proposed management impact scenic quality and the public's highly valued experience of enjoying scenery?

How would proposed management affect inventoried visual values?

Geographic and Temporal Scale of Analysis

The geographic scope for the analysis corresponds to the visible area surrounding GSENM up to 15 miles beyond the boundary, which is associated with the limit of the background distance zone of the GSENM visual inventory. The temporal scope of the analysis is the life of the plan.

Relevant Assumptions

Assumptions for the analysis of the visual resource issues noted above include:

- Based on project implementation and use trends over the past 25 years, the development of recreation, livestock grazing, and community-scale utility infrastructure and vegetation management would continue to be the primary types of projects that could affect visual resource values in GSENM.
- Visual design considerations to minimize visual contrast and to protect the scenic quality will be incorporated into all surface-disturbing projects regardless of size, potential impact, or VRM class.
- The contrast rating analysis will be used to evaluate proposed projects in GSENM to reduce the contrast and determine conformance with visual objectives.
- The construction of residential, commercial, recreational, and utility infrastructure near GSENM and on inholdings will continue.
- Trends in drought and wildfires that affect vegetation and surface water will continue.

Analysis Methodology and Techniques

Effects on scenic quality resulting from different VRM class allocations, which allow for varying levels of modification to the characteristic landscape, will be compared with the inventoried Class A, B, and C scenic quality areas under each RMP alternative. These changes to the characteristic landscape could decrease the scenic quality inventory key factor scores (specifically vegetation, adjacent scenery, and cultural modification) and lead to diminishing scenic quality, where the designated VRM class objectives

would allow these types of management activities. Effects on scenic quality will also be discussed qualitatively.

Effects on sensitivity and distance zones will be analyzed qualitatively using the best available data.

Units of Measure

The analysis will use the acres of proposed VRM class objectives within Class A, B, and C scenic quality areas under different VRM class objective allocations.

Relevant Data and Information to Be Used

- GSENM VRI, including scenic quality
- GSENM VRM classes
- GSENM Recreation Experience Baseline Study

Analytical Conclusions to Be Answered

The level of protection provided in each alternative to visual values will be determined and explained qualitatively. Additionally, for scenic quality, the scenic quality scores (A, B, or C) compared with the VRM class allocations across alternatives will identify areas and acres of protection levels provided by each alternative. The management of other resources and discretionary uses, and how those might affect scenic quality, will also be examined and explained in a narrative format.

Analysis Display

Tables and maps will be developed to display the scenic quality ratings and the proposed VRM classes across the range of RMP alternatives.

How would proposed management actions under the alternatives affect dark night skies?

How will factors outside the BLM's control affect dark night skies?

Geographic and Temporal Scale of Analysis

The geographic scope for the dark night skies analysis corresponds to the planning area and adjacent communities producing sky glow in GSENM. The temporal scope of the analysis will be the life of the plan.

Relevant Assumptions

Assumptions for the analysis of the dark night sky issues noted above include:

- Visitors and local residents appreciate and value night skies that are unimpaired by light pollution.
- The quality of dark night skies depends on the weather, the clarity of the air, and the amount of light pollution present.
- Protection of dark nights skies is most successful as a result of coordination with federal, state, county, tribal, and local partners.

Analysis Methodology and Techniques

A qualitative assessment of different management approaches across alternatives will be used. I analysis will compare areas of more stringent dark night sky management, including areas where no projects that require artificial light would be allowed or where they would be allowed but only with restrictive BMPs, with the existing sky brightness level to identify the extent of GSENM where these increased protections would occur.

Units of Measure

- Acres of GSENM with differing management approaches to protect dark night skies compared with 1) those areas already impacted by sky glow and 2) the portions of GSENM largely unaffected by sky glow

Relevant Data and Information to Be Used

- The New World Atlas of Artificial Night Sky Brightness (Falchi et al. 2016)
- Areas in GSENM proposed for differing ranges and types of dark night sky protection measures under different RMP alternatives
- Grand Staircase-Escalante National Monument Night Sky Quality Research Report (IDA 2016)

Analytical Conclusions to Be Answered

The analysis of the different RMP alternatives will compare the acres of GSENM with increased dark night sky management requirements and the existing sky brightness thresholds. By comparing where more stringent management of dark skies could occur with the existing sky brightness levels, the analysis will identify the portions of GSENM where the dark night sky resource would be most and least protected. The BLM will also examine how other resources and resource uses would affect dark night skies and explain the analysis in a narrative format.

Analysis Display

Tables and maps will be developed to display the existing sky brightness levels and areas where differing management prescriptions would occur across the range of RMP alternatives.

How would proposed management affect natural quiet soundscapes?

How will factors outside the BLM's control affect natural quiet soundscapes?

Geographic and Temporal Scale of Analysis

The geographic scope for the natural soundscapes analysis corresponds to the planning area and the area within 3 miles[14] of the planning area. The temporal scope of the analysis will be the life of the plan .

Relevant Assumptions

Assumptions for analysis of the soundscape issues noted above include:

- Visitors and local residents appreciate and value quiet natural soundscapes, and they are intrinsic the visitor experience of GSENM.

[14] Noise deceases with distance according to the inverse square law. 6db with a doubling of distance. Significant noise levels will likely decrease to non-significant levels within 3 miles.

- Noise caused by airplane traffic and recreational use will continue.
- Protection of natural soundscapes is most successful as a result of coordination with federal state, county, tribal, and local partners, including the NPS air tour management plans for adjacent NPS units.

Analysis Methodology and Techniques

The BLM has identified standards for managing soundscapes indirectly for other resources. For example, near greater sage-grouse leks, there is a limit of increasing noise 10 A-weighted decibels (dBA) above the background, which equates to doubling the existing sound levels. Based on the quiet landscapes that comprise GSENM, this standard would be appropriate for other noise-sensitive receptors, including developed and primitive recreation locations.

Since there are no management classifications, like BLM VRM classes for visual resources, this analysis will first focus on a qualitative assessment of different management approach alternatives. The RMP alternatives will include differing BMPs to reduce impacts on natural soundscapes. Additionally, the BLM will map areas where motorized use is allowed or where there is other planned development, including new recreation sites (where these are identified in the range of RMP alternatives); this will identify the extent of GSENM where noise-producing management activities may occur. These areas will then be compared with the different existing soundscape conditions in GSENM to identify where existing soundscapes are most likely to be impacted.

Units of Measure

- Acres of GSENM where noise-producing management activities and uses may occur.

Relevant Data and Information to Be Used

- Land use allocations by alternative
- Discretionary uses by alternative
- NPS Sound Map: Existing Conditions
- GSENM Acoustic Monitoring Report (Southern Utah University 2020)

Analytical Conclusions to Be Answered

The analysis of the different RMP alternatives will compare the acres of GSENM where noise-producing management activities and uses may occur and the existing soundscape conditions. By identifying the acres where these activities may occur, compared with the existing soundscape conditions thresholds (such as dBA), the extent of GSENM where noise levels could increase can be quantified, including where existing soundscapes are highly intact. The analysis of discretionary uses and how those might affect natural soundscapes will also be examined and explained in a narrative format.

Analysis Display

Tables and maps will be developed to display the existing soundscape conditions (such as dBA thresholds) and how many acres could have increased noise pollution within these areas (which would affect natural soundscapes) across the range of RMP alternatives.

6.2.19 Lands with Wilderness Characteristics

How would proposed management affect the naturalness, size, and opportunities for solitude or primitive and unconfined recreation of lands with wilderness characteristics?

Geographic and Temporal Scale of Analysis

The geographic scale of the analysis consists of the extent of the identified lands with wilderness characteristics. The temporal scale of the analysis is the life of the RMP.

Relevant Assumptions

- Trends in demand for recreational use will continue into the foreseeable future.

Analysis Methodology and Techniques

The analysis will determine whether land use allocations or discretionary uses would impact the requirements of naturalness, size, and opportunities for solitude or primitive and unconfined recreation to be considered lands with wilderness characteristics.

Units of Measure

- Acres of lands with wilderness characteristics on BLM-managed lands within the planning area

Relevant Data and Information to Be Used

- Inventory forms or background information for lands with wilderness characteristics within the decision area
- Geospatial data of lands with wilderness characteristics units

Analytical Conclusions to Be Answered

The analysis will include a narrative discussion of how land use allocations and discretionary uses across the decision area under each alternative would affect the naturalness, size, and opportunities for solitude or primitive and unconfined recreation of lands with wilderness characteristics.

Analysis Display

- A map displaying lands with wilderness characteristics as updated in the 2020 inventory
- A table displaying lands with wilderness characteristics units and acreages
- A table displaying acres of lands with wilderness characteristics with land use allocations by alternative.

Conclusions will be explained in the text.

6.2.20 Special Land Designations for Conservation and Protection

How would management affect the relevant and important values of potential ACECs?

Geographic and Temporal Scale of Analysis

The analysis area for ACECs will consist of each proposed ACEC within the decision area. The temporal scale of the analysis will be the life of the plan.

Relevant Assumptions

- None identified at this time.

Analysis Methodology and Techniques

Impacts on potential ACECs would result from management actions that would irreparably damage the identified relevant and important values. Surface-disturbing activities typically provide the greatest threat to historical and cultural, paleontological, geological, scenic, and natural relevant and important values.

To determine whether the management direction of each alternative protects the relevant and important resource values associated with each potential ACEC, first the BLM will list and map the locations of potential ACECs by alternative. Next, special management needed to protect or maintain each ACEC's relevant and important values will be defined by alternative. Finally, for each alternative, the BLM will determine whether specific management activities or the lack of management direction would affect the relevant and important values that do not receive special management attention.

Units of Measure

The analysis will use the acres within each potential ACEC that would be impacted by land use allocations, where applicable. Other impacts will be described qualitatively.

Relevant Data and Information to Be Used

- GIS data of potential ACEC boundaries
- GIS data of potential ACEC boundaries with overlapping acreages of other land use allocations by alternative

Analytical Conclusions to Be Answered

The analysis will provide a description of how land use allocations and management direction for each alternative affect the relevant and important values for each area. Under some alternatives, the BLM may conclude that some potential ACECs require no special management to protect the relevant and important values, and, therefore, ACEC designation is unnecessary.

Analysis Display

The analysis will be presented through text that describes the impacts that each proposed management action would have on the relevant and important values identified for each proposed ACEC. Tables will also be included that show a breakdown of proposed ACEC acreages, designations by alternative, applicable relevant and important values, and management direction, if designated.

How would management affect research natural areas?

Geographic and Temporal Scale of Analysis

The geographic scope of analysis is limited to any potential research natural areas identified in the alternatives. The temporal scale of analysis is the life of the plan.

Relevant Assumptions

None identified at this time.

Analysis Methodologies and Techniques

Primary analysis methodologies will include GIS overlays of potential research natural areas in a given alternative with land use allocations in that alternative to determine how allowable uses might impact

research opportunities in identified areas. A qualitative discussion of discretionary uses will also be provided.

Units of Measure

- Acres and miles

Relevant Data and Information to Be Used

- GIS data for potential research natural areas
- Information related to scientific opportunities in the potential research natural areas
- Climate change models
- GIS data for land use allocations

Analytical Conclusions to Be Answered

The analysis will provide a description of how potential research natural areas would be impacted or provide opportunities for scientific research in a given alternative.

Analysis Display

The analysis will be presented through text, maps, and tables that describe the impacts each proposed alternative would have on research natural areas.

How would management affect the Old Spanish National Historic Trails?

Geographic and Temporal Scale of Analysis

The analysis area for national trails is the OSNHT management corridor or inventory corridor that was established during the inventory conducted for this planning effort. Linearly, it consists of 36 miles of trail. Its width or corridor will be established by a viewshed analysis and various other practices established in BLM Manual 6280. The temporal scale of the analysis is the life of the plan.

Relevant Assumptions

None identified.

Analysis Methodology and Techniques

To determine whether the management direction of each alternative meets the requirements and purposes set forth in the National Trails System Act, FLPMA, and other laws and policies applicable to the OSNHT, the following analysis methodologies and techniques will be used. First, all trail inventory work conducted will be done in accordance with BLM Manual 6280 and BLM Technical Reference 6280-1 Volumes 1 and 2. Reference to the Comprehensive Administrative Strategy will be made for all high potential sites and segments and all objectives that are stated within that document. Special management needed will be defined by alternative; if needed, special management will be applied to the proposed management corridor for each alternative.

Units of Measure

The BLM will use the acres within the OSNHT management corridor or inventory corridor and the existing and proposed management corridors to disclose impacts and management actions for each alternative. Other impacts will be described qualitatively, as needed.

Relevant Data and Information to Be Used

The BLM is currently conducting an inventory based on the methodology that was approved in 2020. This inventory, along with all cultural, recreational, visual, and natural resource data within the corridor area, will be used. In addition, all relevant OSNHT planning documents, such as the Comprehensive Administrative Strategy and existing planning documents, will be used.

Analytical Conclusions to Be Answered

The analysis will provide a description of how the OSNHT will be affected by each proposed alternative's land use allocations and management direction.

Analysis Display

The analysis will be presented through text, maps, and tables that describe the impacts each proposed alternative would have on the OSNHT.

How would management protect the viewshed surrounding scenic routes and the experience of enjoying scenic routes within the planning area?

Geographic and Temporal Scale of Analysis

The geographic analysis scale for scenic routes will include the route and viewshed or "seen area" from the route. The temporal scale of the analysis will be the life of the plan.

Relevant Assumptions

- Visitors and local residents enjoy and value the experience of appreciating scenery when traveling on scenic routes.

Analysis Methodology and Techniques

Potential impacts on scenic routes would be assessed by comparing the levels of change to the landscape characteristic that could occur under differing VRM classifications across alternatives. Impacts on the viewsheds would also examine how other management actions affect the viewshed across alternatives. Impacts on the experience of enjoying scenic routes would be assessed qualitatively by examining the effects of other management actions across alternatives.

Units of Measure

The analysis will use the acres of VRM classes that would protect the scenic route viewshed and any applicable land use allocations that would impact or protect scenic route viewsheds. Other impacts will be discussed qualitatively.

Relevant Data and Information to Be Used

- GIS data of scenic routes
- Viewshed analysis to determine the "seen area"
- VRM class data within route viewsheds
- Land use allocations overlapping with routes and viewsheds
- US Department of Transportation highway statistics for Scenic Byway 12 and RMIS statistics for use numbers for GSENM interior routes, as applicable
- Scenic Byway 12 Economic Impact Study

Analytical Conclusions to Be Answered

The analysis will provide a description of how land use allocations and management direction for each alternative affect the viewshed surrounding scenic routes.

Analysis Display

A table showing the acres of VRM classes within the viewsheds of scenic routes by alternative will be included for the analysis. Additionally, the analysis will include map(s) depicting the viewshed or "seen area" of scenic routes within the planning area.

How would management affect the free-flowing condition, outstandingly remarkable values, and tentative classification of river segments found suitable for inclusion in the National Wild and Scenic Rivers System?

Geographic and Temporal Scale of Analysis

The analysis area for wild and scenic rivers (WSRs) is the suitable river corridors (0.25 miles of land from the ordinary high-water mark on each side of the segment) on BLM-administered lands in GSENM. The temporal scale of the analysis is the life of the plan.

Relevant Assumptions

Until the record of decision for this RMP is adopted, the BLM will manage all suitable stream segments under interim protective measures, as required by the Wild and Scenic Rivers Act and BLM Manual 6400, Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning, and Management (BLM 2012b). This procedure and the interim protective measures would ensure that the outstandingly remarkable values for which these river segments were found eligible and suitable are not compromised until Congress makes a decision regarding WSR designation. The interim management policy requires the BLM to protect the identified outstandingly remarkable values, the free-flowing condition of the stream segment, and the classification of the segment (allowable level of stream corridor development). In the case of segments classified as wild, the BLM must also maintain the water quality.

Analysis Methodology and Techniques

The BLM will determine whether the management direction of each alternative protects outstandingly remarkable values of suitable WSRs. First, the BLM will list and map the locations of the suitable WSR segments by alternative. Next, special management needed to protect or maintain the outstandingly remarkable values of suitable WSRs will be defined by alternative. Finally, for each alternative, the BLM will determine whether specific management activities or the lack of management direction would affect the outstandingly remarkable values, free-flowing condition, or classification of suitable WSRs that do not receive special management attention.

Units of Measure

Measurements will be in miles and acres of each suitable river corridor that would be impacted by a management action, where applicable. Other impacts will be described qualitatively.

Relevant Data and Information to Be Used

- GIS data for suitable river corridors on BLM-administered lands in GSENM

- Miles of suitable river corridors by administrative unit and tentative classification (wild, scenic, or recreational)
- GIS data of suitable river corridors with overlapping acreages of other land use allocations for each alternative

Analytical Conclusions to Be Answered

The analysis will provide a description of how land use allocations and management direction for each alternative affect the suitable WSR segments and corridors.

Analysis Display

The analysis will be presented through text that describes the impacts each proposed management action would have on the suitable WSR segments and corridors. The analysis will also include a table showing impacts on suitable WSR segments by alternative.

How would management affect the wilderness characteristics of WSAs?

Geographic and Temporal Scale of Analysis

The analysis areas for WSAs will comprise each WSA within the decision area. The temporal scale of the analysis will be the life of the plan.

Relevant Assumptions

- Consistent with BLM Manual 6330, Management of Wilderness Study Areas (BLM 2012d), the BLM will manage WSAs so as to not impair their suitability for preservation as wilderness until Congress either designates or releases all portions of WSAs from further consideration for wilderness.

Analysis Methodology and Techniques

The BLM will determine whether the management direction of each alternative protects the suitability of each WSA for preservation as wilderness. First, the BLM will list and map the locations of the existing and proposed WSAs and ISAs in the planning area by alternative. Next, management needed to protect or maintain the wilderness characteristics of WSAs and ISAs will be defined by alternative (activities must be temporary and create no new surface disturbance). Finally, the BLM will determine whether specific management activities or the lack of management direction would affect the wilderness characteristics for WSAs and ISAs.

Units of Measure

Measurements will be in acres within each WSA and ISA that would be impacted by a management action, where applicable. Other impacts will be described qualitatively.

Relevant Data and Information to Be Used

- WSA inventories and monitoring reports for BLM-managed lands within the planning area
- GIS data of lands with WSA parcel boundaries
- Acres of WSAs by alternative, with overlapping acreages of other land use allocations

Analytical Conclusions to Be Answered

The analysis will provide a description of how land use allocations and management direction for each alternative affect each WSA in GSENM.

Analysis Display

The analysis will be presented through text that describes the impacts that each proposed management action would have on each WSA and ISA. Additionally, a table showing the impacts on each WSA and ISA by alternative and map(s) depicting WSA and ISA boundaries in GSENM will be included as part of the analysis.

6.2.21 Wild Horses

How would proposed management impact wild horses?

Geographic and Temporal Scale of Analysis

The geographic scale of analysis is the two wild horse herd areas in GSENM, the Moody-Wagon Box Mesa Herd Area (71,500 acres) and the Harvey's Fear Herd Area (18,100 acres). The temporal analysis scale is the life of the plan.

Relevant Assumptions

- The existing wild horse herd population size is largely kept in check by a lack of resources and predation by native predators.

Analysis Methodology and Techniques

- Changes in forage availability and utilization
- Changes in herd size

Units of Measure

- Acres

Relevant Data and Information to Be Used

- GIS data of herd area acres
- BLM herd area statistics

Analytical Conclusions to Be Answered

- Analyze if alternatives would influence wild horses or herd areas

Analysis Display

- Narrative of qualitative and quantitative impacts on wild horses and their resources

Chapter 7. Preliminary Range of Alternatives

Under NEPA, federal agencies are required to evaluate the potential environmental impacts of a major federal action—and to consider a range of reasonable alternatives. As noted in Chapter 4, the purpose (the specific objective of the agency's proposed action) and the need (the broader underlying agency need or legal requirement to which the agency is responding) largely determine what constitutes a range of reasonable of alternatives. "Reasonable alternatives" means a range of alternatives that are technically and economically feasible and that meet the purpose and need for the proposed action (40 CFR 1508.1(z)). All reasonable alternatives must be rigorously explored and objectively evaluated. Further, other alternatives eliminated from detailed study must be included with a brief discussion of the reasons for eliminating them.

The range of alternatives must also include consideration of a no-action alternative, which is usually interpreted as "no change" from current management direction or level of management intensity. In other words, "no action" may be considered a continuation of the present course of action until that action is changed.

The BLM has identified the following preliminary alternatives for consideration. These alternatives are not final but rather the product of the BLM's initial considerations of the issues and the purpose and need. The BLM invites and encourages your input on these initial ideas as well as your suggestions for other alternatives at this time so that a range of reasonable alternatives can be developed.

7.1 Approaches Common to All Alternatives

In accordance with Proclamation 10286, if grazing permits or leases are voluntarily relinquished by existing holders, the lands covered by such permits or leases would be retired from livestock grazing. Forage would not be reallocated for livestock grazing purposes unless the Secretary of the Interior specifically finds that such reallocation would advance the purposes of Proclamation 10286 and Proclamation 6920.

Proclamation 10286 also withdrew GSENM from all forms of mineral entry and location, the lands previously available for mineral and energy activities under the KEPA RMP, are no longer available for such use subject to valid existing rights.

7.2 Alternative A (No Action Alternative)

Alternative A represents current management from the 2020 GSENM Resource Management Plans, which applies to the lands in GSENM as it existed under Proclamation 9682, and the 2020 KEPA Management Plan, which applies to the lands that were excluded from GSENM under Proclamation 9682, to the extent that those management actions are consistent with the proper care and management of objects identified in Proclamation 10286.

Alternative A generally allows for maximum discretionary uses (e.g., rights-of-way and livestock grazing) and emphasizes management flexibility while still providing for resource protection as required by

applicable regulations, laws, policies, plans, and guidance, including the proper care and management of GSENM objects and values.

- Recreation Areas: There are five SRMAs, two ERMAs, and nine RMZs.
- OHV Use: OHV use is limited to designated routes, except in No Man's Mesa Research Natural Area (closed to OHV use) and the Little Desert RMZ, in the former KEPA (open to cross-country OHV use).
- Target Shooting: Target shooting is prohibited within at least 0.25-mile of residences, campgrounds, and developed recreation facilities. The distance may be increased depending on area-specific conditions.
- Recreational Facilities: The 2020 Approved RMPs do not expressly speak to recreational facilities. However, there are largely few express restrictions outside of WSAs on where development could occur.
- Livestock Grazing: Nearly all allotments are available for livestock grazing. All suspended AUMs would be activated over time. Range improvements, both structural and nonstructural, would be implemented to increase forage for livestock to support the permitted AUMs. Existing seedings would be restored using a mix of native and nonnative species.
- Vegetation Management: Vegetation management prioritizes the use of native species. Nonnative species are allowed where necessary to optimize land health, forage, and productivity in nonstructural range improvements.
- Other Discretionary Actions: Outside of WSAs, which are exclusion areas for ROWs, all lands are either avoidance areas or open for ROWs, permits, and leases. The suitability for these land actions would be judged on a case-by-case basis. The No Action alternative also prohibits the casual collection of all paleontological resources, mineral resources, and petrified wood within monument boundaries established by Proclamation 9682, yet is mostly open to casual collection of common paleontological resources, rocks, minerals, and petrified wood in the former KEPA, except where prohibited and posted.
- Lands with Wilderness Characteristics: Lands with wilderness characteristics do not receive any special management to protect naturalness and opportunities for solitude, or primitive and unconfined types of recreation.
- Transportation and Access: Route maintenance is not described in the 2020 Approved RMPs.

7.3 Approaches Common to All Action Alternatives

Under all action alternatives, the BLM would provide for scientific discovery, where GSENM would serve as an outdoor laboratory for basic and applied science. Science would be integrated into proposed actions where there are meaningful opportunities for applied science and/or adaptive management. This would include consulting with the scientific community and reviewing relevant scientific literature to design projects to maximize scientific outcomes. Research Natural Areas (RNA, 43 CFR 8223) may be established to prioritize scientific research opportunities. These areas may be closed or limited to discretionary uses that are not consistent with the purposes of the RNA.

Under each action alternative adaptive management thresholds and responses would be identified to respond to the effects of climate change and other impacts on resources. Where resource monitoring would determine when thresholds are reached, based on those outcomes, the BLM would modify the

management of discretionary uses to meet the goals and objectives. For example, if percent cover of vegetation falls below the identified threshold, the BLM would change management in the area. This could include changing recreation group sizes, limiting access to certain areas, implementing permit systems, implementing fee-based systems, and/or changing grazing systems – all with the intent to further protect, restore, and/or increase resiliency of GSENM objects and values.

All action alternatives would emphasize the need to develop and maintain strong relationships with Tribal Nations, to conduct government-to-government consultations for proposed management actions, and to design projects accordingly. Consistent with Secretarial Order 3043 (Joint Secretarial Order on Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters), the BLM would seek opportunities for co-stewardship in the plan's development and implementation with interested Tribal Nations.

Paleontological resources would be managed the same across all action alternatives and GSENM would be closed to the casual collection of all paleontological resources, rocks, minerals, and petrified wood.

The BLM would limit discretionary actions in known areas of high concentrations of cultural resources. Three cultural sites would be allocated as a public use site and developed in a manner to protect the sites while accommodating interpretation for public knowledge.

All action alternatives would include provisions to ensure the appropriate ability to facilitate necessary search-and-rescue efforts to maintain and promote public health and safety in GSENM.

7.4 ALTERNATIVE B

This alternative would maintain current management for GSENM according to the 2020 GSENM Management Plan and expand it to the full boundary to cover the former KEPA areas. Some management identified for the former KEPA would be changed to protect, restore, and/or increase resiliency of GSENM objects and values.

- Recreation Areas: Same as Alternative A.
- OHV Use: This alternative would not designate any OHV open areas; all lands in GSENM would be designated as either OHV limited or OHV closed areas.
- Target Shooting: Same as Alternative A.
- Recreational Facilities: Same as Alternative A.
- Livestock Grazing: Same as Alternative A.
- Vegetation Management: Same as Alternative A.
- Other Discretionary Actions: The entire GSENM would be closed to the casual collection of paleontological resources and mineral resources. Otherwise, other discretionary actions would be the same as under Alternative A.
- Lands with Wilderness Characteristics: Same as Alternative A.
- Transportation and Access: Primary and secondary routes could be maintained and improved to meet public health and safety needs.

7.5 ALTERNATIVE C

Alternative C would emphasize providing for a variety of world-class outdoor recreational opportunities.

- Recreation Areas: Several SRMAs and ERMAs would be established to provide for specific outcomes-based recreational experiences in an identified recreational setting.
- OHV Use: Some areas with resource conflicts, such as No Man's Mesa, would be closed to OHV use; the remainder of GSENM would limit OHV travel to designated routes, with some road density and siting criteria identified.
- Target Shooting: Target shooting would be prohibited except in areas designated for such use.
- Recreational Facilities: In order to provide for public health and safety, recreational facilities such as designated campgrounds and bathrooms may be needed at some locations. This alternative would likely feature the most recreational facilities to support user demands. Visual resource management classes would be assigned accordingly.
- Livestock Grazing: Livestock grazing would be managed to improve land health, in a manner that protects, restores, and/or increases resiliency of GSENM objects and values. Allotments that are not under permit would be made unavailable for livestock grazing. Forage reserves may be created. AUMs on certain available allotments may be reduced to achieve resource objectives and protect, restore, and/or increase resiliency of GSENM objects and values. New range improvements, including nonstructural range improvements, could be permitted if they contribute to the protection, restoration, and/or increased resiliency of GSENM objects and values. Existing range improvements could be maintained or, where it protects, restores, and/or increases resiliency of GSENM objects and values, modified.
- Vegetation Management: Vegetation management actions may be used if it would further the protection, restoration, and/or increased resiliency of GSENM objects and values. The BLM would ensure seedings are appropriate for the soil type, in accordance with BLM policy. Nonnative species would only be allowed where consistent with the protection, restoration, and/or increased resiliency of GSENM objects and values and where native seeds would have a low potential for success; in these cases, native seeds would be used in subsequent treatments.
- Other Discretionary Actions: Alternative C would accommodate other discretionary actions, such as ROW authorizations. The BLM would ensure protection, restoration, and/or increased resiliency of GSENM objects and values by evaluating proposed actions on a project-by-project basis to ensure discretionary uses are designed to protect, restore, and/or increase resiliency of GSENM objects and values.
- Lands with Wilderness Characteristics: Some lands with wilderness characteristics would be managed to protect those characteristics and therefore eliminate or limit discretionary uses in these areas, while others would be managed to minimize impacts on wilderness characteristics while allowing discretionary uses and still protecting GSENM objects and values.
- Transportation and access: Primary and secondary routes could be maintained and improved to meet public health and safety needs.

7.6 ALTERNATIVE D

Alternative D would emphasize the protection of resilient and intact landscapes in GSENM while allowing for discretionary uses in identified management zones similar to those used for GSENM

management in accordance with the 2000 Monument Management Plan (MMP). For example, the 2000 MMP established four management zones, front country zone, passage zone, outback zone, and primitive zone. New management zones would be used to identify the allowable uses that meet the goals and objectives of the zone while also protecting objects and values throughout GSENM.

- Recreation Areas: In addition to management zones, a number of SRMAs would be established to provide for specific outcomes-based recreational experiences in an identified recreational setting. ERMAs would also be designated to facilitate specific recreational outcomes while ensuring resource protection.
- OHV Use: Some areas, such as No Man's Mesa, some lands with wilderness characteristics, and areas of high resource concern would be closed to all OHV use; the remainder of GSENM would limit OHV travel to designated routes. In OHV-limited areas, road density would be minimized and siting criteria would be identified, especially in important resource areas, to ensure the protection, restoration, and/or increased resiliency of GSENM objects and values.
- Target Shooting: Target shooting would be limited to appropriate management zones.
- Recreational Facilities: Management zones will identify areas in which recreation facilities could be developed to meet future recreational needs.
- Livestock Grazing: Livestock grazing would be managed to improve land health and to meet the goals and objectives of the management zones, in a manner that protects, restores, and/or increases resiliency of GSENM objects and values. Allotments that are not under permit would be made unavailable for livestock grazing. Forage reserves may be created. Certain allotments may be made unavailable for livestock grazing or AUMs on certain available allotments may be reduced to achieve the goals and objectives of management zones, achieve resource objectives, and protect, restore, and/or increase resiliency of GSENM objects and values. No new range improvements, including nonstructural range improvements, would be permitted unless, as a primary purpose of the range improvement, they contribute to the protection, restoration, and/or increased resiliency of GSENM objects and values. Existing range improvements could be maintained or, where it protects, restores, and/or increases resiliency of GSENM objects and values, modified.
- Vegetation Management: Some vegetation management actions may be used if it would further the protection, restoration, and/or increased resiliency of GSENM objects and values. The BLM would ensure seedings are of native seeds and appropriate for the soil type, in accordance with BLM policy.
- Other Discretionary Actions: Alternative D would prohibit discretionary actions in a large portion of GSENM to protect and restore soil health, which is foundational for healthy ecosystems. No new ROWs would be authorized outside of the pre-existing designated utility corridors. Access ROWs to private inholdings would be authorized, if required bylaw or regulation.
- Lands with Wilderness Characteristics: All lands with wilderness characteristics would be managed to protect those characteristics. Inclusive of the WSAs, more than half of GSENM would be managed to protect naturalness and opportunities for solitude or primitive and unconfined types of recreation.
- Transportation and access: Primary and secondary routes could be maintained and improved to meet public health and safety needs.

7.7 ALTERNATIVE E

This alternative strives to maximize maintenance of natural processes through limiting and/or discontinuing discretionary uses. Land use allocations would result in substantially curtailing discretionary uses, including recreation, livestock grazing, ROWs, and activities under special recreation permits. This alternative would also constrain management actions to emphasize natural conditions. Scientific studies would be limited to those that emphasize the protection, restoration, and/or increased resiliency of native ecosystems.

- Recreation Areas: Recreational uses would be limited in intensity and density through establishment of a GSENM-wide ERMA, which may include fee or permit requirements.
- OHV Use: This alternative would designate more lands as closed to OHV use than any other alternative. Recreational access would be limited to the designated roads. Designated road density would be minimized and siting criteria would be identified to ensure the protection, restoration, and/or increased resiliency of GSENM objects and values. All travel, including foot traffic, would be limited to designated trails and use areas.
- Target Shooting: Target shooting would not be allowed anywhere within the boundaries of GSENM.
- Recreational Facilities: Existing recreational facilities could be maintained and improved; no new recreation facilities would be allowed unless they contribute to the protection of GSENM objects and values.
- Livestock Grazing: Livestock grazing would be limited to grazing permits where the primary purpose is the protection, restoration, and/or increased resiliency of GSENM objects and values (e.g., for vegetation management purposes). No new range improvements would be authorized. Existing range improvements would be removed unless they would protect, restore, and/or increase resiliency of GSENM objects and values.
- Vegetation Management: Vegetation management methods would prioritize natural processes and techniques over other methods.
- Other Discretionary Actions: No new ROWs would be authorized. Access ROWs to private inholdings would be authorized, if required by law or regulation.
- Lands with Wilderness Characteristics: Lands with wilderness characteristics would be managed the same as Alternative D.
- Transportation and access: Primary routes could be maintained and improved to meet public health and safety needs.

7.8 ADDITIONAL POTENTIAL ALTERNATIVES

- The BLM is interested in additional potential alternatives from the public, Tribal Nations, and State and local government (e.g., a local government alternative that seeks to maximize the extent of consistency between BLM's plan and the local government plans) for consideration in the land use planning effort.

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Appendix A

Presidential Proclamations

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Proclamation 10286
October 8, 2021

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Presidential Documents

Proclamation 10286 of October 8, 2021

Grand Staircase-Escalante National Monument

By the President of the United States of America

A Proclamation

President Clinton's designation of the Grand Staircase-Escalante National Monument in Proclamation 6920 of September 18, 1996, was a watershed moment for conservation in the United States. Proclamation 6920 represents the first time a President designated a national monument under the Antiquities Act to be managed by the Bureau of Land Management, signaling the dawn of the modern era of Antiquities Act protection and a reawakening of conservation efforts on public lands in the West.

Proclamation 6920 describes the rich mosaic of objects of historic and scientific interest across Grand Staircase-Escalante. Proclamation 6920 details the monument's varied geology, from the cliffs of the Grand Staircase in the west, to the fossil-rich formations in the Kaiparowits Plateau that demonstrate billions of years of geology infused with world-class paleontological sites, to the badlands of the Burning Hills in the center, to the intricate and complex system of canyons in the Escalante region in the east. The proclamation goes on to describe the area's rich human history, spanning from the indigenous people and cultures who made this area home to Anglo-American explorers and early Latter-day Saint pioneers. The proclamation further identifies outstanding biological resources, describing the monument as "in the heart of perhaps the richest floristic region in the Intermountain West," spanning five life zones and supporting diverse, rare, and endemic populations of plants and a diversity of animals, as well as unusual and diverse soils that support communities of mosses, lichens, and cyanobacteria. In addition, the proclamation describes the vast opportunities for additional scientific research and discovery within the monument. Grand Staircase-Escalante has become the focus of a multi-disciplinary study of its large landscape for the benefit of current and future generations.

After the monument was established, the Congress adjusted the boundaries or ratified the acquisition of additional lands within the monument on three separate occasions, in some cases adding lands, in other cases subtracting lands. When the Congress had completed its fine-tuning, it had increased the monument's reservation by more than 180,000 acres, bringing the total Federal lands within the monument boundaries to approximately 1.87 million acres.

Remarkably, given its size, in the 25 years since its designation, Grand Staircase-Escalante has fulfilled the vision of an outdoor laboratory with great potential for diverse and significant scientific discoveries. During this period, hundreds of scientific studies and projects have been conducted within the monument, including investigating how the monument's geology provides insight into the hydrology of Mars; discovering many previously unknown species of dinosaurs, some of which have become household names; unearthing some of the oldest marsupial fossils ever identified; conducting extensive inventories of invertebrates, including the identification of more than 600 species of bees, some of which likely exist nowhere else on Earth; performing hydrologic research in the Escalante River and Deer Creek; studying and restoring habitat for amphibians, mammals, and bird species, including the reintroduction of bighorn sheep and pronghorn

to their native range; completing rangeland science assessments, including a complete Level III soils survey; carrying out widespread archaeological surveys that have documented important sites and rock writings; and implementing social science projects related to visitor experiences and impacts. New scientific discoveries are likely just around the corner; for example, scientists have collected thousands of specimens of invertebrates from the monument that await further study and are expected to yield new species that are endemic to the monument. Scientists have utilized every corner of the monument in their efforts to better understand our environment, our history, our planet's past, and our place in the universe.

On December 4, 2017, President Donald Trump issued Proclamation 9682 to reduce the monument by over 860,000 acres. Proclamation 9682 removes protection from objects of historic and scientific interest across the Grand Staircase-Escalante landscape, including some resources Proclamation 6920 specifically identifies for protection. Multiple parties challenged Proclamation 9682 in Federal court, asserting that it exceeded the President's authority under the Antiquities Act.

Restoring the Grand Staircase-Escalante National Monument to its size and boundaries as they existed prior to December 4, 2017, will ensure that this exceptional and inimitable landscape filled with an unparalleled diversity of resources will be properly protected and will continue to provide the living laboratory that has produced so many dramatic discoveries in the first quarter century of its existence. Given the unique nature of the objects identified across the Grand Staircase-Escalante landscape, the threat of damage and destruction to those objects, and the current inadequate protection they are afforded, a reservation of this size is the smallest area compatible with the proper care and management of the objects of historic and scientific interest named in this proclamation and Proclamation 6920.

The entire Grand Staircase-Escalante landscape—stretching from Skutumpah Terrace and the escarpments of the Grand Staircase in the west, Nipple Bench, Smoky Mountain, the Burning Hills, Grand Bench, the East and West Clark Benches, and Buckskin Mountain in the south, the Hole-in-the-Rock Trail that runs through the Escalante Desert, Upper Escalante Canyons, and Circle Cliffs in the northeast, and Alvey Wash and the Blues in the north—is an object of historic and scientific interest requiring protection under the Antiquities Act. There are innumerable objects of historic or scientific interest within this extraordinary landscape. Some of the objects are also sacred to Tribal Nations, rare, fragile, or vulnerable to vandalism and theft, or are dangerous to visit and, therefore, revealing their specific names and locations could pose a danger to the objects or the public.

High, rugged, and remote, the vast and austere Grand Staircase-Escalante landscape is characterized by bold plateaus and multihued cliffs that run for distances that defy human perspective. It is also home to world-famous slot canyons that are so deep and narrow that sunlight almost never penetrates their ultimate depths, and pools of numbingly cold water remain throughout the hottest months. Despite being the last place in the contiguous United States to be mapped and remaining a remote and primitive landscape to this day, the Grand Staircase-Escalante area has a long and dignified human history. The landscape teems with evidence of the efforts expended by both indigenous people and early Anglo pioneers to carve existences into an arid and unforgiving region. The Grand Staircase-Escalante region retains the frontier character of the American West, providing visitors with an opportunity to experience a remote landscape rich with opportunities for adventure and self-discovery. It is unique and rare in today's world to encounter a place where one can wander and ponder undisturbed, and explore and discover at one's own pace. It also serves as an outdoor laboratory on the frontier of scientific research that continues to regularly reveal important insights into our planet and our past.

The Grand Staircase-Escalante landscape is a geologic treasure of clearly exposed stratigraphy and structures. The sedimentary rock layers are relatively undeformed and unobscured by vegetation, offering a clear view to understanding the Earth's geological development. Owing in large part to the exposure of so many formations, the landscape is one of the world's great paleontological laboratories. From remarkable specimens of petrified wood, to the most continuous record of Late Cretaceous life, to the first evidence that tyrannosaurs hunted in packs, to marble-like iron oxide concretions found in Navajo Sandstone that provide insight into Martian geology, the ongoing discoveries on the Grand Staircase-Escalante landscape continue to make invaluable contributions to our understanding of the planet's past. Despite the abundance of paleontological discoveries that have occurred on the landscape, and the wealth of information they have provided about the entire Mesozoic Era, it is likely that we have thus far uncovered only a fragment of Grand Staircase-Escalante's paleontological story.

Rich in human history, the Grand Staircase-Escalante landscape abounds in evidence of habitation by the Ancestral Pueblo and Fremont cultures. Tribal Nations, including the Hopi Tribe, the Kaibab Band of Paiute Indians, the Navajo Nation, the Paiute Indian Tribe of Utah, the San Juan Southern Paiute Tribe of Arizona, the Pueblo of Acoma, the Pueblo of San Felipe, the Pueblo of Tesuque, and the Pueblo of Zuni, have ancestral, cultural, or historical ties to this area and continue to use the area to this day. The Southern Paiute people in particular hold these lands sacred as they make up a portion of their traditional homeland. The landscape has also played an important role in European settlement of the American West. In 1776, the Dominguez-Escalante expedition may have passed through the region, and subsequent travelers on the Armijo Route of the Old Spanish Trail journeyed up the Paria River, through Cottonwood Canyon and the Cockscomb, and to the west through Kimball Valley and along parts of Telegraph Flat below the Vermillion Cliffs. The John Wesley Powell expedition created some of the earliest maps of the area in 1872, and later that decade, Latter-day Saint pioneers literally etched portions of the Hole-in-the-Rock Trail across the desert in their efforts to settle southern Utah.

The landscape is also an outstanding biological resource. As a result of the blending of warm and cold desert flora and the high number of endemic species, the Grand Staircase-Escalante landscape, which contains 50 percent of Utah's rare flora and 125 species of plants that occur only in Utah or on the Colorado Plateau, is one of the most floristically rich regions in the Intermountain West. An abundance of unique, isolated plant communities can be found, such as hanging gardens, tinajas, and rock crevice, canyon bottom, and dunal pocket communities. Large expanses of various exposed geologic strata, each with unique physical and chemical characteristics, have resulted in a spectacular array of unusual and diverse soils, including desert pavement and biological soil crusts, which support a wide range of vegetative communities, such as relict plant communities that have existed since the Pleistocene, and a multitude of endemic plants and pollinators. For example, lands within the Grand Staircase-Escalante landscape contain an astounding biodiversity of bees due, in large part, to the substantial elevational gradient, diversity of habitats, and abundance of flowering plants. The area is home to hundreds of bee species, including dozens of species that are believed to be unique to this landscape. Many of the species found in the Grand Staircase-Escalante region are highly localized, with small populations occurring in only a few locations or near certain flowering plants. Wildlife also flourishes; from mountain lion, bear, pronghorn, and desert bighorn sheep, to hundreds of species of birds, the landscape's location and the great variation in its elevation and topography have created a unique environment where suitable habitat exists for species associated with multiple eco-regions.

The Grand Staircase-Escalante's large, isolated, and, at times, impenetrable landscape is one of the most naturally dark outdoor spaces left in America, providing views of the cosmos that are nearly unrivaled in the contiguous

United States, and an opportunity for visitors to encounter a landscape at night, undisturbed by electric lights, in the same way people have experienced the West for most of America's history. According to recent research, over 90 percent of the landscape, or nearly 1.7 million acres, contains pristine night skies, meaning that observers would see no indication of artificial skyglow anywhere in the night sky. Only natural sources of light are visible to the human eye, such as starlight, airglow, aurora, and zodiacal light. Comparatively, less than one third of the land area of the United States regularly experiences this degree of natural darkness, and most of that land is located in Alaska. The Grand Staircase-Escalante area also provides a remarkable natural soundscape with infrequent human-caused sounds. From popular recreational destinations to remote, isolated locations, acoustic baseline research has found that some of the quietest conditions found in protected areas across the United States can be found in the Grand Staircase-Escalante landscape.

The Grand Staircase-Escalante landscape is akin to a nesting doll of objects of historic and scientific interest. The landscape as a whole is an important object that provides context for each of its constituent parts. Within the whole are distinct and unique areas, which are themselves objects qualifying for protection. In turn, each of those areas contain innumerable individual fossils, archaeological sites, rare species, and other objects that are independently of historic or scientific interest and require protection under the Antiquities Act.

Located in the northeast corner of the Grand Staircase-Escalante landscape adjacent to Capitol Reef National Park is the Circle Cliffs area, which is dominated by a northwest-trending sandstone anticline and dramatic red sandstone cliffs. The area also encompasses several sky islands, including Studhorse Peaks, Colt Mesa, and Deer Point, the latter of which provides exquisite views of Waterpocket Fold—a stunning fold in the area's geologic layers that is the central feature of Capitol Reef National Park. The ecologically intact region provides important winter habitat for elk and contains a significant number of cultural sites used by Ancestral Pueblos and the Fremont. Specimens of petrified wood can be found across the Circle Cliffs area, including in the well-known Wolverine Petrified Wood Area, which includes some largely intact logs nearly 100 feet in length. Additionally, the Circle Cliffs landscape is rich in paleontological resources. The area, with geology dating back to the Triassic and Permian Periods, contains at least 45 known paleontological sites, including one in which a nearly complete articulated skeleton of *Poposaurus*—a rare bipedal crocodilian from the Late Triassic Period—was found. The Circle Cliffs landscape also contains portions of the Burr Trail, a route originally blazed by stockman John Atlantic Burr that is now a Utah Scenic Backway offering remarkable views of the Waterpocket Fold, the Henry Mountains, and the Boulder Mountain area of the Aquarius Plateau.

West of the Circle Cliffs and bisected by the Escalante River is the awe-inspiring Upper Escalante Canyons landscape. In this region, vivid geological features are laid bare in narrow, serpentine canyons, where erosion has exposed rolling expanses of petrified dunes and rock striations in shades of red, salmon, white, buff, and rust. The area's resources are almost too numerous to name. There are natural bridges and arches, such as Maverick Natural Bridge and Phipps Arch, the 130-foot tall Escalante Natural Bridge, and Bowington Arch; a large and unusual circular erosional sandstone formation that has sparked the public's imagination, as evidenced by its many names, including the Cosmic Navel; and several world-class slot canyons that draw adventurers from the world over, such as the Dry Fork of Coyote Gulch, Brimstone Canyon, Peek-a-boo Canyon, Spooky Gulch, Zebra and Tunnel Slot Canyons, and the Egypt Slots. The Escalante Canyons landscape also contains a high density of Fremont prehistoric sites, such as pithouses, villages, and storage cysts. The area's many canyons contain a world-class density and variety of Fremont, Ancestral Pueblo, and Southern Paiute rock writings, including a panel that is particularly meaningful to Tribal Nations

with ancestral and historical ties to the area and another panel containing polychromatic depictions of long, linear figures that may date back to the Archaic period. The Escalante Canyons landscape also contains many inscriptions left by early settlers of European descent and significant historic sites telling tales of the region's more recent past, such as the Boulder Mail Trail, which was used to ferry mail between the small desert outpost towns of Escalante and Boulder beginning in 1902. The Boulder Mail Trail intersects incredibly scenic canyons that empty into the Escalante River. The narrow sandstone walls of Sand Creek shade a perennial stream that meanders through cool pools and supports riparian habitat and hanging gardens. Perennial flows are also found in Death Hollow, a stunning canyon chiseled into yellow and white Navajo Sandstone that is narrow and extraordinarily deep in its upper reaches before transitioning near the Boulder Mail Trail into a wider canyon dotted with ponderosa pine and riparian habitat. As a result of the abundance of water in tributaries of the Escalante River, as well as various seeps and springs, the Escalante Canyons area is dotted with hanging gardens, tinajas, and riparian vegetation that provide oases of sorts in an otherwise arid environment. The area is distilled to its essence in Calf Creek Canyon, the home of towering Navajo Sandstone cliffs, lush vegetation, cultural sites, and a perennial stream with two waterfalls: a slender 88-foot plunge in the upper part of the canyon, and a 126-foot cascade farther downstream that is one of the more elegant waterfalls in the entire Southwest. The upper part of the watershed is strewn with black basalt boulders and expanses of iron concretion sheets.

To the southeast of the Upper Escalante Canyons, adjacent to Capitol Reef National Park and Glen Canyon National Recreation Area, is a region with a rich pioneer history that functions as a gateway to the many slot canyons and arches near the Escalante River. Traversing the area is the historically significant Hole-in-the-Rock Road, which generally follows the route that Latter-day Saint pioneers constructed between 1879 and 1880 when crossing southern Utah to establish a wagon route between Escalante and southeast Utah settlements. Today, the road provides access to many of the landscape's resources, including Devil's Garden, an area with hoodoos, colorful rock formations, and unique sandstone arches like the impressively delicate Metate Arch; the small but attractive Little Jumbo Arch; the widely photographed Sunrise and Sunset arches; and Chimney Rock, a remote, lonely sandstone pillar that seems to defy its otherwise flat surroundings. This area is also the location of Dance Hall Rock, an important landmark where Latter-day Saint pioneers camped and held meetings and dances when constructing the Hole-in-the-Rock Trail. These uncompromising desert lands are home to high concentrations of rare species of bees with fascinating adaptations to their local environment, such as *Diadasia* bees, which build nests in the hard desert soil that feature a clay chimney on top, an architectural design that has, thus far, stumped scientists trying to understand its utility. Consisting of rock primarily from the Jurassic Period, there are many paleontological sites in this region. Among those, the sprawling Twentymile Wash Dinosaur Megatrackway consists of more than several hundred individual dinosaur tracks and what some scientists believe is a rare, mid-line tail-drag impression left in the Escalante Member of the Entrada Formation by a sauropod, or long-necked dinosaur.

At the center of the Grand Staircase-Escalante landscape is the Kaiparowits Plateau, containing roughly 1,600 square miles of sedimentary rock that towers over the surrounding area. The plateau is bordered on the east side by the Straight Cliffs, which stretch from near the beginning of the Escalante River to Fiftymile Mountain, and on the west by the East Kaibab Monocline, better known as the Cockscomb. The area is made up of steep-walled canyons, escarpments, towers, arches, and a series of benches that ascend from the southern border of the Grand Staircase-Escalante landscape. The Cockscomb is formed by parallel ridges with an intersecting steep v-shaped trough, and flatirons, small monoliths, and other colorful formations along the western ridge. The plateau has evidence of thousands of years

of human habitation with sites attributed to many prehistoric cultures in southern Utah. Bighorn sheep and pronghorn have historically roamed the Kaiparowits Plateau—as evidenced by the area's petroglyph and pictograph panels—and reproducing populations have been reintroduced in recent years. The area is also home to a small population of chuckwalla and a population of desert night lizard, a species rarely seen in Utah.

The stratified geology of the Kaiparowits Plateau exposes fossils and other indicia of hundreds of millions of years of our planet's history, the only evidence in our hemisphere of mammals from the Cenomanian through Santonian ages and one of the world's best and most continuous records of Late Cretaceous terrestrial life. To date, many thousands of fossil sites have been documented on the plateau, including evidence of at least 15 previously unknown species of dinosaur. Fossils are preserved in stunning detail rarely seen in North America, including traces of soft tissue and the impressions of skin, beaks, and claws. The plateau contains a diverse assemblage of Campanian fauna, including a remarkable record of vertebrate species that include many new taxa and new temporal and geographic occurrences, thereby making the Kaiparowits Plateau an important scientific resource providing insight to the Late Cretaceous biosphere.

The Kaiparowits Plateau comprises multiple geological formations. The Kaiparowits and Wahweap Formations contain diverse and unique fossil evidence of ancient fauna and flora, including pterosaurs, frogs, salamanders, and snakes, that are fundamentally different from discoveries in other parts of North America. The Kaiparowits Formation has produced many ancient vertebrate taxa that are entirely new to science, including a vast array of horned dinosaurs, such as the *Nasutoceratops*, *Kosmoceratops*, and *Utahceratops*, a new species of *Gryposaurus* possessing a more robust skull, a new raptor, and the tyrannosaurid *Teratophoneus*. It has also produced evidence of a potentially new crested duck-billed dinosaur and incredibly diverse vegetative communities with previously undescribed fossil trees and aquatic plants. In 2018, researchers recovered the *Akainacephalus*, which is the most complete ankylosaur ever recovered in the southwestern United States. Exploration of the Wahweap Formation, while still in early stages, has led to striking Mesozoic Era discoveries, including the horned dinosaur *Diabloceratops* and the tyrannosaurid *Lythronax*. Similarly, the Dakota Formation contains some of the earliest evidence of mammals in the fossil record, and the Tropic Shale Formation includes important marine reptiles such as five species of plesiosaur and North America's oldest mosasaur. There are at least two mass mortality sites on the Kaiparowits Plateau, including the Rainbows and Unicorns site, which preserves the relatively complete remains of at least four tyrannosaurs ranging in age from juvenile to large adult, indicating that tyrannosaurs may have been social hunters and engaged in extended parental care, and Uncle Charley's Bonebed, which produced the fossilized remains of extinct tortoises, many of which had soft tissue preservation of skin and claws, and one of which even had a clutch of eggs preserved in its carapace. In addition, petrified wood from the Late Jurassic and Late Cretaceous Periods is found in the Morrison, Wahweap, and Kaiparowits Formations. The plateau also has an expansive exposure of a unique deposit of fossil oyster beds up to six feet thick from the Cretaceous Period, along with other marine mollusk shells.

The eastern portion of the Kaiparowits Plateau is dominated by Fiftymile Mountain and Fiftymile Bench. The upper elevations of these bench lands contain rich and varied ecosystems that include pinyon and juniper woodlands, ponderosa pine forests, and aspen groves. The area is dissected by a labyrinth of picturesque canyons, many of which contain important riparian ecosystems. The Fiftymile Mountain area has a high density of archaeological sites, including masonry structures, which have architectural styles suggesting that the Virgin Branch and Kayenta Branch of Ancestral Pueblos and the Fremont culture converged in the area. There are also sites considered sacred to several Tribal Nations with historical or ancestral ties to the Grand Staircase-Escalante region. This area further contains evidence of

early pioneers who tried to scratch out a life on the sparse landscape, including historic cabins, fences, and stock trails. The sagebrush steppe ecosystem of Fiftymile Bench provides views of Window Wind Arch and striking vistas of the skyscraper-like escarpment that is the eastern face of the Straight Cliffs. The Straight Cliffs Formation, which is particularly exposed in this part of southern Utah, is rich with fossil resources containing evidence of primitive mammals, as well as straight cone cephalopods, ammonites, gastropods, pelecypods, and Cretaceous shark teeth. The Straight Cliffs also contain many clusters of balanced or pedestal rocks, known as hoodoos. Sooner Rocks, at the base of the Straight Cliffs, provides outstanding examples of the geologic feature known as "mega-potholes" that are more often found in some of the sandstone formations in and around Glen Canyon.

Grand Bench lies on the southeastern border of the Kaiparowits Plateau between the Burning Hills to the west and Fiftymile Mountain to the east. The sparse road network in Grand Bench makes it one of the most remote locations in the Grand Staircase-Escalante, with largely unspoiled and unimpeded views of the night sky. The Grand Bench area is also home to the mostly freestanding Woolsey Arch, as well as many recorded paleontology sites found in its Cretaceous and Jurassic Period rocks, including petrified wood and important fossils.

The Smoky Mountain area just west of Grand Bench on the Kaiparowits Plateau provides a striking scene. The steep and rugged hilltops of the Burning Hills have been scorched red by naturally occurring underground coal fires that have been smoldering for hundreds, if not thousands, of years. Similarly, Smoky Mountain is dotted with natural chimneys that release hot smoke and sulfuric gasses from the coal fires below. Despite the hostile environment, this area is home to a number of rare and endemic plant species, including Atwood evening primrose and Smoky Mountain globemallow, as well as a thriving herd of desert bighorn sheep and nesting areas for a high density of raptors.

The lower benches of the Kaiparowits Plateau, including John Henry Bench, Tibbet Bench, Nipple Bench, and Jack Riggs Bench, lie to the west of Smoky Mountain and provide important habitat for big game, including desert bighorn sheep and pronghorn, and sweeping views to the south. The Cretaceous Wahweap Formation runs through the area and has been the site of many important fossil finds, including turtle shells, dinosaurs, and crocodile teeth. Just west of Nipple Bench are the Wahweap Hoodoos, ghostly white formations with brown capstones that can appear to float in the right conditions.

Alvey Wash is situated in the northern part of the Kaiparowits Plateau, close to the Straight Cliffs, and north of Death Ridge. In addition to providing access to the interior of the Kaiparowits Plateau, the Alvey Wash area contains geologic objects of historic and scientific interest, including various arches and portions of the Smoky Mountain Road State Scenic Backway, a remote, unpaved route that offers unparalleled views of Lake Powell and the Kaiparowits Plateau. The region's fossil-rich Cretaceous rocks contain more than a hundred known recorded paleontological sites. Alvey Wash, which likely acted as an important travel route between the Escalante River and the top of the Kaiparowits Plateau, also contains several important Fremont and Ancestral Pueblo sites, including rock writings, rock shelters, cliffside storage structures, and pithouses.

In the northern part of the landscape, east of the towns of Tropic and Cannonville, are the Blues, an area named for the blue-grey sandstone that provides a striking contrast against the forested uplands and the pink and white cliffs of Powell Point towering in the background. The velvety gray slopes of these shale badlands include exposures of the Kaiparowits Formation that are unique on the Colorado Plateau. Representing rapid accumulation of sediment during the Late Cretaceous Period, the stratigraphy has facilitated the discovery of a diversity of fossils, including early mammals,

lizards, dinosaurs, crocodilians, turtles, mollusks, and some fossils found nowhere else on Earth, including one of the largest oviraptors ever discovered. This area may also provide habitat for many raptor species, including Swainson's hawks, golden eagles, and peregrine falcons.

South of the Blues, the Butler Valley area provides jaw-dropping views of multi-colored sandstone cliffs to the north and contains important microvertebrate fossil localities in the Smoky Hollow Member of the Straight Cliffs Formation found near the upper reaches of Wiggler Wash. Also nearby is Grosvenor Arch, a rare double arch with sandstone buttresses that soars 150 feet in the air, as well as the tight canyons of Butler Valley and Round Valley Draw.

To the west of the Cockscomb lies the Hackberry Canyon area, with a deep gorge containing towering Wingate Sandstone cliffs and impressive narrows, and Yellow Rock, a smooth-sided dome that obtains its unique appearance from evaporated pools of water and the presence of limonite in its swirling Navajo Sandstone. With limited vegetation, Yellow Rock provides a commanding view of Hackberry Canyon to the north, the Paria River to the west, and the Cockscomb to the east. The area's high scenic quality is further enhanced by a number of towering arches, including Sam Pollock Arch, which spans 70 feet in a tributary of Hackberry Canyon. The Hackberry Canyon area contains Virgin Branch of Ancestral Pueblo sites, such as rock shelters, pithouses, lithic scatters, and masonry structures, as well as rock writings that can be found in side canyons. Hackberry Canyon also contains evidence of later Anglo habitation, including Watson Cabin, a one-room log cabin with a fieldstone chimney that was built in the early 1890s and is one of the few standing pioneer structures in the region.

To the west of the Kaiparowits Plateau, the Upper Paria River complex is a highly scenic and colorful maze of canyons, arches, and "hydrothermal-collapse" pipes and dikes that expose the multihued Carmel and Entrada Formations. The area is home to many perennial streams, the Paria River, and hundreds of acres of riparian vegetation, all of which support a particularly rich diversity of terrestrial vertebrate and avian species. Flowing continuously for most of the year thanks to water from the higher elevations in the north and west, the area's perennial streams have left the area dissected with canyons that eventually drain into the Paria River. As the flow increases, the Paria River cuts its way through a series of benches and cliffs that form a portion of the Grand Staircase as it meanders towards its confluence with the Colorado River near Lee's Ferry. For example, there is the spring-fed Willis Creek, which flows year-round through a moderately deep gorge that contains several sections of elegant narrows. Other nearby canyons, although dry most of the year, are subject to extreme erosional events from passing storms, such as Lick Wash, a deep canyon enclosed by horizontally striated white sandstone walls that are hundreds of feet high, and Bull Valley Gorge, an impressively deep and narrow canyon cut through Navajo Sandstone containing a variety of rock formations and colors. The Upper Paria River complex contains paleontological sites found in strata from the Jurassic and Cretaceous Periods. The Paria River corridor is also the site of the Paria ghost town, the only historic townsite in the monument. First settled by Latter-day Saint pioneers in 1865 as a farming community, the town was largely abandoned after a series of floods in the late 1800s, save for a post office, which served the area for many years.

After the Paria River crosses the Cockscomb and enters Cottonwood Canyon, it feeds a rich riparian area that provides important habitat for the endangered southwestern willow flycatcher. Cottonwood Canyon and the nearby Rimrocks area are home to a number of rare plants, such as the Tropic goldeneye and Atwood's pretty phacelia. This area, down to West Clark Bench, is also characterized by high ecological system diversity and is home to a number of rare bee species as well as a number of hot desert endemic species of bees in the northernmost known extent of their range.

The Rimrocks area is home to striking geological formations known as the Toadstool Hoodoos, fascinating features composed of Dakota Sandstone boulders perched precariously atop softer and eroded Entrada Sandstone, and a narrow slot canyon that contains rock writings. Further east, other geological formations include the White Rocks, and to the south, the area around the East and West Clark Benches forms a barren and austere landscape that exposes Jurassic and Cretaceous Period rocks rich in paleontological resources.

On the west side of the landscape is the Grand Staircase, a series of intensely colorful cliffs and plateaus that connect Bryce Canyon to the Grand Canyon. The Grey Cliffs are composed of soft Cretaceous shale and sandstone in subdued shades of gray, brown, and yellow that were deposited approximately 130 million years ago. The White Cliffs are high white or yellow cliffs of Navajo Sandstone that consistently reach heights of more than 1,000 feet. The area is home to rare and endemic bee species, particularly near Timber Mountain. The area also contains a number of relict plant communities on the sky islands of No Man's Mesa and Little No Man's Mesa, whose steep walls have guarded such communities for thousands of years, providing a living window into the past. Further south, the eponymous Vermilion Cliffs, once the shoreline for the ancient Lake Dixie, contain fossilized fish, dinosaurs, and early reptiles, as well as multiple tracksites. The Flag Point tracksite provides an enduring testament to humans' fascination with the traces of epochs past. The site contains a series of theropod tracks leading right to the cliff edge and, nearby, pictographs of the tracks that were likely left by ancient indigenous peoples living in nearby communities. The Grand Staircase area is also replete with evidence of thousands of years of human habitation. Pre-historic projectile points and hunter-gatherer residential pit structures are found in the higher elevations, whereas evidence of some of the earliest corn-related agriculture in the Southwest, developed by the Virgin Branch of Ancestral Pueblos, as well as evidence of the Southern Paiute people, who identify this area as part of their ancestral homeland, are found in the lower elevations. This area also contains a number of other unusual and important resources, including a high density of petrified wood and rare and endemic plant species, such as the Higgins spring parsley and Kane breadroot.

The Buckskin Mountain area, located southeast of the Vermilion Cliffs and west of the Cockscomb, is a unique lithological area, rich in rocks from the Triassic Period and late Paleozoic Era. It also provides winter range for the renowned Paunsaugunt mule deer herd and is the location of the Eagle Sink, a stunning sinkhole where the surrounding limestone collapsed to create an enormous 160-foot depression. The area also contains many Ancestral Pueblo cultural sites and provides access to the primary trailheads used to access Buckskin Gulch—the longest slot canyon in the United States, with walls ascending up to 400 feet—located in the adjacent Paria Canyon-Vermilion Cliffs Wilderness.

Protection of the Grand Staircase-Escalante National Monument will preserve its cultural, prehistoric, and historic legacy and maintain its diverse array of natural and scientific resources, ensuring that the prehistoric, historic, and scientific values of this area remain for the benefit of all Americans. Reservation of these lands will preserve the living laboratory within the monument boundaries that will facilitate significant scientific discoveries for years to come. The area contains numerous objects of historic and scientific interest, and it provides world-class outdoor recreation opportunities, including rock climbing, hunting, hiking, backpacking, canyoneering, river running, mountain biking, and horseback riding, that support a travel and tourism sector that is a source of economic opportunity for the region.

WHEREAS, section 320301 of title 54, United States Code (known as the "Antiquities Act"), 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 Federal Government to be national monuments, and to reserve as a part thereof parcels of land, the limits of which shall be confined to the smallest area compatible with the proper care and management of the objects to be protected; and

WHEREAS, Proclamation 6920 of September 18, 1996, designated the Grand Staircase-Escalante National Monument in the State of Utah and reserved approximately 1.7 million acres of Federal lands as the smallest area compatible with the proper care and management of objects of historic and scientific interest; and

WHEREAS, on three separate occasions the Congress adjusted the boundaries of the monument—the Utah Schools and Lands Exchange Act of 1998, Public Law 105–335, 112 Stat. 3139; title II of Public Law 105–355, 112 Stat. 3247, 3252 (1998); and section 2604 of the Omnibus Public Land Management Act of 2009, Public Law 111–11, 123 Stat. 991, 1120—ultimately increasing the Federal lands reserved for the monument by more than 180,000 acres.

WHEREAS, Proclamation 9682 of December 4, 2017, modifies the management direction of the Grand Staircase-Escalante National Monument and excludes nearly half of the lands reserved in Proclamation 6920, which include lands containing objects of historic and scientific interest that Proclamation 6920 identifies as needing protection, such as portions of Circle Cliffs and Waterpocket Fold; and

WHEREAS, December 4, 2017, was the first time that a President asserted that the Antiquities Act included the authority to reduce the boundaries of a national monument or remove objects from protection under the Antiquities Act since the 1976 passage of the Federal Land Policy and Management Act, as amended (43 U.S.C. 1701 *et seq.*); and

WHEREAS, I find that each of the historic and scientific resources identified above and in Proclamation 6920 are objects of historic or scientific interest in need of protection under 54 U.S.C. 320301; and

WHEREAS, I find that the unique nature of the Grand Staircase-Escalante landscape, and the collection of objects and resources therein, make the entire landscape within the boundaries reserved by this proclamation an object of historic and scientific interest in need of protection under 54 U.S.C. 320301; and

WHEREAS, I find that there are threats to the objects identified in this proclamation and Proclamation 6920; and

WHEREAS, I find, in the absence of a reservation under the Antiquities Act, the objects identified in this proclamation and in Proclamation 6920 are not adequately protected by otherwise applicable law or administrative designations because neither provide the Department of the Interior with the specific mandate to ensure proper care and management of the objects, nor do they withdraw the lands from the operation of the public land, mining, and mineral leasing laws, and so a national monument reservation is necessary to protect the objects of historic and scientific interest in the Grand Staircase-Escalante region for current and future generations; and

WHEREAS, I find that the boundaries of the monument reserved by this proclamation represent the smallest area compatible with the protection of the objects of historic or scientific interest as required by the Antiquities Act; and

WHEREAS, it is in the public interest to ensure the preservation, restoration, and protection of the objects of historic or scientific interest on the Grand Staircase-Escalante lands, including the entire monument landscape, reserved within the boundaries established by this proclamation;

NOW, THEREFORE, I, JOSEPH R. BIDEN JR., President of the United States of America, by the authority vested in me by section 320301 of title 54, United States Code, hereby proclaim the objects identified above and in

Proclamation 6920 that are situated upon lands and interests in lands owned or controlled by the Federal Government to be the Grand Staircase-Escalante National Monument (monument) and, for the purpose of protecting those objects, reserve as part thereof all lands and interests in lands not currently reserved as part of a monument reservation and that are owned or controlled by the Federal Government within the boundaries described on the accompanying map, which is attached to and forms a part of this proclamation. These reserved Federal lands and interests in lands consist of those lands reserved as part of the Grand Staircase-Escalante National Monument as of December 3, 2017, encompassing approximately 1.87 million acres. As a result of the distribution of the objects across the Grand Staircase-Escalante landscape, and additionally and independently, because the landscape itself is an object in need of protection, the boundaries described on the accompanying map are confined to the smallest area compatible with the proper care and management of the objects of historic or scientific interest identified above and in Proclamation 6920.

All Federal lands and interests in lands within the boundaries of the monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or other disposition 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, other than by exchange that furthers the protective purposes of the monument.

This proclamation is subject to valid existing rights. If the Federal Government subsequently acquires any lands or interests in lands not owned or controlled by the Federal Government within the boundaries described on the accompanying map, such lands and interests in lands shall be reserved as a part of the monument, and objects identified above that are situated upon those lands and interests in lands shall be part of the monument, upon acquisition of ownership or control by the Federal Government.

The Secretary of the Interior (Secretary) shall manage the monument through the Bureau of Land Management (BLM), as a unit of the National Landscape Conservation System, and in accordance with the terms, conditions, and management direction provided by this proclamation and, unless otherwise specifically provided herein, those provided by Proclamation 6920, the latter of which are incorporated herein by reference. To the extent any provision of Proclamation 9682 is inconsistent with Proclamation 6920 or this proclamation, the terms of this proclamation and Proclamation 6920 shall govern. To further the orderly management of monument lands, the monument will be managed as a single unit comprising the entire 1.87 million-acre Grand Staircase-Escalante National Monument.

For purposes of protecting and restoring the objects identified above and in Proclamation 6920, the Secretary shall prepare and maintain a new management plan for the entire monument. The Secretary, through the BLM, shall consult with other Federal land management agencies or agency components in the local area, including the National Park Service, in developing the management plan. The Secretary shall provide for maximum public involvement in the development of that plan, including consultation with federally recognized Tribal Nations and State and local governments. In the development and implementation of the management plan, the Secretary shall maximize opportunities, pursuant to applicable legal authorities, for shared resources, operational efficiency, and cooperation.

The Secretary, through the BLM, shall maintain an advisory committee under the Federal Advisory Committee Act (5 U.S.C. App.) with the specific purpose of providing information and advice regarding the development of the management plan and, as appropriate, management of the monument, including scientific research that occurs therein. This advisory committee shall consist of a fair and balanced representation of interested stakeholders, including State and local governments, Tribal Nations, recreational users, conservation organizations, educators, local business owners, private landowners, and the scientific community, which may include members with

expertise in archaeology, paleontology, entomology, geology, botany, wildlife biology, social science, or systems ecology.

Nothing in this proclamation shall be deemed to enlarge or diminish the rights or jurisdiction of any Tribal Nation. The Secretary shall, to the maximum extent permitted by law and in consultation with Tribal Nations, ensure the protection of sacred sites and cultural properties and sites in the monument and provide access to Tribal members for traditional cultural, spiritual, and customary uses, consistent with the American Indian Religious Freedom Act (42 U.S.C. 1996) and Executive Order 13007 of May 24, 1996 (Indian Sacred Sites), including collection of medicines, berries and other vegetation, forest products, and firewood for personal noncommercial use in a manner consistent with the care and management of the objects identified above and in Proclamation 6920.

The Secretary shall manage livestock grazing as authorized under existing permits or leases, and subject to appropriate terms and conditions in accordance with existing laws and regulations, consistent with the care and management of the objects identified above and in Proclamation 6920. Should grazing permits or leases be voluntarily relinquished by existing holders, the Secretary shall retire from livestock grazing the lands covered by such permits or leases pursuant to the processes of applicable law. Forage shall not be reallocated for livestock grazing purposes unless the Secretary specifically finds that such reallocation will advance the purposes of this proclamation and Proclamation 6920.

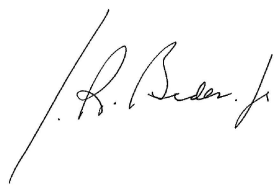
Nothing in this proclamation shall be construed to alter the authority or responsibility of any party with respect to emergency response activities within the monument, including wildland fire response.

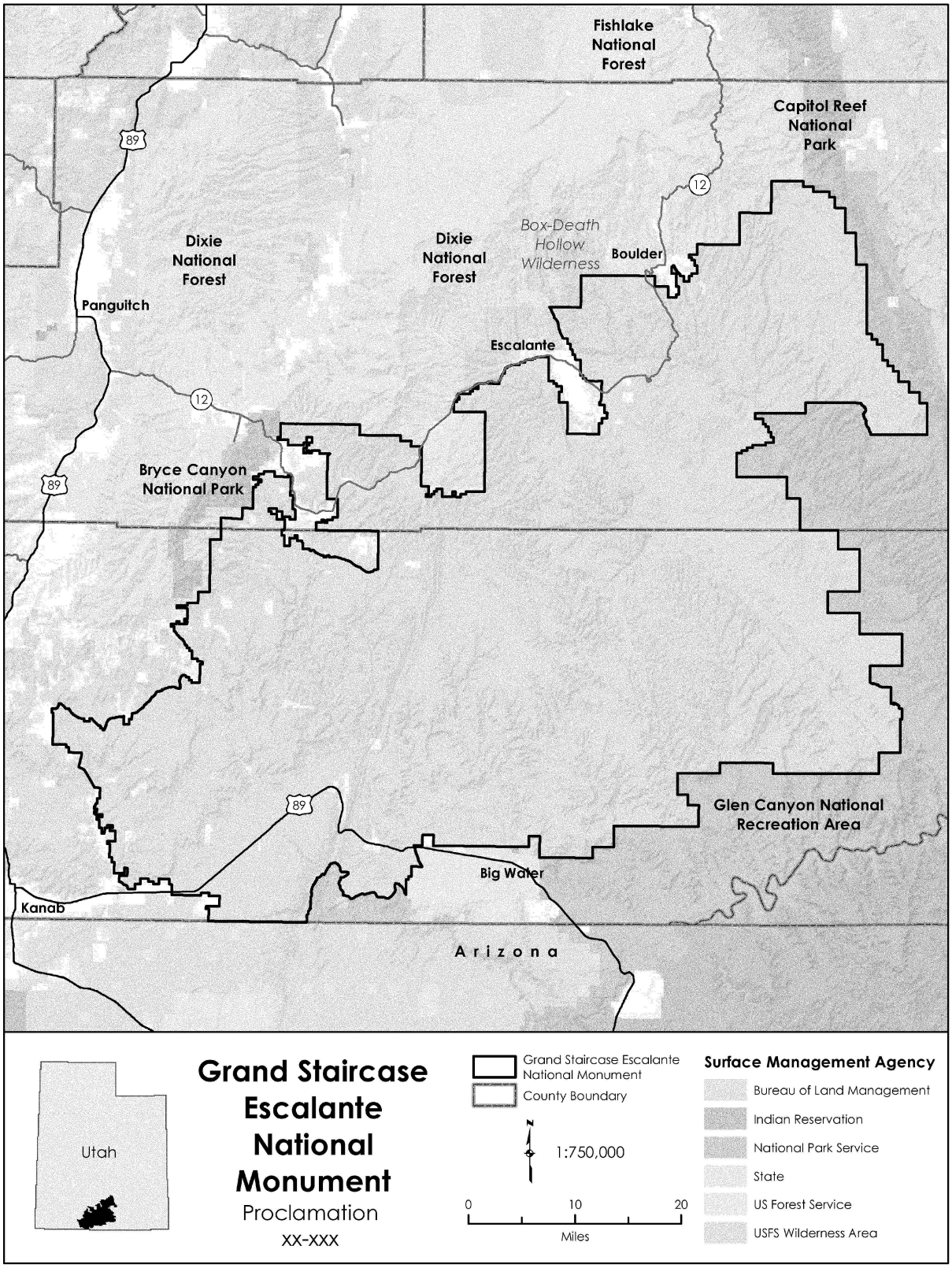
Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of the monument and not to locate or settle upon any of the lands thereof.

If any provision of this proclamation, including its application to a particular parcel of land, is held to be invalid, the remainder of this proclamation and its application to other parcels of land shall not be affected thereby.

IN WITNESS WHEREOF, I have hereunto set my hand this eighth day of October, in the year of our Lord two thousand twenty-one, and of the Independence of the United States of America the two hundred and forty-sixth.





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Proclamation 9682
December 4, 2017

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Presidential Documents

Proclamation 9682 of December 4, 2017

Modifying the Grand Staircase-Escalante National Monument

By the President of the United States of America

A Proclamation

In Proclamation 6920 of September 18, 1996, and exercising his authority under the Act of June 8, 1906 (34 Stat. 225) (the "Antiquities Act"), President William J. Clinton established the Grand Staircase-Escalante National Monument in the State of Utah, reserving approximately 1.7 million acres of Federal lands for the care and management of objects of historic and scientific interest identified therein. The monument is managed by the Department of the Interior's Bureau of Land Management (BLM). This proclamation makes certain modifications to the monument.

Proclamation 6920 identifies a long list of objects of historic or scientific interest within the boundaries of the monument. In the 20 years since the designation, the BLM and academic researchers have studied the monument to better understand the geology, paleontology, archeology, history, and biology of the area.

The Antiquities Act requires that any reservation of land as part of a monument be confined to the smallest area compatible with the proper care and management of the objects of historic or scientific interest to be protected. Determining the appropriate protective area involves examination of a number of factors, including the uniqueness and nature of the objects, the nature of the needed protection, and the protection provided by other laws.

Proclamation 6920 identifies the monument area as rich with paleontological sites and fossils, including marine and brackish water mollusks, turtles, crocodilians, lizards, dinosaurs, fishes, and mammals, as well as terrestrial vertebrate fauna, including mammals, of the Cenomanian-Santonian ages, and one of the most continuous records of Late Cretaceous terrestrial life in the world. Nearly 2 decades of intense study of the monument has provided a better understanding of the areas with the highest concentrations of fossil resources and the best opportunities to discover previously unknown species. While formations like the Wahweap and Kaiparowits occur only in southern Utah and provide an important record of Late Cretaceous fossils, others like the Chinle and Morrison formations occur throughout the Colorado Plateau. The modified monument boundaries take into account this new information and, as described in more detail below, retain the majority of the high-potential areas for locating new fossil resources that have been identified within the area reserved by Proclamation 6920.

Proclamation 6920 also identifies a number of unique geological formations and landscape features within the monument boundaries. These include the Grand Staircase, White Cliffs, Vermilion Cliffs, Kaiparowits Plateau, Upper Paria Canyon System, Upper Escalante Canyons, Burning Hills, Circle Cliffs, East Kaibab Monocline, Grosvenor Arch, and Escalante Natural Bridge, all of which are retained in whole or part within the revised monument boundaries. The Waterpocket Fold, however, is located mostly within the Capitol Reef National Park and the portions within the monument are not unique or particularly scientifically significant. Therefore, the boundaries of the monument may be modified to exclude the Waterpocket Fold without imperiling the proper care and management of that formation. The more general landscape features discussed in the proclamation, such as serpentine

canyons, arches, and natural bridges, are common across the Colorado Plateau both within and outside of the modified boundaries of the monument described below.

Archeological and historic objects identified within the monument are more generally discussed in Proclamation 6920, which specifically identifies only the Hole-in-the-Rock Trail, the Paria Townsite, and Dance Hall Rock as objects of historic or scientific interest, all 3 of which will remain within the revised monument boundaries, although a portion of the Hole-in-the-Rock Trail will be excluded. Proclamation 6920 also describes Fremont and Ancestral Puebloan rock art panels, occupation sites, campsites, and granaries, as well as historic objects such as those left behind by Mormon pioneers, including trails, inscriptions, ghost towns, rock houses, and cowboy line camps. These are artifacts that are known to generally occur across the Four Corners region, particularly in southern Utah, and the examples found within the monument are not, as described, of any unique or distinctive scientific or historic significance. In light of the prevalence of similar objects throughout the region, the existing boundaries of the monument are not "the smallest area compatible with the proper care" of these objects, and they may be excluded from the monument's boundaries. Further, many of these objects or examples of these objects are retained within the modified boundaries described below.

Finally, with respect to the animal and plant species, Proclamation 6920 characterizes the area as one of the richest floristic regions in the Intermountain West, but it identifies only a few specific species as objects of scientific or historic interest. The revised boundaries contain the majority of habitat types originally protected by Proclamation 6920.

Thus, many of the objects identified by Proclamation 6920 are not unique to the monument, and some of the particular examples of those objects within the monument are not of significant historic or scientific interest. Moreover, many of the objects identified by Proclamation 6920 are not under threat of damage or destruction such that they require a reservation of land to protect them; in fact, many are already subject to Federal protection under existing law and agency management designations. The BLM manages nearly 900,000 acres of lands within the existing monument as Wilderness Study Areas, which the BLM is already required by law to manage so as not to impair the suitability of such areas for future congressional designation as Wilderness.

A host of laws enacted after the Antiquities Act provide specific protection for archaeological, historic, cultural, paleontological, and plant and animal resources and give authority to the BLM to condition permitted activities on Federal lands, whether within or outside a monument. These laws include the Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa–470mm, National Historic Preservation Act, 54 U.S.C. 300101 *et seq.*, Bald and Golden Eagle Protection Act, 16 U.S.C. 668–668d, Endangered Species Act of 1973, 16 U.S.C. 1531 *et seq.*, Federal Cave Resources Protection Act of 1988, 16 U.S.C. 4301 *et seq.*, Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701 *et seq.*, Migratory Bird Treaty Act, 16 U.S.C. 703–712, Native American Graves Protection and Repatriation Act of 1976, 25 U.S.C. 3001 *et seq.*, and Paleontological Resources Preservation Act, 16 U.S.C. 470aaa–470aaa–11. Of particular note, the Paleontological Resources Preservation Act, enacted in 2009, imposes criminal penalties for unauthorized excavation, removal, damage, alteration, or defacement of paleontological resources. Federal land management agencies can grant permits authorizing excavation or removal, but only when undertaken for the purpose of furthering paleontological knowledge. The Archaeological Resources Protection Act contains very similar provisions protecting archeological resources. And the Migratory Bird Treaty Act and Endangered Species Act protect migratory birds and listed endangered and threatened species and their habitats.

Especially in light of the research conducted since designation, I find that the current boundaries of the Grand Staircase-Escalante National Monument established by Proclamation 6920 are greater than the smallest area compatible with the protection of the objects for which lands were reserved and, therefore, that the boundaries of the monument should be reduced to 3 areas: Grand Staircase, Kaiparowits, and Escalante Canyons. These revisions will ensure that the monument is no larger than necessary for the proper care and management of the objects.

The Grand Staircase area is named for one of the iconic landscapes in the American West. An unbroken sequence of cliffs and plateaus, considered to be the most colorful exposed geologic section in the world, has inspired wonder in visitors since the days of early western explorers.

The White Cliffs that rise more than 1,500 feet from the desert floor are the hardened remains of the largest sand sea that ever existed. The deep red Vermilion Cliffs, once the eastern shore of the ancient Lake Dixie, contain a rich fossil record from the Late Triassic period to the early Jurassic period, including petrified wood, fish, dinosaur, and other reptilian bones. Fossil footprints are also common, including those at the Flag Point tracksite, which includes dinosaur fossil tracks adjacent to a Native American rock art panel depicting dinosaur tracks. This area also contains a number of relict vegetative communities occurring on isolated mesa tops, an example of which, No Mans Mesa, was identified in Proclamation 6920.

The archaeology of the Grand Staircase area is dominated by sites constructed by the Virgin Branch of the Ancestral Puebloans—ancient horticulturalists and farmers who subsisted largely on corn, beans, and squash, and occupied the area from nearly 2000 B.C.E. to about 1250 C.E. The landscape was also the home of some of the earliest corn-related agriculture in the Southwest, and it continues to hold remnants of these early farmsteads and small pueblos. The evidence of this history, including remnants of the beginning of agriculture, development of prehistoric farming systems, and the final abandonment of the area, is concentrated in the lower levels of the Grand Staircase. The higher cliffs, benches, and plateaus hold evidence of occupation by Archaic and Late Prehistoric people, including Clovis and other projectile points and residential pit structures that indicate occupation by hunter-gatherers starting about 13,000 years ago.

Following the abandonment of the area by Ancestral Puebloans, the area was re-occupied by a new population of hunter-gatherers, the people known today as the Southern Paiute Indians. The Southern Paiute Indians identify this area as part of their ancestral homeland. Still later Mormon pioneers settled the area, as evidenced by remnants of roads, trails, line shacks, rock houses, and abandoned town sites.

The Kaiparowits area is dominated by a dissected mesa that rises thousands of feet above the surrounding terrain. These vast, rugged badlands are characterized by towering cliffs and escarpments that expose tiers of fossil-rich formations.

In addition to striking scenery, the area is world-renowned for rich fossil resources, including 16 species that have been found nowhere else. The plateau is considered one of the best, most continuous records of Late Cretaceous life in the world. It includes fossils of mollusks, reptiles, dinosaurs, fishes, and mammals, as well as the only evidence in our hemisphere of terrestrial vertebrate fauna from the Cenomanian through Santonian ages. Since 2000, nearly 4,000 new fossil sites have been documented on the plateau. The Dakota, Tropic Shale, Wahweap, and Kaiparowits formations in the area have been found to contain numerous important fossils, including those of early mammals and reptiles (Dakota); marine reptiles, including 5 species of plesiosaur and North America's oldest mosasaur (Tropic Shale); and multiple new species of dinosaurs (Wahweap and Kaiparowits), including the *Diabloceratops eatoni,* a relative of the Triceratops named for its devil-like horns, and the *Lythronax argestes,* whose name means "Gore King of the Southwest."

The Kaiparowits area also includes objects of geologic interest, which Proclamation 6920 identified. The rugged canyons and natural arches of the Upper Paria River expose the colorful and varied Carmel and Entrada formations that draw visitors to the area. One of the most famous arches, Grosvenor Arch, is a rare double arch that towers more than 150 feet above the desert floor. The area also contains "hydrothermal-collapse" pipes and dikes that have revealed to researchers a fascinating story of a geologic catastrophe triggered by either a massive earthquake or an asteroid impact.

The western side of the Kaiparowits area includes the majority of the East Kaibab Monocline, which features an erosional "hogback" known as the "Cockscomb," as well as broad exposures of multicolored rocks and intricate canyons. It is considered one of the true scenic and geologic wonders of the area. On the east side of the plateau, the scorched earth of the Burning Hills is a geologic curiosity: a vast underground coal seam that some researchers believe has been burning for eons, sending acrid smoke up through vents in the ground and turning the hillsides brick red. Finally, along the eastern edge of the Kaiparowits Plateau is a series of oddly shaped arches and other rock formations known as the Devil's Garden.

The Kaiparowits area also contains a unique record of human history. The overall archaeology of the Kaiparowits Plateau is dominated by Archaic and Late Prehistoric era sites. There are, however, a few important sites that tell the story of occupation first by the Fremont, who came from an area to the east, and later by Virgin and Kayenta Ancestral Puebloans. These sites show new types of architecture and pottery that mixed traditional Fremont and Ancestral Puebloan styles. Prehistoric cliff structures in parts of the Kaiparowits Plateau are well preserved and provide researchers and visitors an opportunity to better understand the apparently peaceful mixture of 3 cultures starting in the early 1100s. In particular, the Fifty-Mile Mountain area contains hundreds of cultural resource sites, including Ancestral Puebloan habitations, granaries, and masonry structures.

Historical use of the Kaiparowits area plays a very important part in the rich ranching history of southern Utah, which is evidenced by a complex pattern of roads, stock trails, line shacks, attempted farmsteads, and small mining operations. Fifty-Mile Mountain, in particular, contains a number of historic cabins, as well as other evidence of pioneer living, including ruins, rip-gut fences, and historic trails. It is believed that Zane Grey used the Fifty-Mile Mountain area as a landscape reference point when he wrote "Wild Horse Mesa." There are also a number of historic signature panels across the plateau that document continued grazing and ranching use of the landscape by multiple generations of the same families.

To the east of Fifty-Mile Mountain in the Escalante Desert, Dance Hall Rock stands out as an important landmark of Mormon pioneers. While the Hole-in-the-Rock Trail was under construction in 1879, Mormon pioneers camped in this area and held meetings and dances here. Similarly, as described above, the old Paria Townsite is an important ghost town within the Kaiparowits area, as it served as the only town and post office site within the area at the turn of the 20th century.

The Escalante Canyons area likewise contains objects of significance. The canyonlands of the area provide a fantastic display of geologic activities and erosional forces that, over millions of years, created a network of deep, narrow canyons, high plateaus, sheer cliffs, and beautiful sandstone arches and natural bridges, including the 130-foot-tall Escalante Natural Bridge. Additionally, this area boasts Calf Creek Canyon, a canyon of red alcoved walls with expanses of white slickrock that is named for its use as a natural cattle pen at the end of the 19th century.

To the east of the Canyonlands, Circle Cliffs is a breached anticline with spectacular painted-desert scenery, the result of exposed sedimentary rocks of the Triassic Chinle and Moenkopi formations. The Circle Cliffs area also contains large, unbroken petrified logs up to 30 feet in length. A

nearly complete articulated skeleton of Poposauras—a rare bipedal crocodilian fossil—was also found here.

The Escalante Canyons area also contains a high density of Fremont prehistoric sites, including pithouses, villages, storage cysts, and rock art. The canyon of the Escalante River and its tributary canyons contain one of the highest densities of rock art sites in southwestern Utah outside of Capitol Reef National Park, with sites dating from the Archaic to the Historic periods. The Hundred Hands rock art panel is located in the river canyon, and is spiritually significant to all tribes that claim ancestry in the area.

There are also significant historic sites in this area related to grazing and ranching, along with the Boulder Mail Trail, which was used to ferry mail between the small desert outpost towns of Escalante and Boulder beginning in 1902. Today, much of the trail is still visible, and it has become popular with backpackers.

The areas described above are the smallest compatible with the proper care and management of the objects to be protected. The Grand Staircase-Escalante National Monument, as modified by this proclamation, will maintain and protect those objects and preserve the area's cultural, scientific, and historic legacy.

WHEREAS, Proclamation 6920 of September 18, 1996, established the Grand Staircase-Escalante National Monument in the State of Utah and reserved approximately 1.7 million acres of Federal lands for the care and management of the objects of historic and scientific interest identified therein; and

WHEREAS, many of the objects identified by Proclamation 6920 are otherwise protected by Federal law; and

WHEREAS, it is in the public interest to modify the boundary of the monument to exclude from its designation and reservation approximately 861,974 acres of land that I find are no longer necessary for the proper care and management of the objects to be protected within the monument; and

WHEREAS, the boundaries of the monument reservation should therefore be reduced to the smallest area compatible with the protection of the objects of scientific or historic interest, as described above in this proclamation;

NOW, THEREFORE, I, DONALD J. TRUMP, President of the United States of America, by the authority vested in me by section 320301 of title 54, United States Code, hereby proclaim that the boundary of the Grand Staircase-Escalante National Monument is hereby modified and reduced to those lands and interests in lands owned or controlled by the Federal Government within the boundaries described on the accompanying map, which is attached to and forms a part of this proclamation. I hereby further proclaim that the modified monument areas identified on the accompanying map shall be known as the Grand Staircase, Kaiparowits, and Escalante Canyons units of the monument. These reserved Federal lands and interests in lands cumulatively encompass approximately 1,003,863 acres. The boundaries described on the accompanying map are confined to the smallest area compatible with the proper care and management of the objects to be protected.

Any lands reserved by Proclamation 6920 not within the boundaries identified on the accompanying map are hereby excluded from the monument.

At 9:00 a.m., eastern standard time, on the date that is 60 days after the date of this proclamation, subject to valid existing rights, the provisions of existing withdrawals, and the requirements of applicable law, the public lands excluded from the monument reservation shall be open to:

(1) entry, location, selection, sale or other disposition under the public land laws;

(2) disposition under all laws relating to mineral and geothermal leasing; and

(3) location, entry, and patent under the mining laws.

Appropriation of lands under the mining laws before the date and time of restoration is unauthorized. Any such attempted appropriation, including attempted adverse possession under 30 U.S.C. 38, shall vest no rights against the United States. Acts required to establish a location and to initiate a right of possession are governed by State law where not in conflict with Federal law.

Nothing in this proclamation shall be construed to revoke, modify, or affect any withdrawal, reservation, or appropriation, other than the one created by Proclamation 6920.

Nothing in this proclamation shall change the management of the areas designated and reserved by Proclamation 6920 that remain part of the monument in accordance with the terms of this proclamation, except as provided by the following 5 paragraphs:

Paragraph 14 of Proclamation 6920 is updated and clarified to require that the Secretary of the Interior (Secretary) prepare and maintain a management plan for each of the 3 units of the monument with maximum public involvement including, but not limited to, consultation with federally recognized tribes and State and local governments. The Secretary, through the BLM, shall also consult with other Federal land management agencies in the local area in developing the management plans.

Proclamation 6920 is amended to provide that the Secretary shall maintain one or more advisory committees under the Federal Advisory Committee Act (5 U.S.C. App.) to provide information and advice regarding the development of the above-described management plans, and, as appropriate, management of the monument. Any advisory committee maintained shall consist of a fair and balanced representation of interested stakeholders, including State and local governments, tribes, recreational users, local business owners, and private landowners.

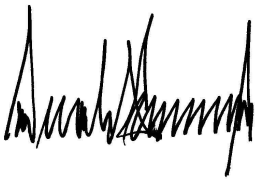
Proclamation 6920 is clarified to provide that, consistent with protection of the objects identified above and other applicable law, the Secretary may allow motorized and non-mechanized vehicle use on roads and trails existing immediately before the issuance of Proclamation 6920 and maintain roads and trails for such use.

Paragraph 12 of Proclamation 6920 governing livestock grazing in the monument is hereby modified to read as follows: "Nothing in this proclamation shall be deemed to affect authorizations for livestock grazing, or administration thereof, on Federal lands within the monument. Livestock grazing within the monument shall continue to be governed by laws and regulations other than this proclamation."

Proclamation 6920 is amended to clarify that, consistent with the care and management of the objects identified above, the Secretary may authorize ecological restoration and active vegetation management activities in the monument.

If any provision of this proclamation, including its application to a particular parcel of land, is held to be invalid, the remainder of this proclamation and its application to other parcels of land shall not be affected thereby.

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



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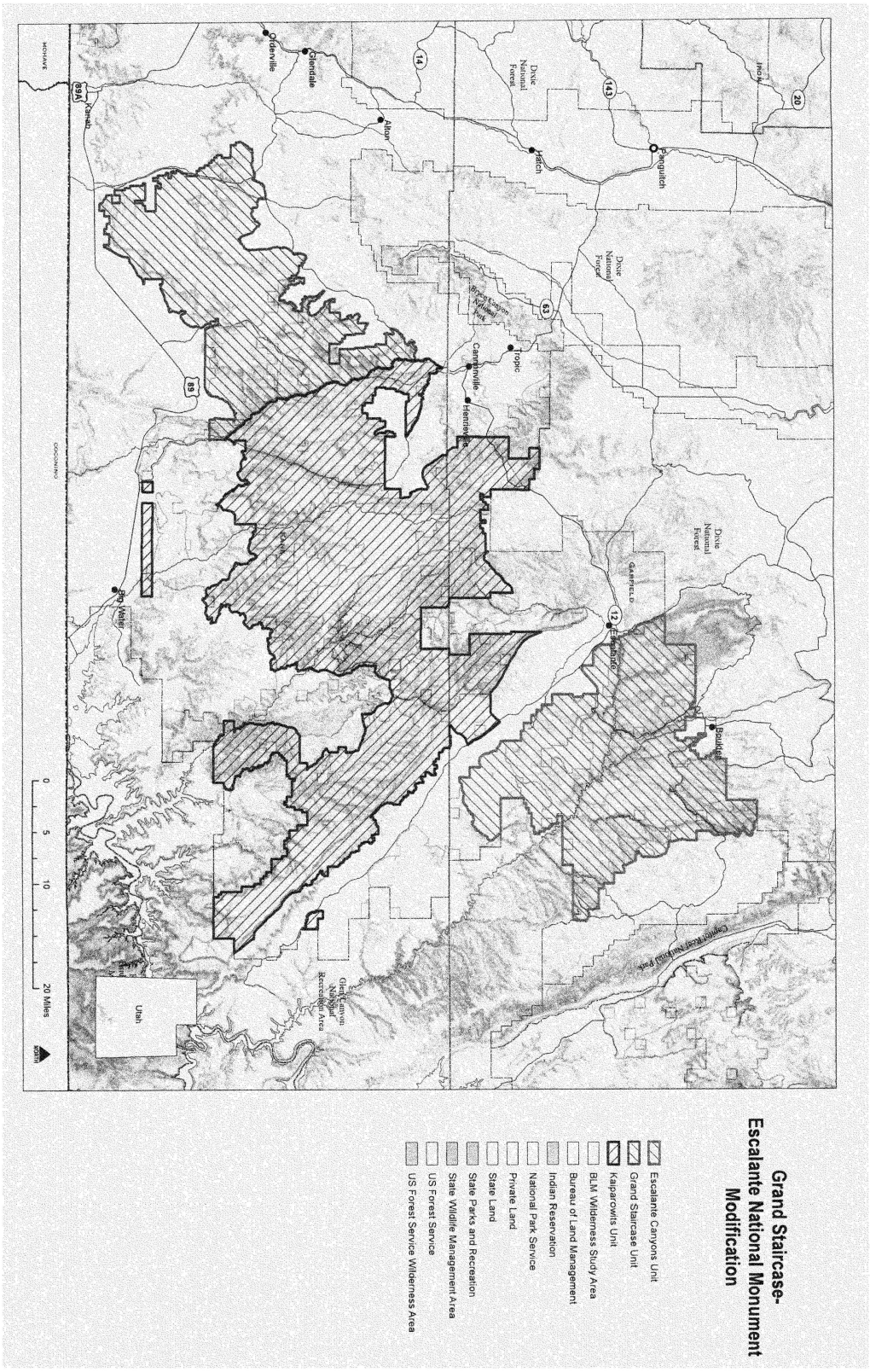

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Proclamation 6920
September 18, 1996

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Federal Register
Vol. 61, No. 186
Tuesday, September 24, 1996

Presidential Documents

Title 3—

The President

Proclamation 6920 of September 18, 1996

Establishment of the Grand Staircase-Escalante National Monument

By the President of the United States of America

A Proclamation

The Grand Staircase-Escalante National Monument's vast and austere landscape embraces a spectacular array of scientific and historic resources. This high, rugged, and remote region, where bold plateaus and multi-hued cliffs run for distances that defy human perspective, was the last place in the continental United States to be mapped. Even today, this unspoiled natural area remains a frontier, a quality that greatly enhances the monument's value for scientific study. The monument has a long and dignified human history: it is a place where one can see how nature shapes human endeavors in the American West, where distance and aridity have been pitted against our dreams and courage. The monument presents exemplary opportunities for geologists, paleontologists, archeologists, historians, and biologists.

The monument is a geologic treasure of clearly exposed stratigraphy and structures. The sedimentary rock layers are relatively undeformed and unobscured by vegetation, offering a clear view to understanding the processes of the earth's formation. A wide variety of formations, some in brilliant colors, have been exposed by millennia of erosion. The monument contains significant portions of a vast geologic stairway, named the Grand Staircase by pioneering geologist Clarence Dutton, which rises 5,500 feet to the rim of Bryce Canyon in an unbroken sequence of great cliffs and plateaus. The monument includes the rugged canyon country of the upper Paria Canyon system, major components of the White and Vermilion Cliffs and associated benches, and the Kaiparowits Plateau. That Plateau encompasses about 1,600 square miles of sedimentary rock and consists of successive south-to-north ascending plateaus or benches, deeply cut by steep-walled canyons. Naturally burning coal seams have scorched the tops of the Burning Hills brick-red. Another prominent geological feature of the plateau is the East Kaibab Monocline, known as the Cockscomb. The monument also includes the spectacular Circle Cliffs and part of the Waterpocket Fold, the inclusion of which completes the protection of this geologic feature begun with the establishment of Capitol Reef National Monument in 1938 (Proclamation No. 2246, 50 Stat. 1856). The monument holds many arches and natural bridges, including the 130-foot-high Escalante Natural Bridge, with a 100 foot span, and Grosvenor Arch, a rare ''double arch.'' The upper Escalante Canyons, in the northeastern reaches of the monument, are distinctive: in addition to several major arches and natural bridges, vivid geological features are laid bare in narrow, serpentine canyons, where erosion has exposed sandstone and shale deposits in shades of red, maroon, chocolate, tan, gray, and white. Such diverse objects make the monument outstanding for purposes of geologic study.

The monument includes world class paleontological sites. The Circle Cliffs reveal remarkable specimens of petrified wood, such as large unbroken logs exceeding 30 feet in length. The thickness, continuity and broad temporal distribution of the Kaiparowits Plateau's stratigraphy provide significant opportunities to study the paleontology of the late Cretaceous Era. Extremely significant fossils, including marine and brackish water mollusks, turtles, crocodilians, lizards, dinosaurs, fishes, and mammals, have been recovered

from the Dakota, Tropic Shale and Wahweap Formations, and the Tibbet Canyon, Smoky Hollow and John Henry members of the Straight Cliffs Formation. Within the monument, these formations have produced the only evidence in our hemisphere of terrestrial vertebrate fauna, including mammals, of the Cenomanian-Santonian ages. This sequence of rocks, including the overlaying Wahweap and Kaiparowits formations, contains one of the best and most continuous records of Late Cretaceous terrestrial life in the world.

Archeological inventories carried out to date show extensive use of places within the monument by ancient Native American cultures. The area was a contact point for the Anasazi and Fremont cultures, and the evidence of this mingling provides a significant opportunity for archeological study. The cultural resources discovered so far in the monument are outstanding in their variety of cultural affiliation, type and distribution. Hundreds of recorded sites include rock art panels, occupation sites, campsites and granaries. Many more undocumented sites that exist within the monument are of significant scientific and historic value worthy of preservation for future study.

The monument is rich in human history. In addition to occupations by the Anasazi and Fremont cultures, the area has been used by modern tribal groups, including the Southern Paiute and Navajo. John Wesley Powell's expedition did initial mapping and scientific field work in the area in 1872. Early Mormon pioneers left many historic objects, including trails, inscriptions, ghost towns such as the Old Paria townsite, rock houses, and cowboy line camps, and built and traversed the renowned Hole-in-the-Rock Trail as part of their epic colonization efforts. Sixty miles of the Trail lie within the monument, as does Dance Hall Rock, used by intrepid Mormon pioneers and now a National Historic Site.

Spanning five life zones from low-lying desert to coniferous forest, with scarce and scattered water sources, the monument is an outstanding biological resource. Remoteness, limited travel corridors and low visitation have all helped to preserve intact the monument's important ecological values. The blending of warm and cold desert floras, along with the high number of endemic species, place this area in the heart of perhaps the richest floristic region in the Intermountain West. It contains an abundance of unique, isolated communities such as hanging gardens, tinajas, and rock crevice, canyon bottom, and dunal pocket communities, which have provided refugia for many ancient plant species for millennia. Geologic uplift with minimal deformation and subsequent downcutting by streams have exposed large expanses of a variety of geologic strata, each with unique physical and chemical characteristics. These strata are the parent material for a spectacular array of unusual and diverse soils that support many different vegetative communities and numerous types of endemic plants and their pollinators. This presents an extraordinary opportunity to study plant speciation and community dynamics independent of climatic variables. The monument contains an extraordinary number of areas of relict vegetation, many of which have existed since the Pleistocene, where natural processes continue unaltered by man. These include relict grasslands, of which No Mans Mesa is an outstanding example, and pinon-juniper communities containing trees up to 1,400 years old. As witnesses to the past, these relict areas establish a baseline against which to measure changes in community dynamics and biogeochemical cycles in areas impacted by human activity. Most of the ecological communities contained in the monument have low resistance to, and slow recovery from, disturbance. Fragile cryptobiotic crusts, themselves of significant biological interest, play a critical role throughout the monument, stabilizing the highly erodible desert soils and providing nutrients to plants. An abundance of packrat middens provides insight into the vegetation and climate of the past 25,000 years and furnishes context for studies of evolution and climate change. The wildlife of the monument is characterized by a diversity of species. The monument varies greatly in elevation and topography and is in a climatic zone where northern and southern

habitat species intermingle. Mountain lion, bear, and desert bighorn sheep roam the monument. Over 200 species of birds, including bald eagles and peregrine falcons, are found within the area. Wildlife, including neotropical birds, concentrate around the Paria and Escalante Rivers and other riparian corridors within the monument.

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

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the Grand Staircase-Escalante 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 document entitled ''Grand Staircase-Escalante National Monument'' attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 1.7 million 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 entry, location, selection, sale, leasing, or other disposition under the public land laws, other than by exchange that furthers the protective purposes of the monument. Lands and interests in lands 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 establishment of this monument is subject to valid existing rights.

Nothing in this proclamation shall be deemed to diminish the responsibility and authority of the State of Utah for management of fish and wildlife, including regulation of hunting and fishing, on Federal lands within the monument.

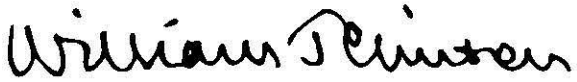
Nothing in this proclamation shall be deemed to affect existing permits or leases for, or levels of, livestock grazing on Federal lands within the monument; existing grazing uses shall continue to be governed by applicable laws and regulations other than this proclamation.

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

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, within 3 years of this date, a management plan for this monument, and shall promulgate such regulations for its management as he deems appropriate. This proclamation does not reserve water as a matter of Federal law. I direct the Secretary to address in the management plan the extent to which water is necessary for the proper care and management of the objects of this monument and the extent to which further action may be necessary pursuant to Federal or State law to assure the availability of water.

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 eighteenth day of September, in the year of our Lord nineteen hundred and ninety-six, and of the Independence of the United States of America the two hundred and twenty-first.



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Filed 9–23–96; 12:27 pm]
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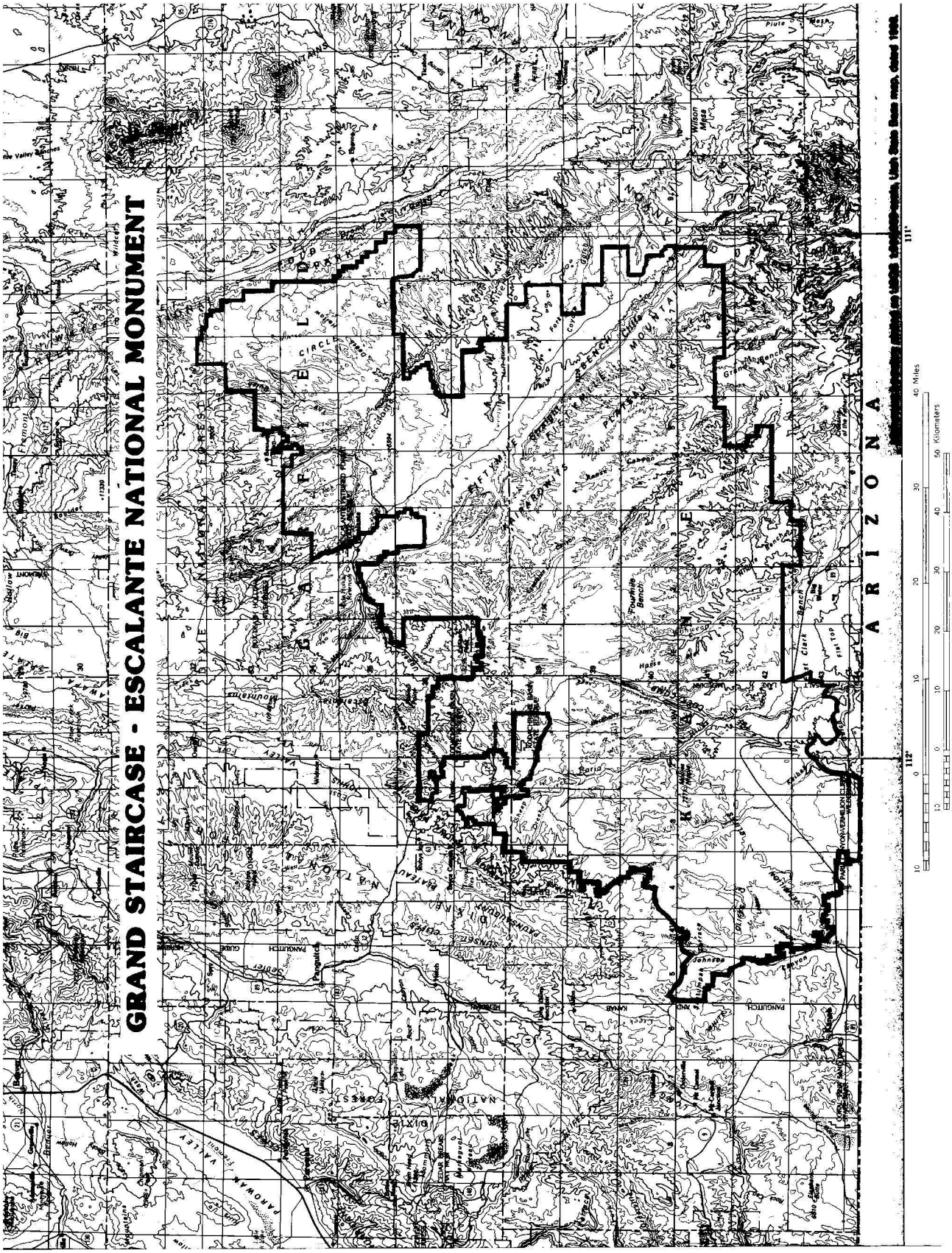

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Appendix B

Figures

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Grand Staircase-Escalante National Monument

Figure 5-1 Vegetation Communities

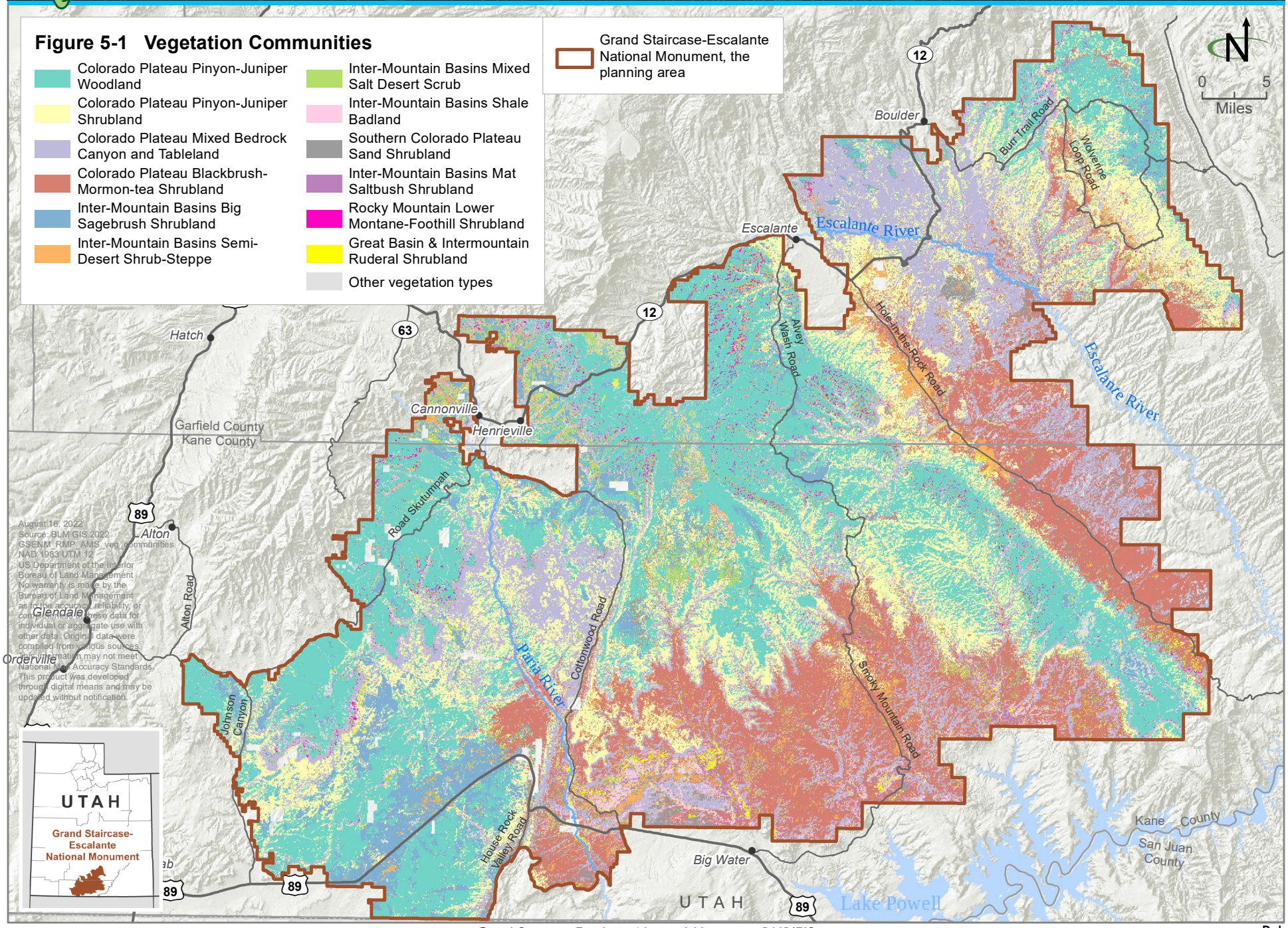


Figure 5-2 Ecological Site Groups

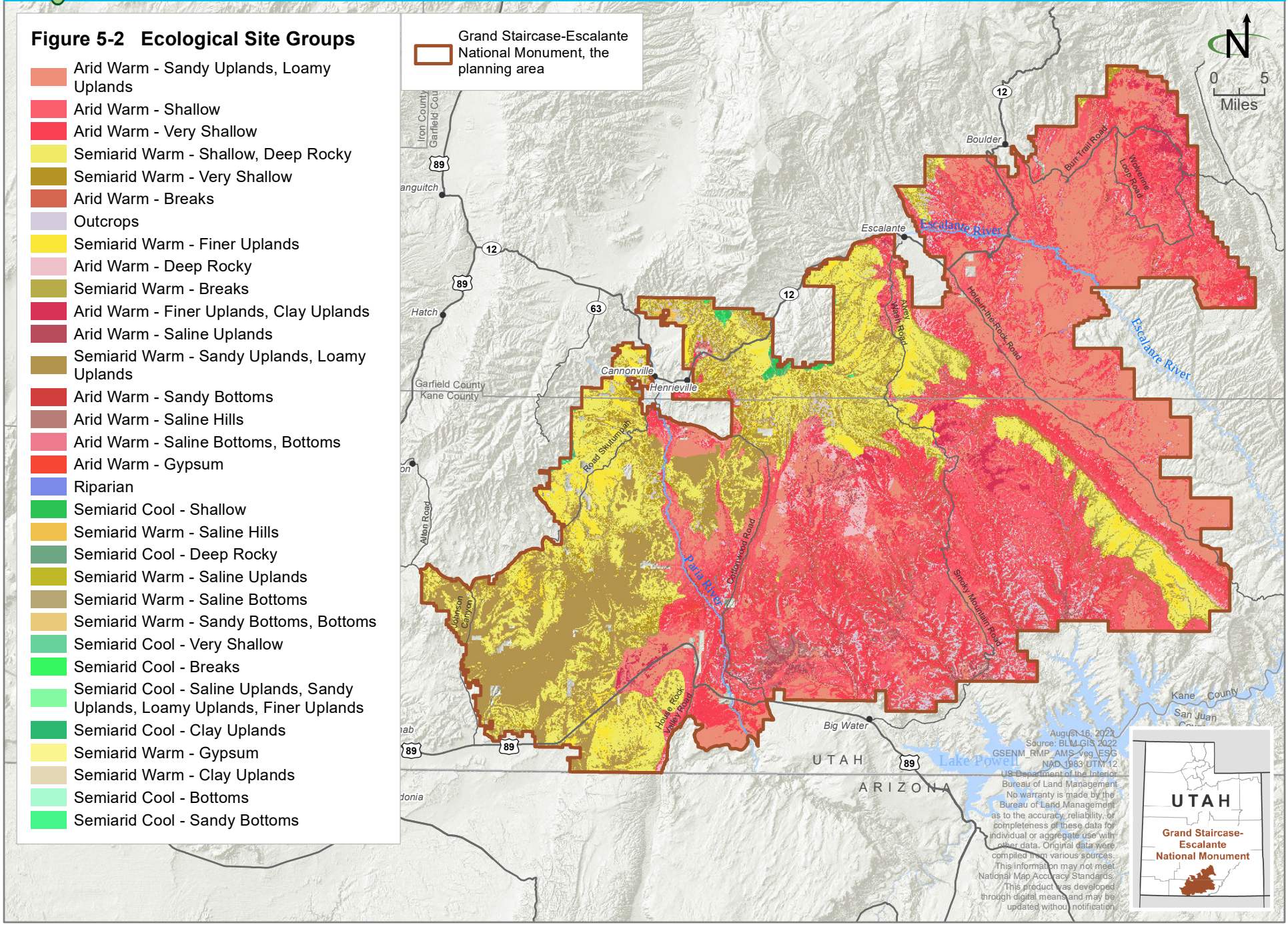


Figure 5-3 Vegetation Treatments

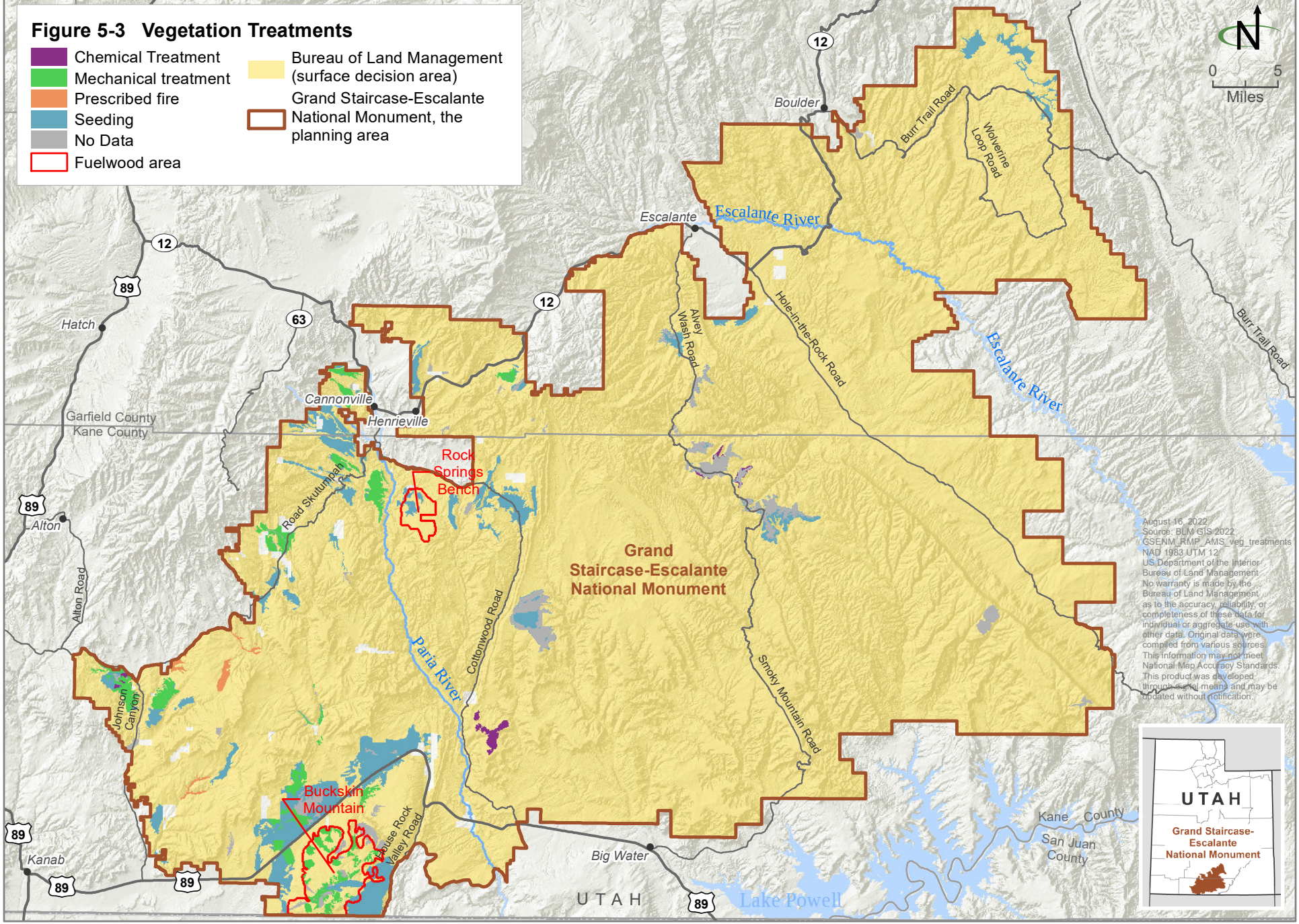
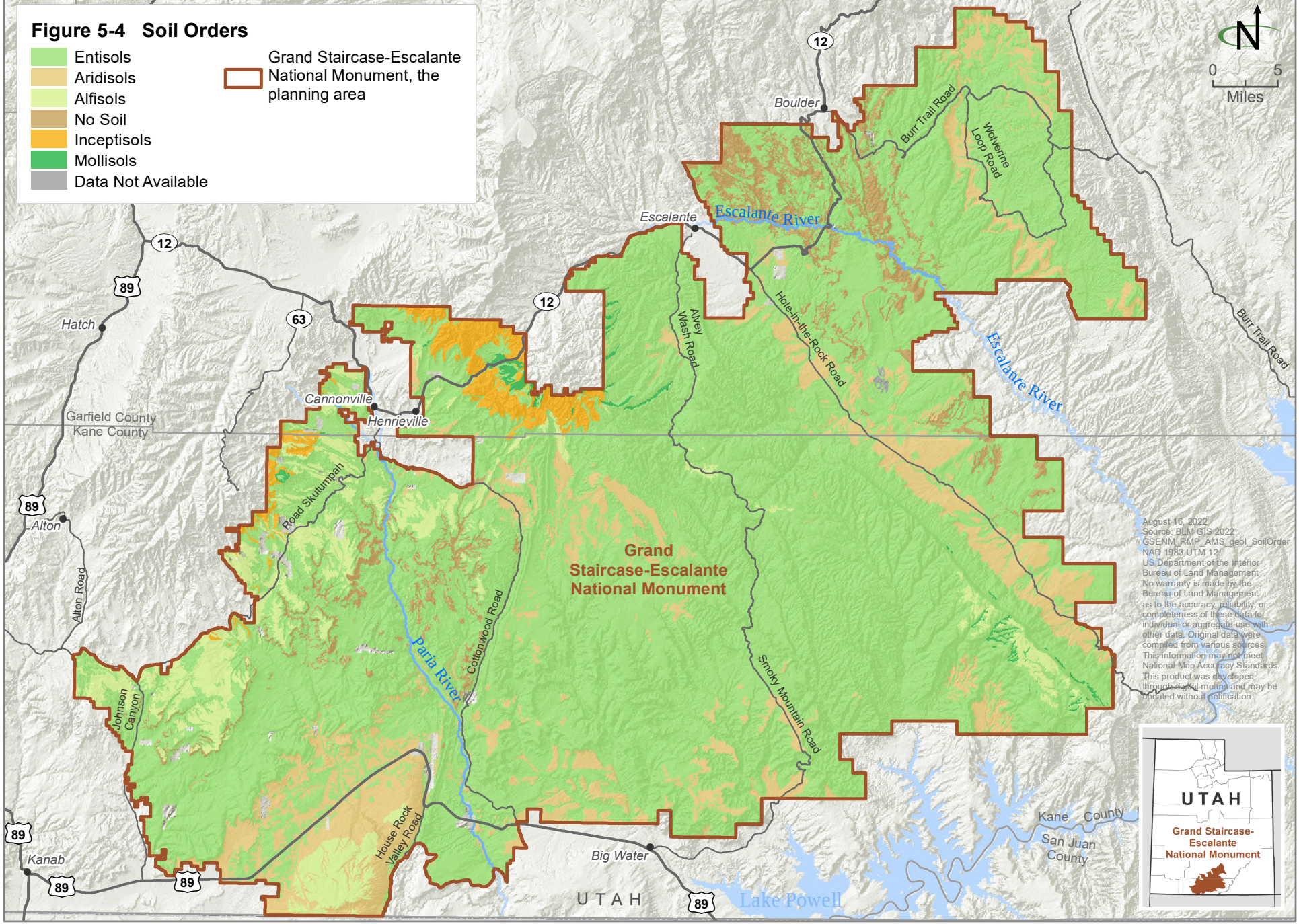


Figure 5-4 Soil Orders



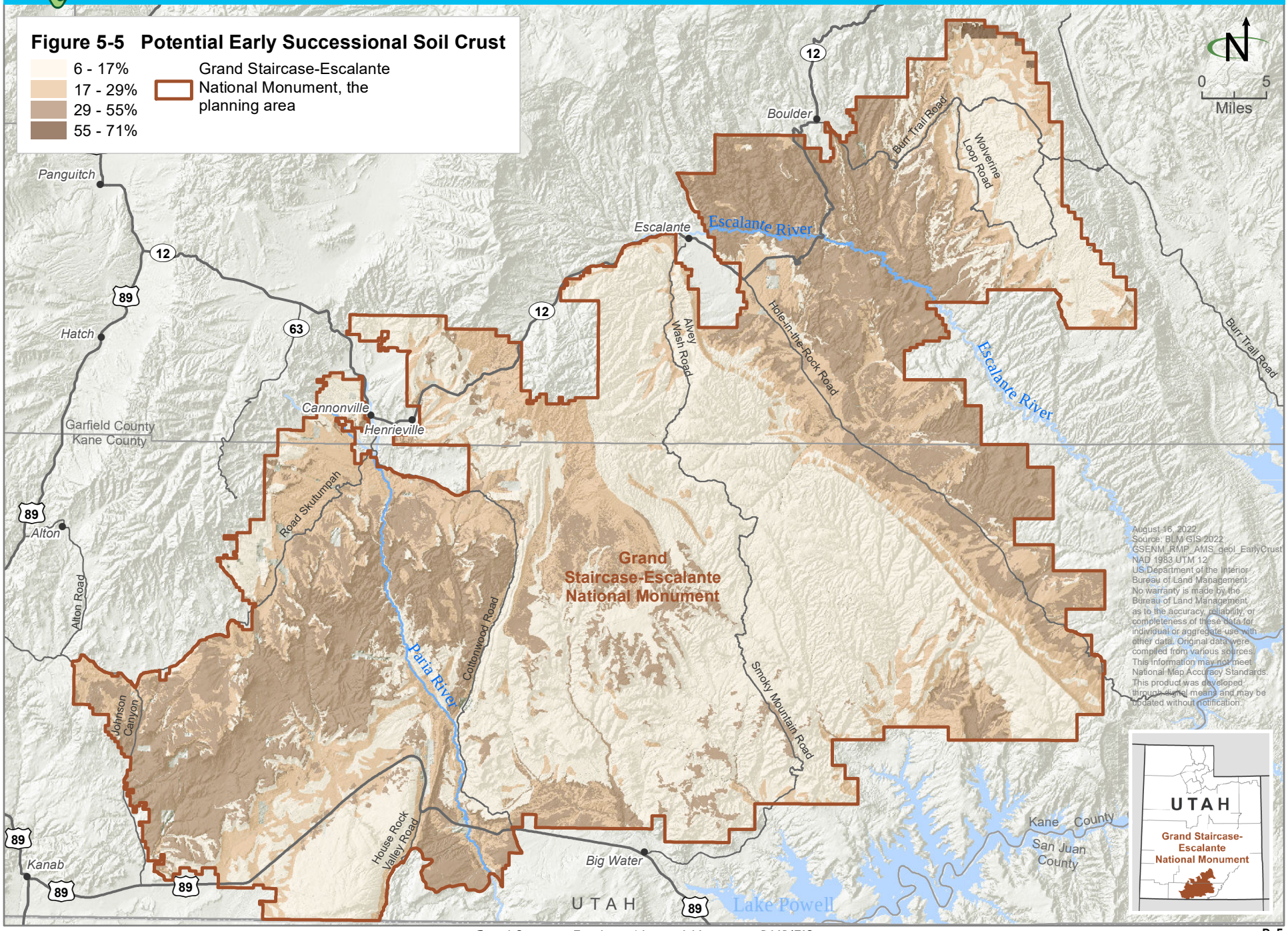


Figure 5-5 Potential Early Successional Soil Crust
6 - 17%
17 - 29%
29 - 55%
55 - 71%
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
12
89
63
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Burr Trail Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_geol_EarlyCrust
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

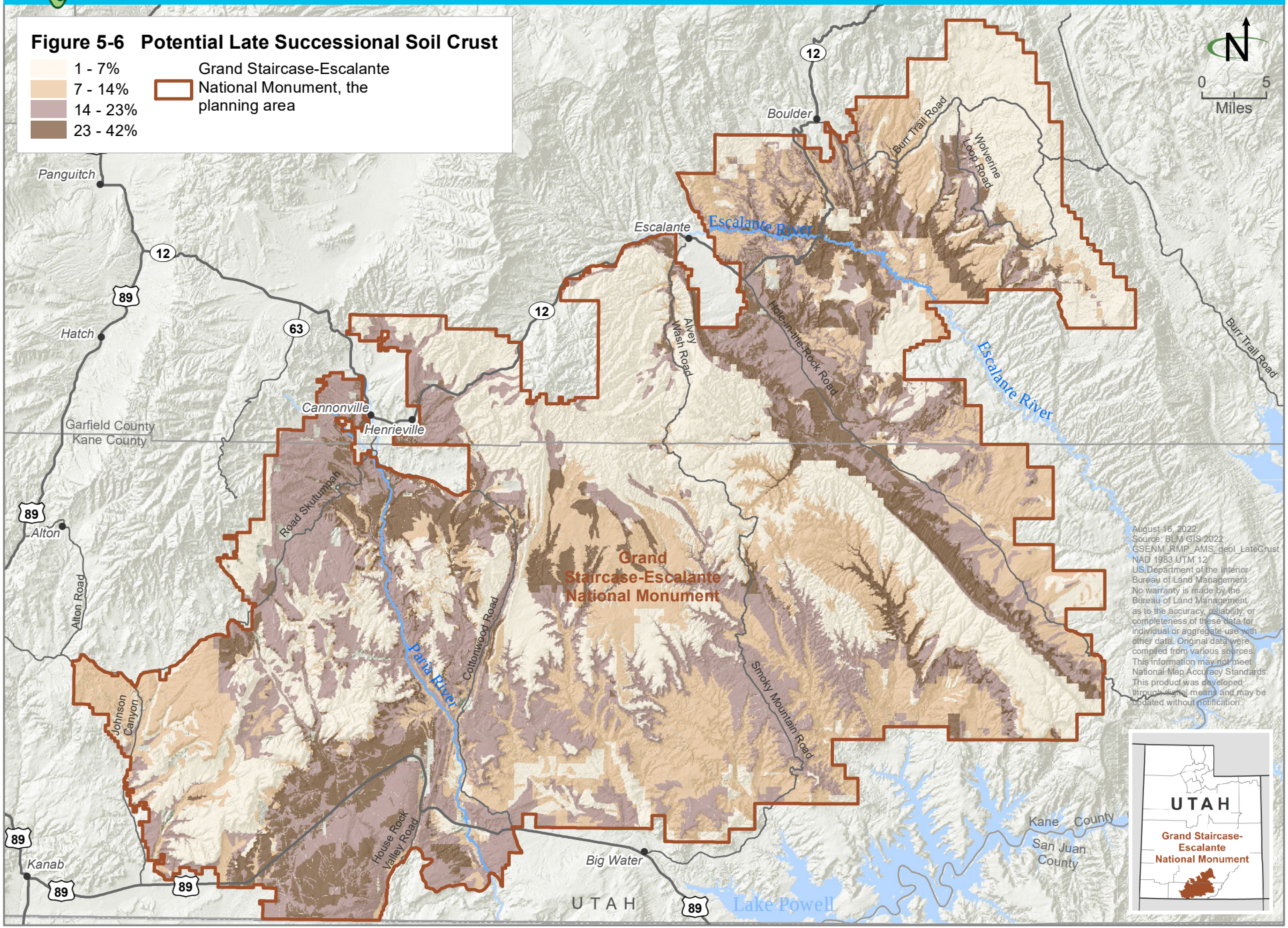
Figure 5-6 Potential Late Successional Soil Crust
1 - 7%
7 - 14%
14 - 23%
23 - 42%
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_geol_LateCrust
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

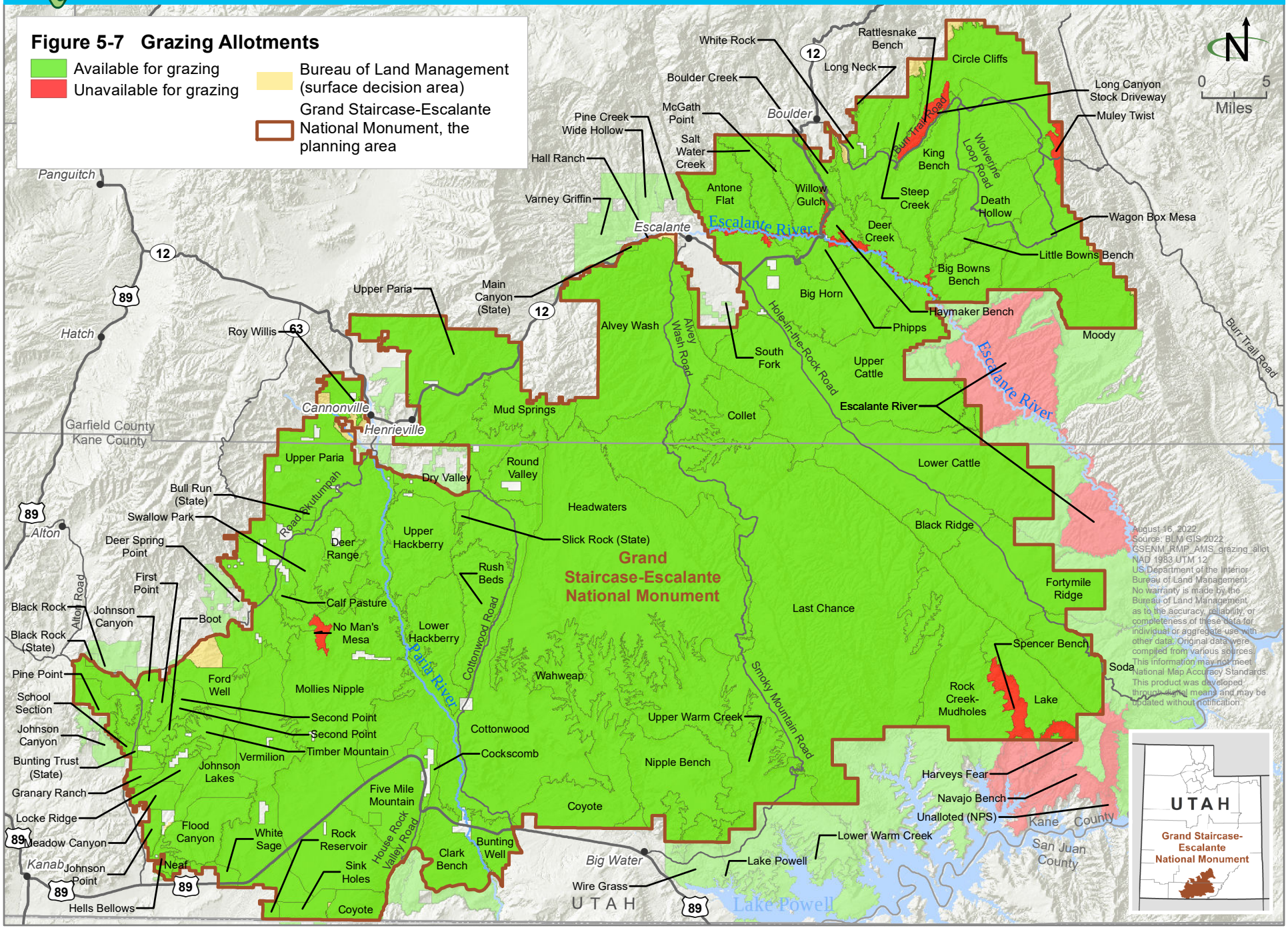
Figure 5-7 Grazing Allotments
Available for grazing
Unavailable for grazing
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Grand Staircase-Escalante National Monument
Escalante River
Paria River
Panguitch
Hatch
Alton
Cannonville
Henrieville
Escalante
Boulder
Garfield County
Kane County
San Juan County
Big Water
Kanab
Lake Powell
UTAH
White Rock
Rattlesnake Bench
Long Neck
Circle Cliffs
Boulder Creek
Long Canyon Stock Driveway
Muley Twist
McGath Point
Pine Creek
Wide Hollow
Salt Water Creek
Hall Ranch
Varney Griffin
Antone Flat
Willow Gulch
King Bench
Steep Creek
Death Hollow
Deer Creek
Wagon Box Mesa
Little Bowns Bench
Big Bowns Bench
Haymaker Bench
Phipps
Moody
Big Horn
Upper Paria
Main Canyon (State)
Roy Willis
Alvey Wash
Alvey Wash Road
South Fork
Hole-in-the-Rock Road
Upper Cattle
Lower Cattle
Collet
Mud Springs
Round Valley
Dry Valley
Headwaters
Slick Rock (State)
Bull Run (State)
Swallow Park
Deer Spring Point
Deer Range
Upper Hackberry
Lower Hackberry
Rush Beds
Calf Pasture
No Man's Mesa
Boot
First Point
Black Rock
Black Rock (State)
Johnson Canyon
Alton Road
Pine Point
School Section
Ford Well
Mollies Nipple
Second Point
Second Point
Timber Mountain
Vermilion
Johnson Lakes
Bunting Trust (State)
Granary Ranch
Locke Ridge
Meadow Canyon
Flood Canyon
White Sage
Rock Reservoir
Sink Holes
Coyote
Five Mile Mountain
House Rock Valley Road
Clark Bench
Bunting Well
Cottonwood
Cockscomb
Cottonwood Road
Wahweap
Nipple Bench
Coyote
Upper Warm Creek
Lower Warm Creek
Lake Powell
Wire Grass
Hells Bellows
Neal
Johnson Point
Last Chance
Black Ridge
Fortymile Ridge
Spencer Bench
Soda
Lake
Rock Creek-Mudholes
Smoky Mountain Road
Harveys Fear
Navajo Bench
Unalloted (NPS)
Kane County
Escalante River
Burr Trail Road
Wolverine Loop Road
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_grazing_allot
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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Figure 5-8 Recreation Management Areas, 2000 Management Plan

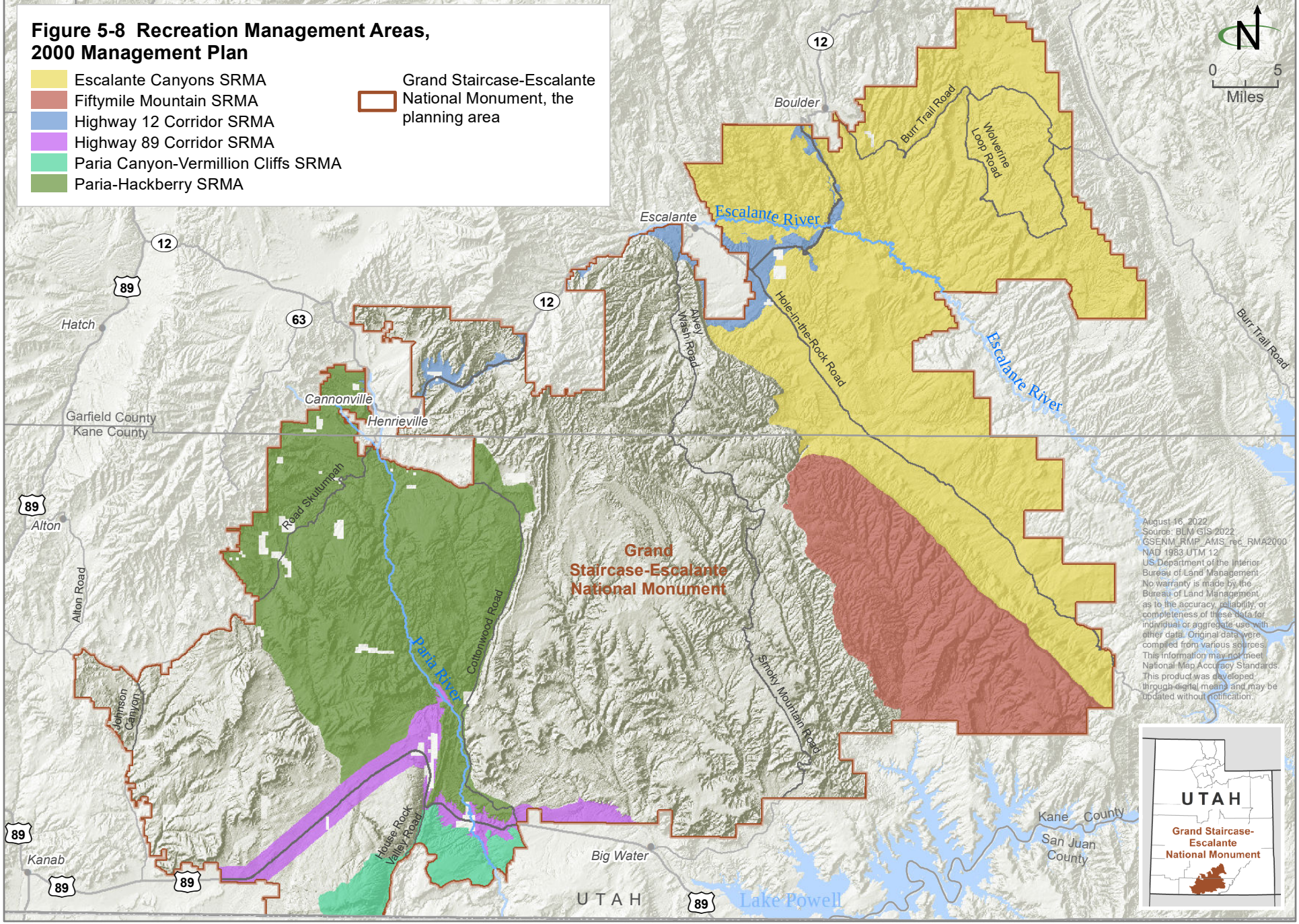
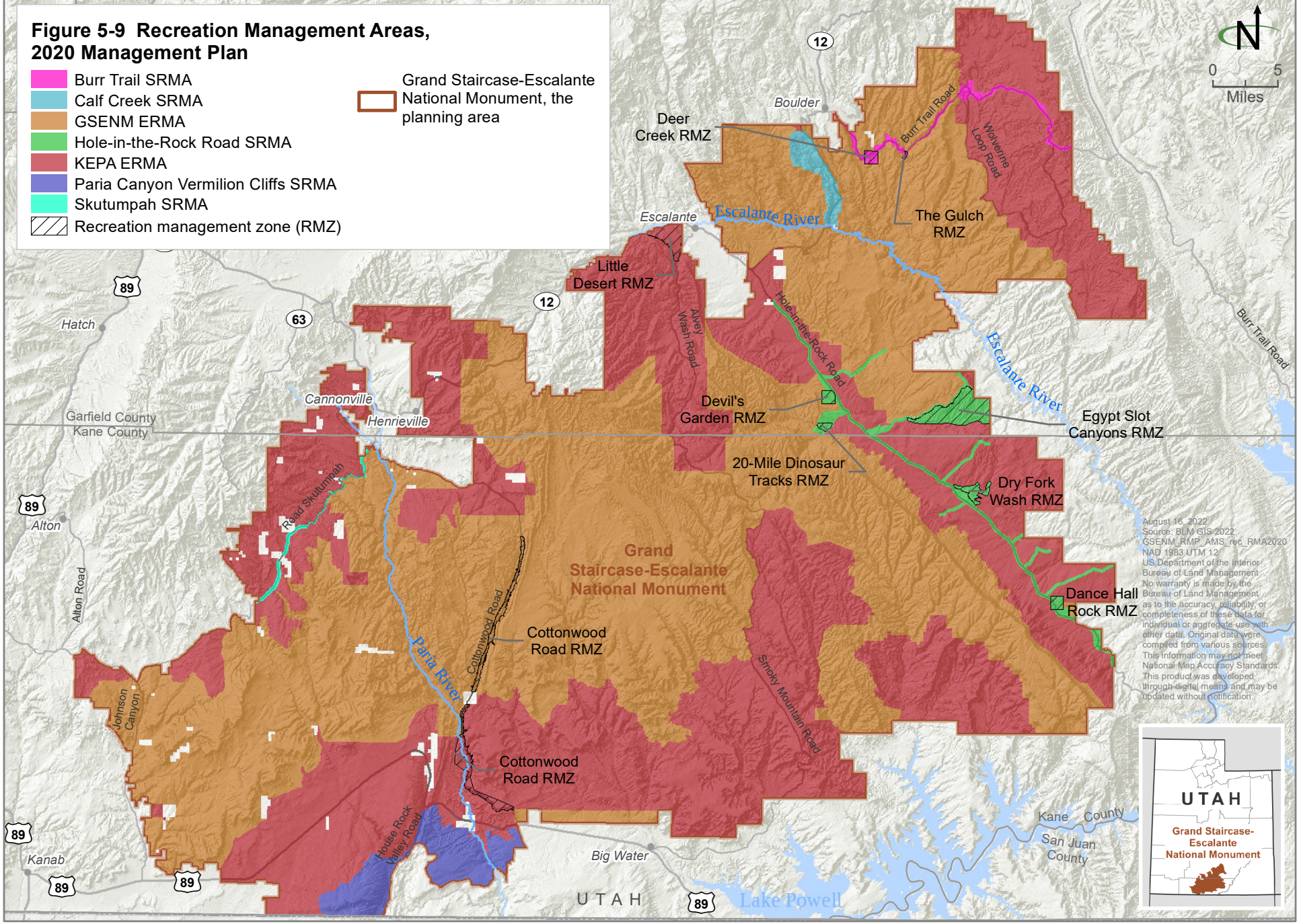


Figure 5-9 Recreation Management Areas, 2020 Management Plan



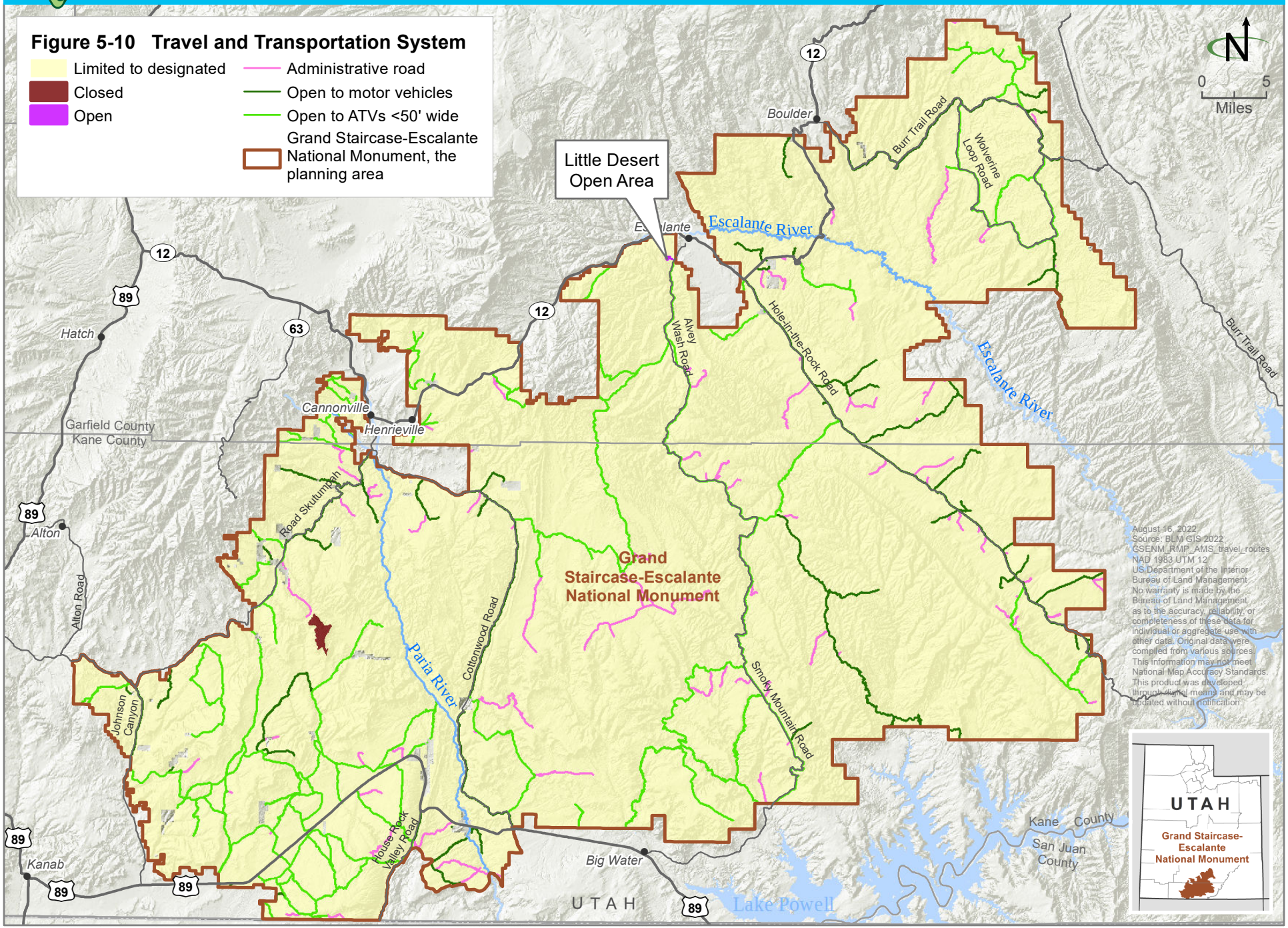


Figure 5-10 Travel and Transportation System
Limited to designated
Closed
Open
Administrative road
Open to motor vehicles
Open to ATVs <50' wide
Grand Staircase-Escalante National Monument, the planning area
Little Desert Open Area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante River
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Alvey Wash Road
Hole-in-the-Rock Road
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_travel_routes
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

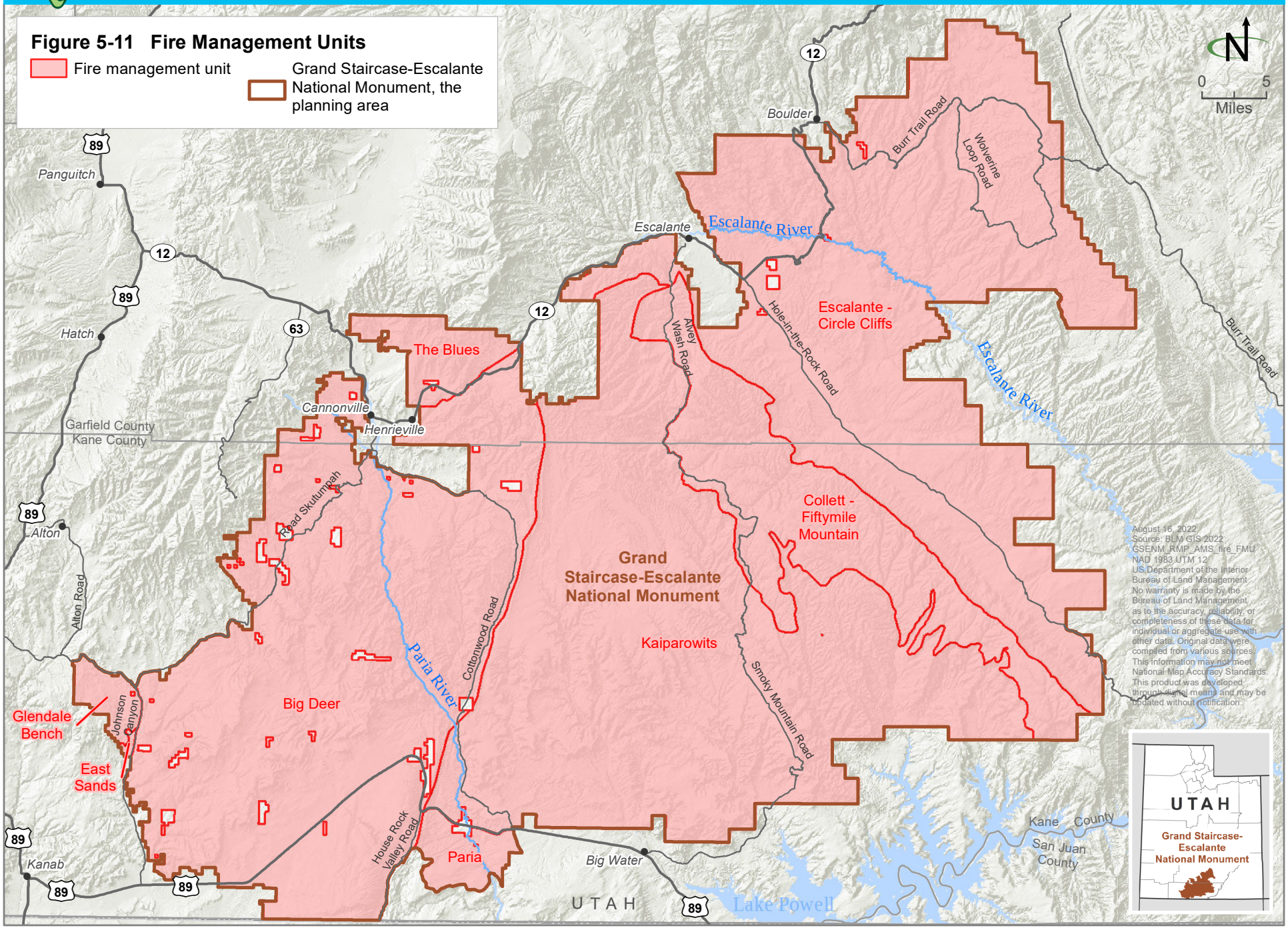
Figure 5-11 Fire Management Units
Fire management unit
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Panguitch
Hatch
Alton
Kanab
Garfield County
Kane County
Alton Road
Johnson Canyon
Glendale Bench
East Sands
Big Deer
Paria River
Cottonwood Road
House Rock Valley Road
Paria
Big Water
UTAH
Lake Powell
Road Skutumpah
Cannonville
Henrieville
The Blues
Escalante
Escalante River
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante - Circle Cliffs
Hole-in-the-Rock Road
Alvey Wash Road
Collett - Fiftymile Mountain
Grand Staircase-Escalante National Monument
Kaiparowits
Smoky Mountain Road
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_fire_FMU
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

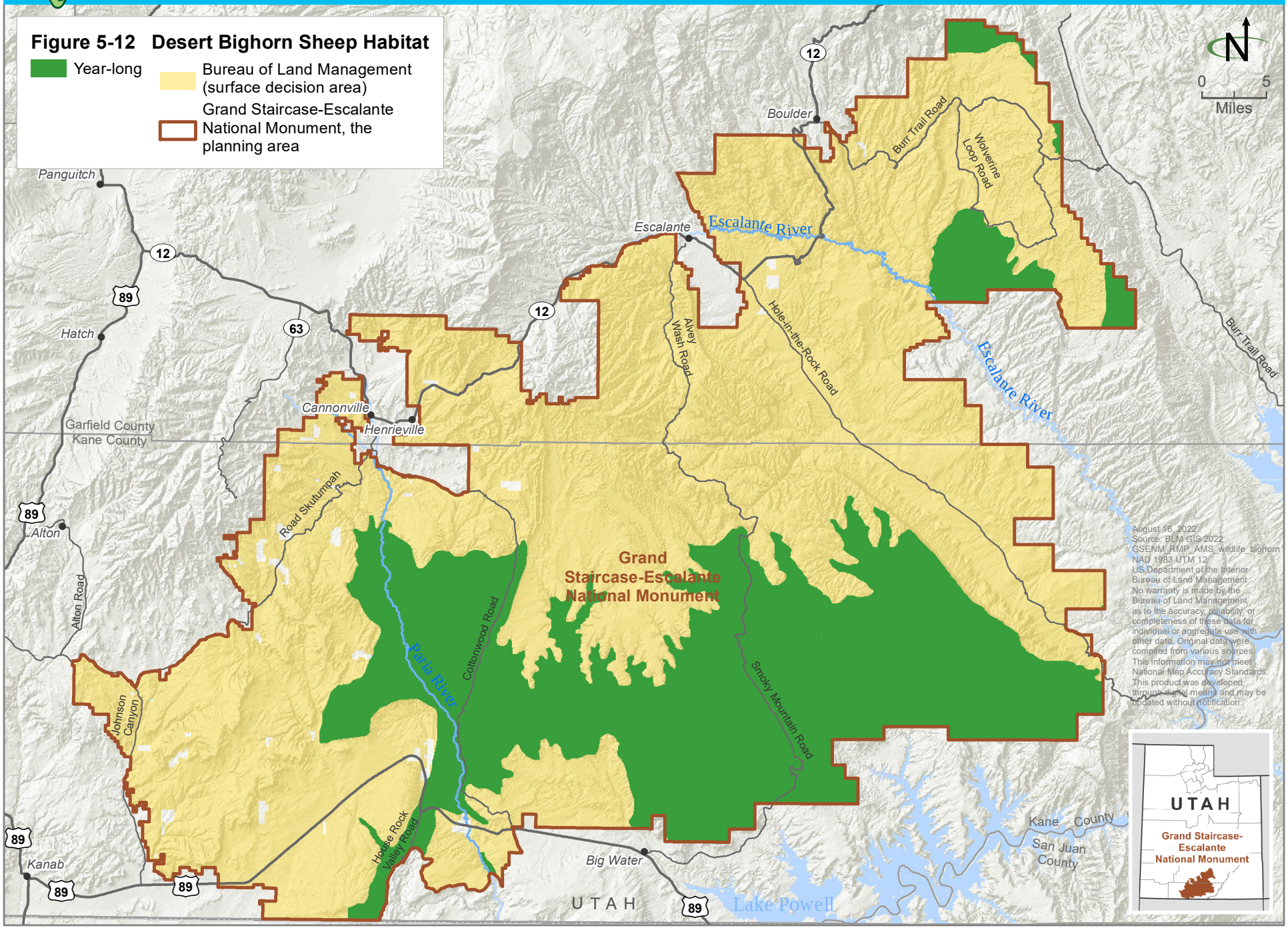
Figure 5-12 Desert Bighorn Sheep Habitat
Year-long
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Panguitch
12
89
Hatch
63
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
Horse Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_wildlife_bighorn
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

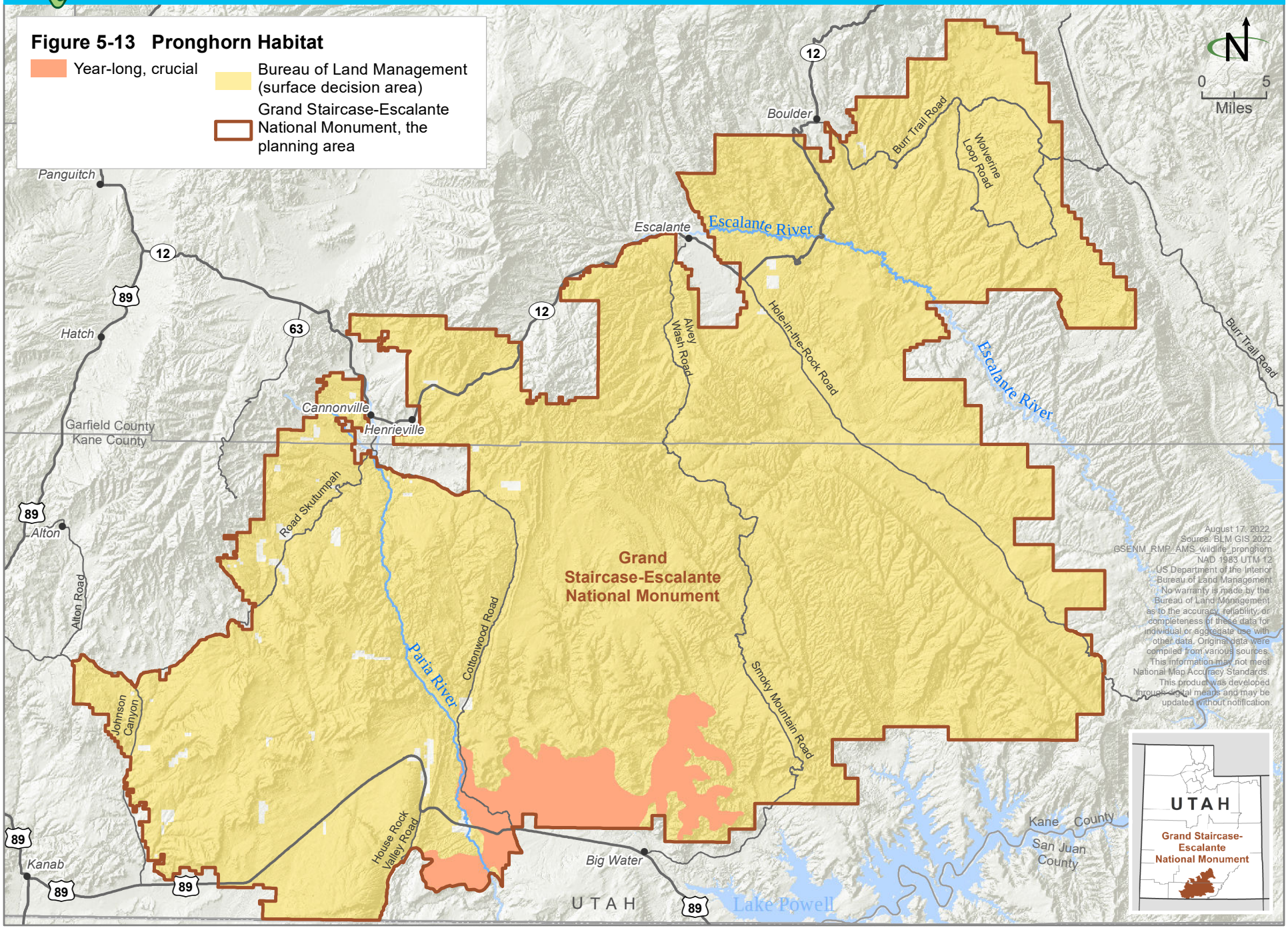
Figure 5-13 Pronghorn Habitat
Year-long, crucial
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Panguitch
12
89
63
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Burr Trail Road
Escalante River
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Cottonwood Road
Paria River
Johnson Canyon
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
Kane County
San Juan County
UTAH
Lake Powell
August 17, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_wildlife_pronghorn
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

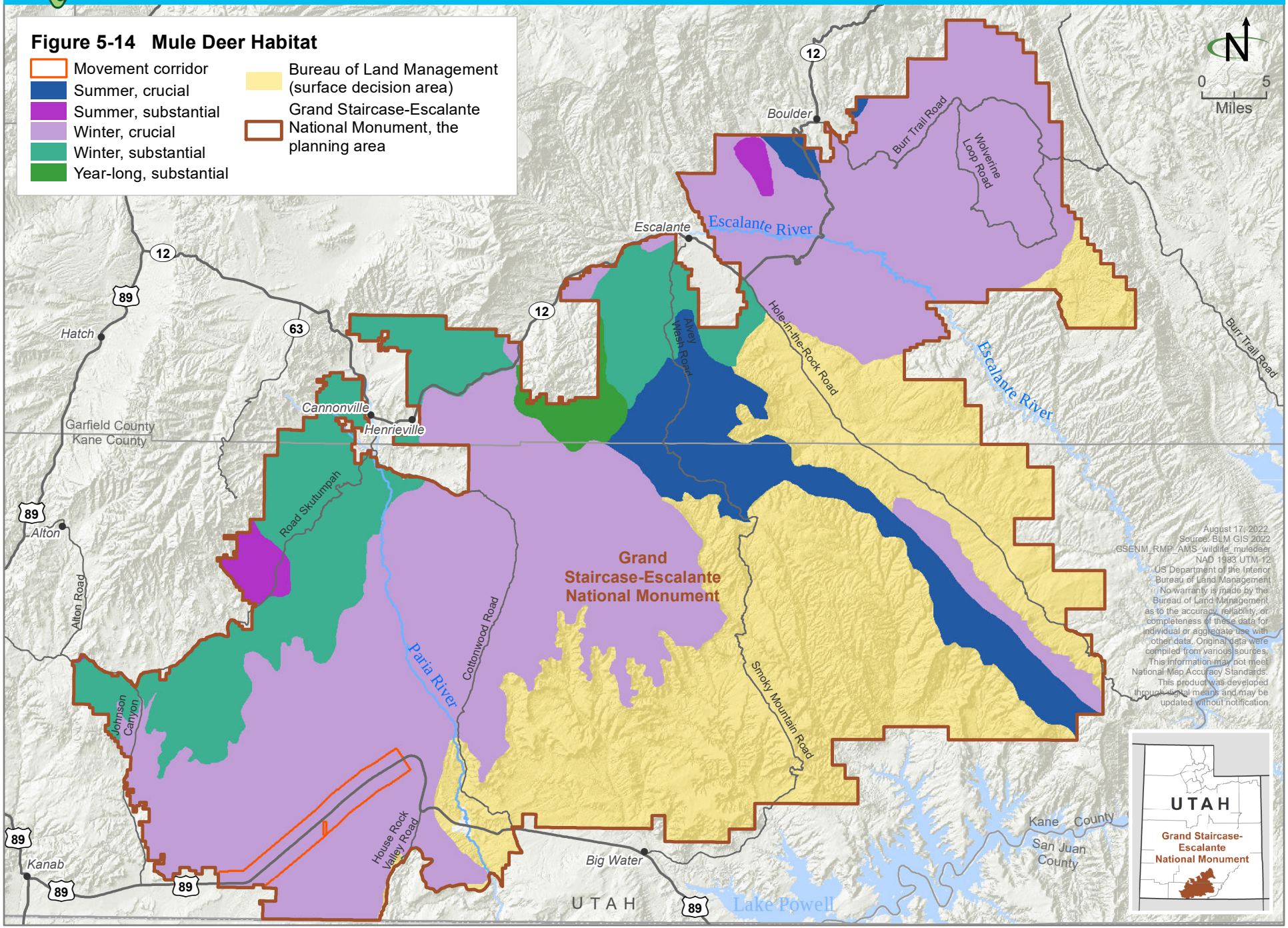
Figure 5-14 Mule Deer Habitat
Movement corridor
Summer, crucial
Summer, substantial
Winter, crucial
Winter, substantial
Year-long, substantial
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Johnson Canyon
Paria River
Cottonwood Road
Grand Staircase-Escalante National Monument
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
12
89
63
August 17, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_wildlife_muledeer
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

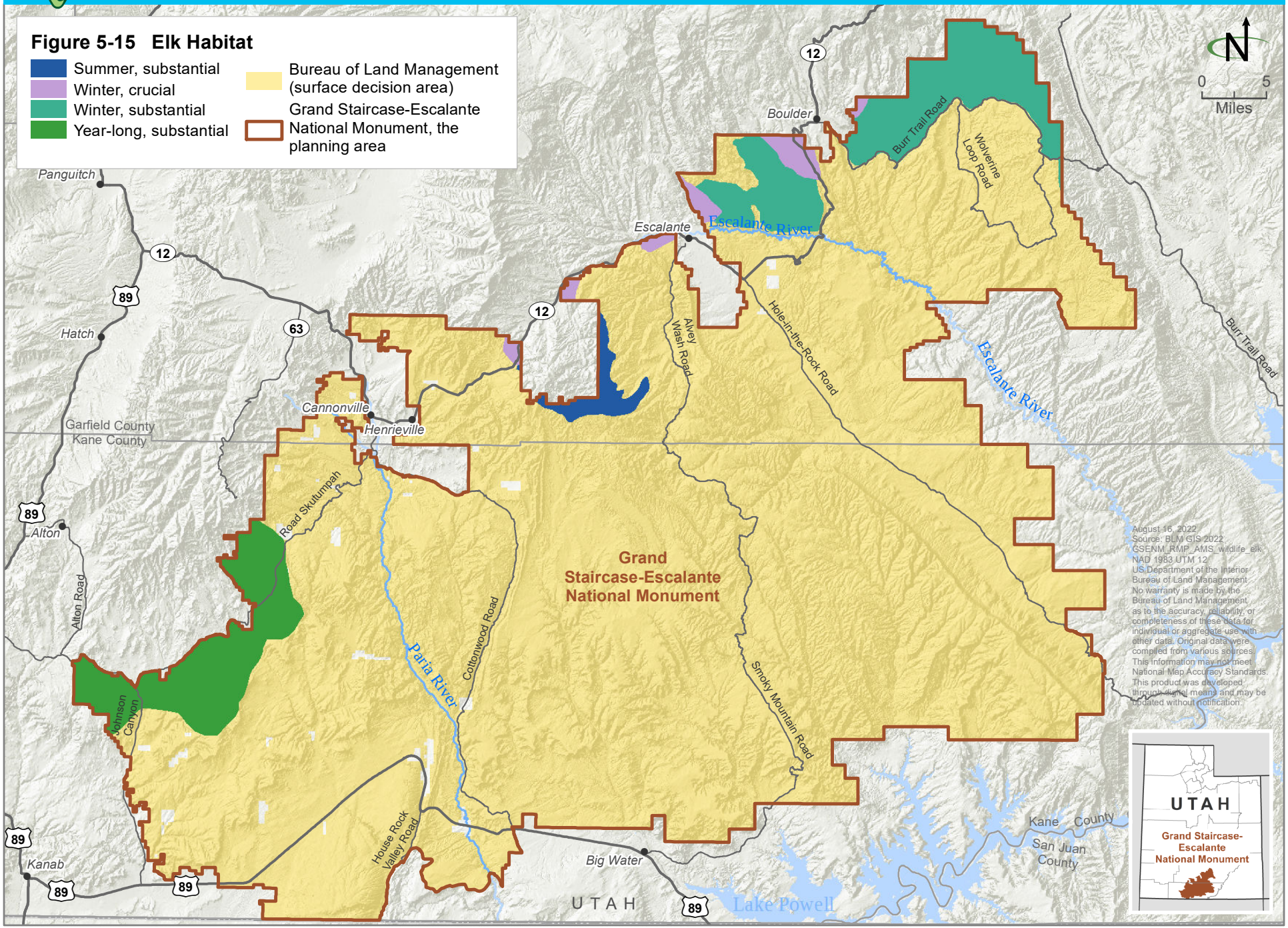
Figure 5-15 Elk Habitat
Summer, substantial
Winter, crucial
Winter, substantial
Year-long, substantial
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
12
89
63
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Burr Trail Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_wildlife_elk
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

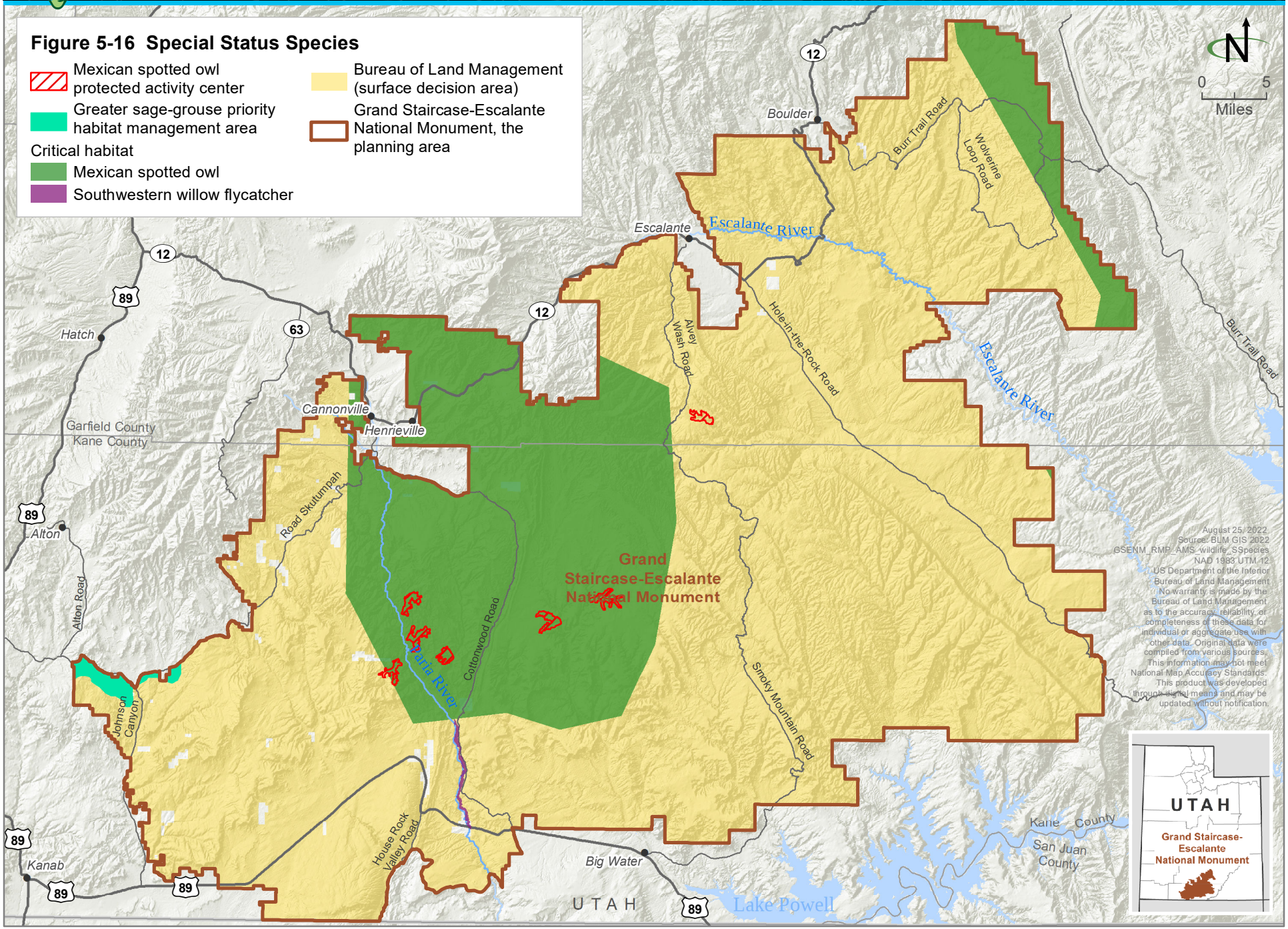
Figure 5-16 Special Status Species
Mexican spotted owl protected activity center
Greater sage-grouse priority habitat management area
Critical habitat
Mexican spotted owl
Southwestern willow flycatcher
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Alvey Wash Road
Hole-in-the-Rock Road
Burr Trail Road
Escalante River
Alton
Alton Road
Road Skutumpah
Grand Staircase-Escalante National Monument
Cottonwood Road
Paria River
Johnson Canyon
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
Kane County
San Juan County
UTAH
Lake Powell
August 25, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_wildlife_SSpecies
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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Grand Staircase-Escalante National Monument

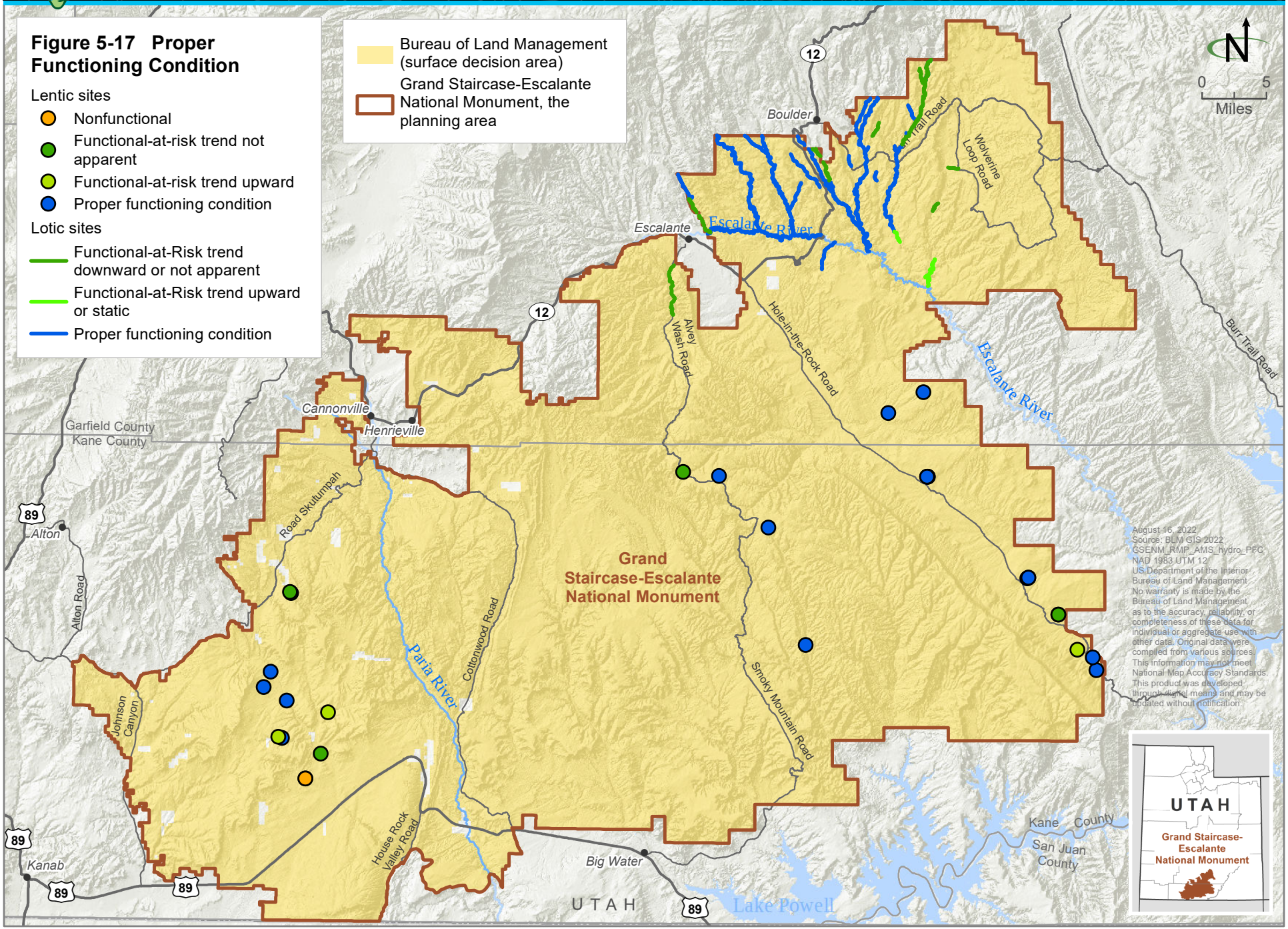
Figure 5-17 Proper Functioning Condition
Lentic sites
Nonfunctional
Functional-at-risk trend not apparent
Functional-at-risk trend upward
Proper functioning condition
Lotic sites
Functional-at-Risk trend downward or not apparent
Functional-at-Risk trend upward or static
Proper functioning condition
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
12
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
89
Alton
Alton Road
Johnson Canyon
Paria River
Cottonwood Road
Grand Staircase-Escalante National Monument
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_hydro_PFC
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

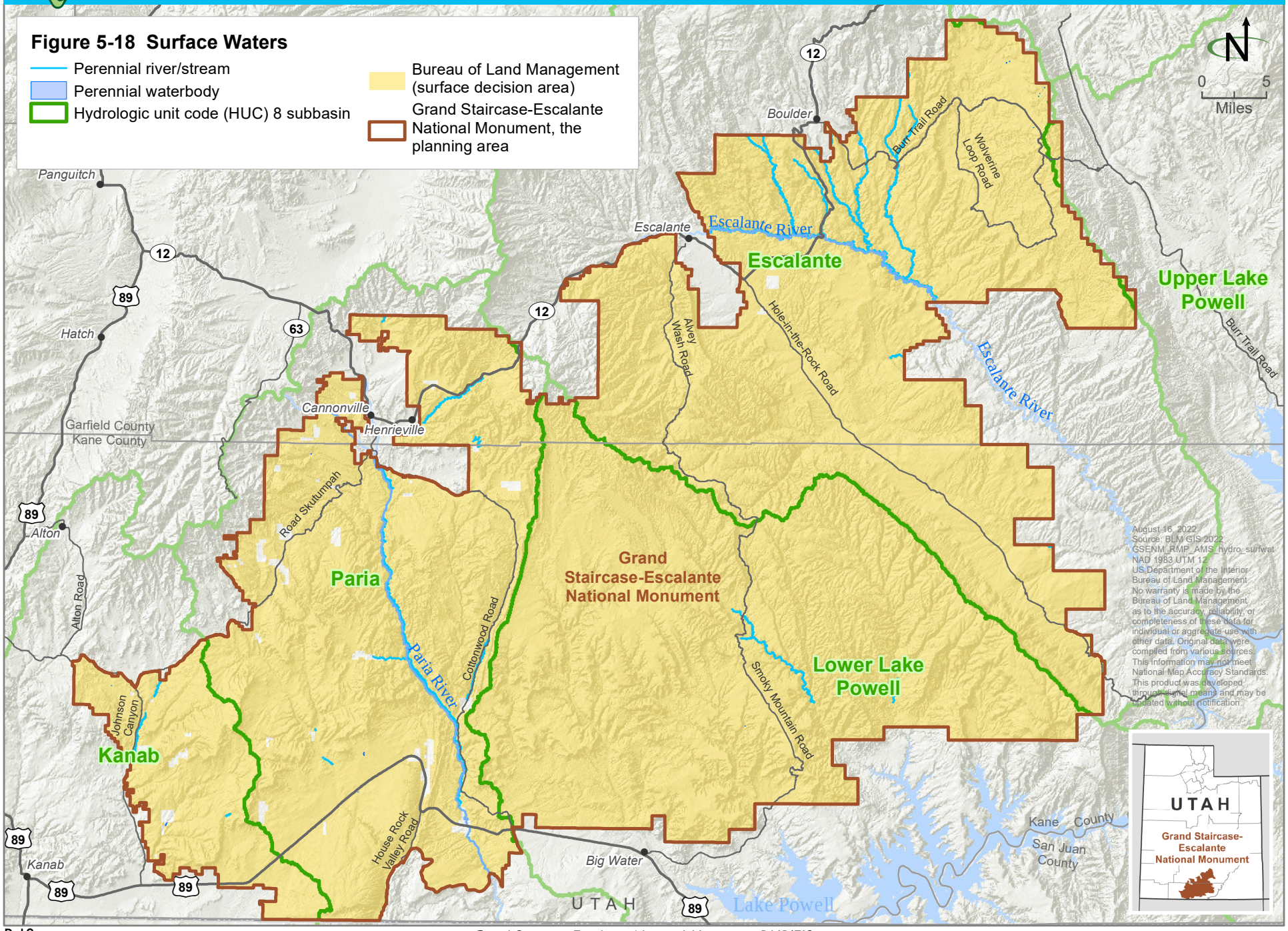
Figure 5-18 Surface Waters
Perennial river/stream
Perennial waterbody
Hydrologic unit code (HUC) 8 subbasin
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
Escalante
Upper Lake Powell
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Escalante River
Road Skutumpah
Alton
Alton Road
Paria
Grand Staircase-Escalante National Monument
Cottonwood Road
Paria River
Lower Lake Powell
Smoky Mountain Road
Johnson Canyon
Kanab
House Rock Valley Road
Big Water
Kane County
San Juan County
UTAH
Lake Powell
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_hydro_surfwat
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

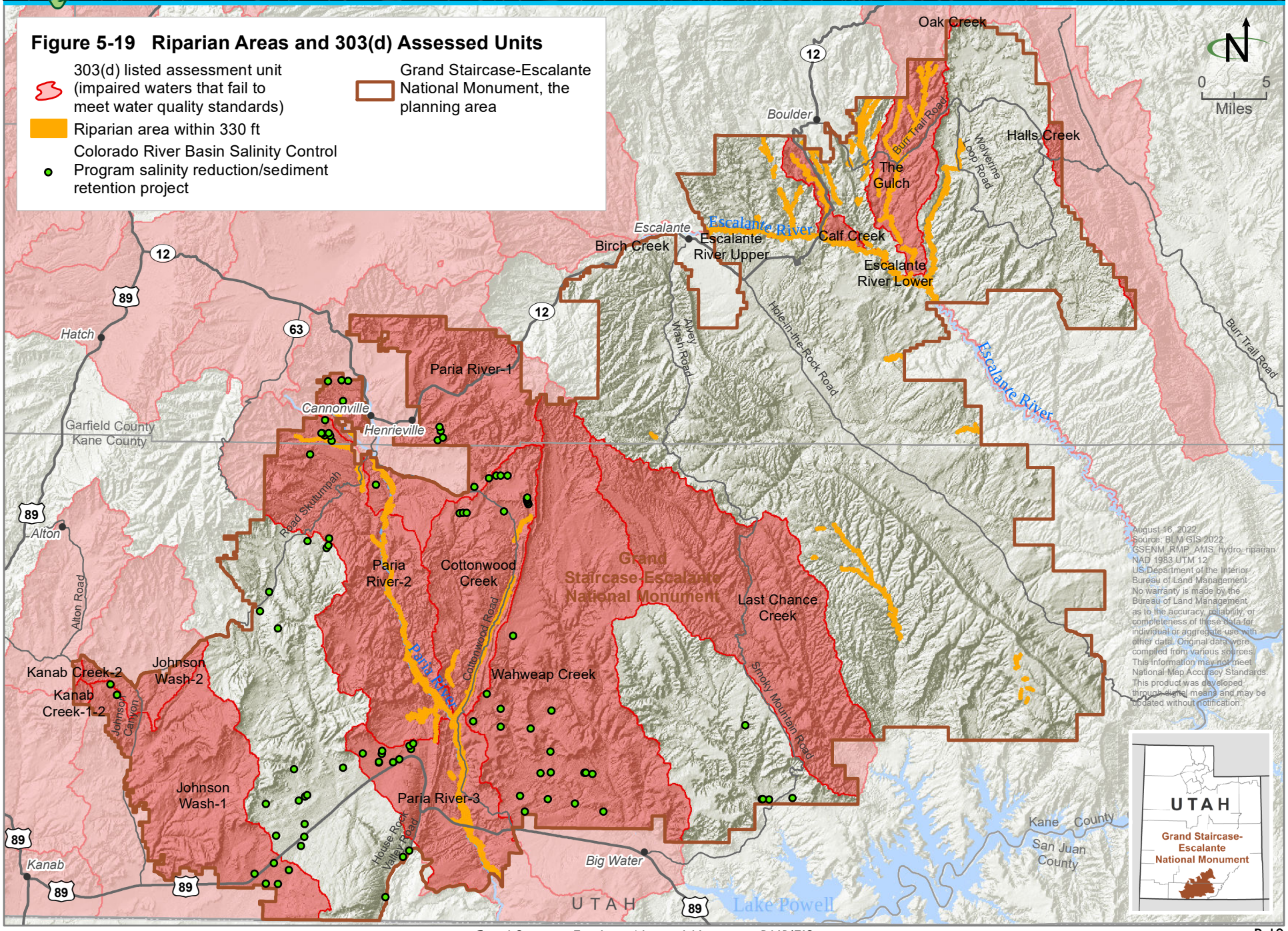
Figure 5-19 Riparian Areas and 303(d) Assessed Units
303(d) listed assessment unit (impaired waters that fail to meet water quality standards)
Riparian area within 330 ft
Colorado River Basin Salinity Control Program salinity reduction/sediment retention project
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Oak Creek
Boulder
Halls Creek
The Gulch
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Birch Creek
Escalante River Upper
Calf Creek
Escalante River Lower
Hole-in-the-Rock Road
Alvey Wash Road
Hatch
Paria River-1
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Paria River-2
Cottonwood Creek
Cottonwood Road
Grand Staircase-Escalante National Monument
Last Chance Creek
Smoky Mountain Road
Kanab Creek-2
Kanab Creek-1-2
Johnson Canyon
Johnson Wash-2
Wahweap Creek
Johnson Wash-1
Paria River-3
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_hydro_riparian
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

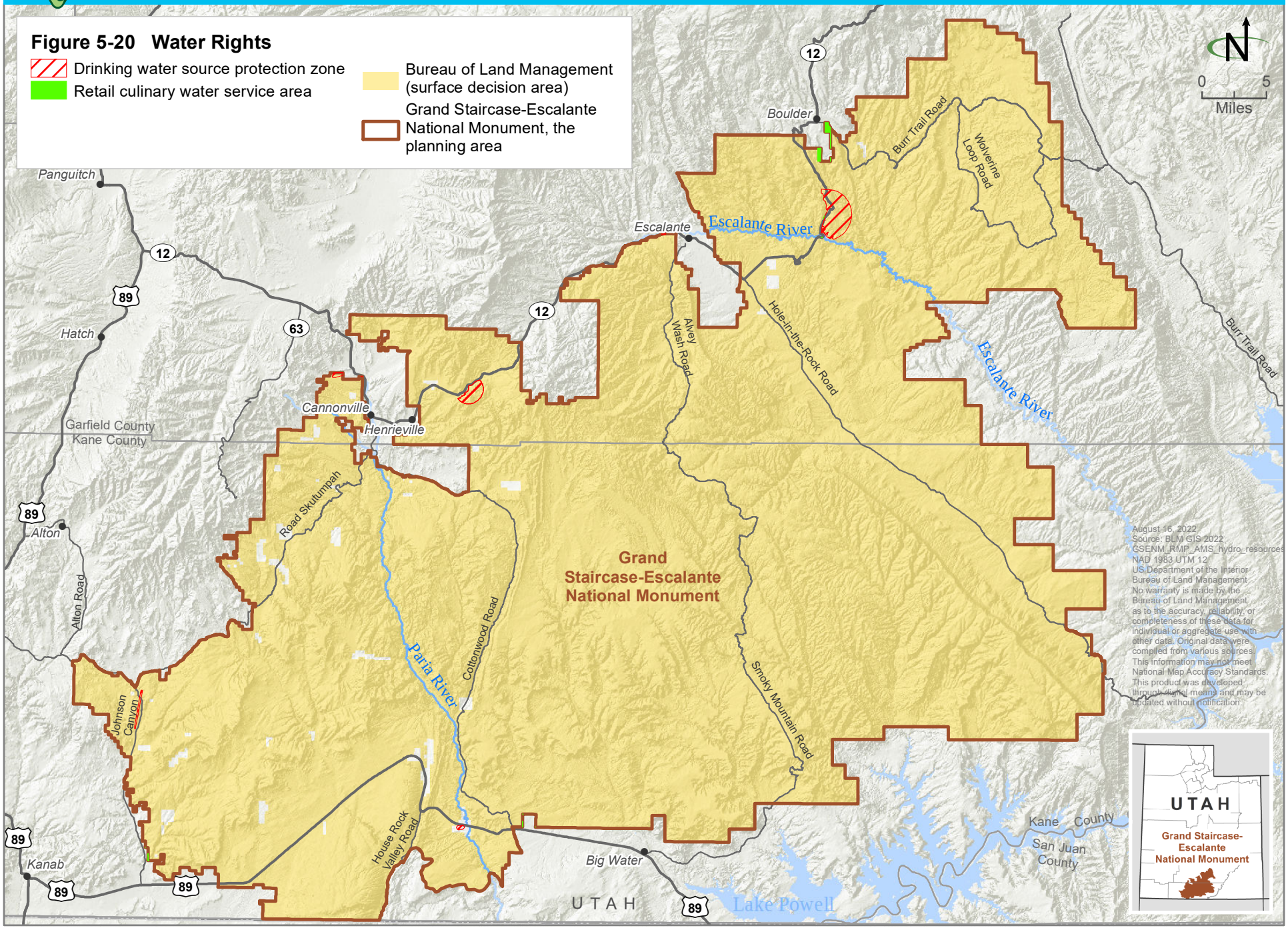
Figure 5-20 Water Rights
Drinking water source protection zone
Retail culinary water service area
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_hydro_resources
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

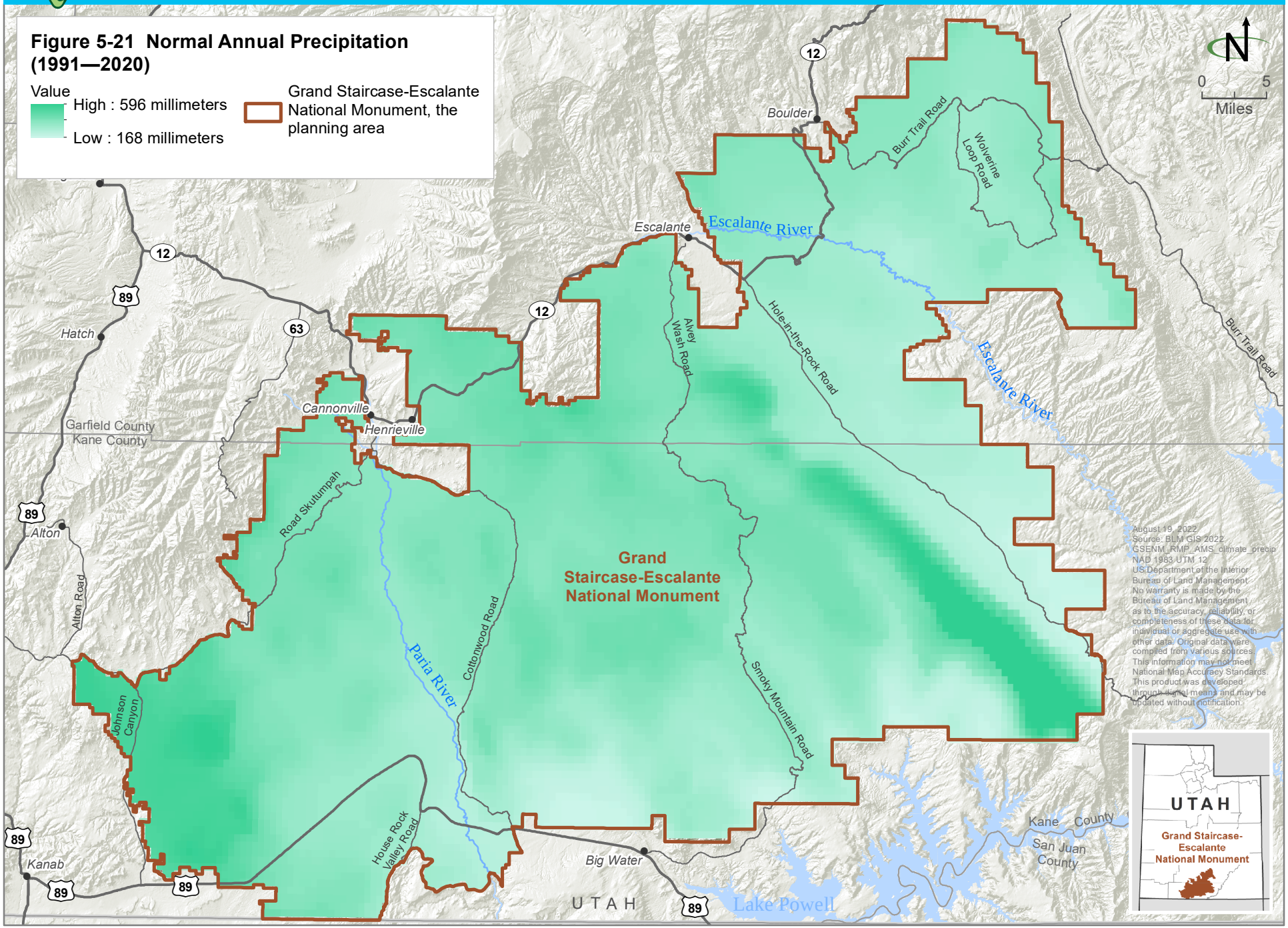
Figure 5-21 Normal Annual Precipitation (1991—2020)
Value
High : 596 millimeters
Low : 168 millimeters
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Johnson Canyon
Paria River
Cottonwood Road
Grand Staircase-Escalante National Monument
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
Kane County
San Juan County
UTAH
Lake Powell
12
89
63
August 19, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_climate_precip
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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UTAH
Grand Staircase-Escalante National Monument

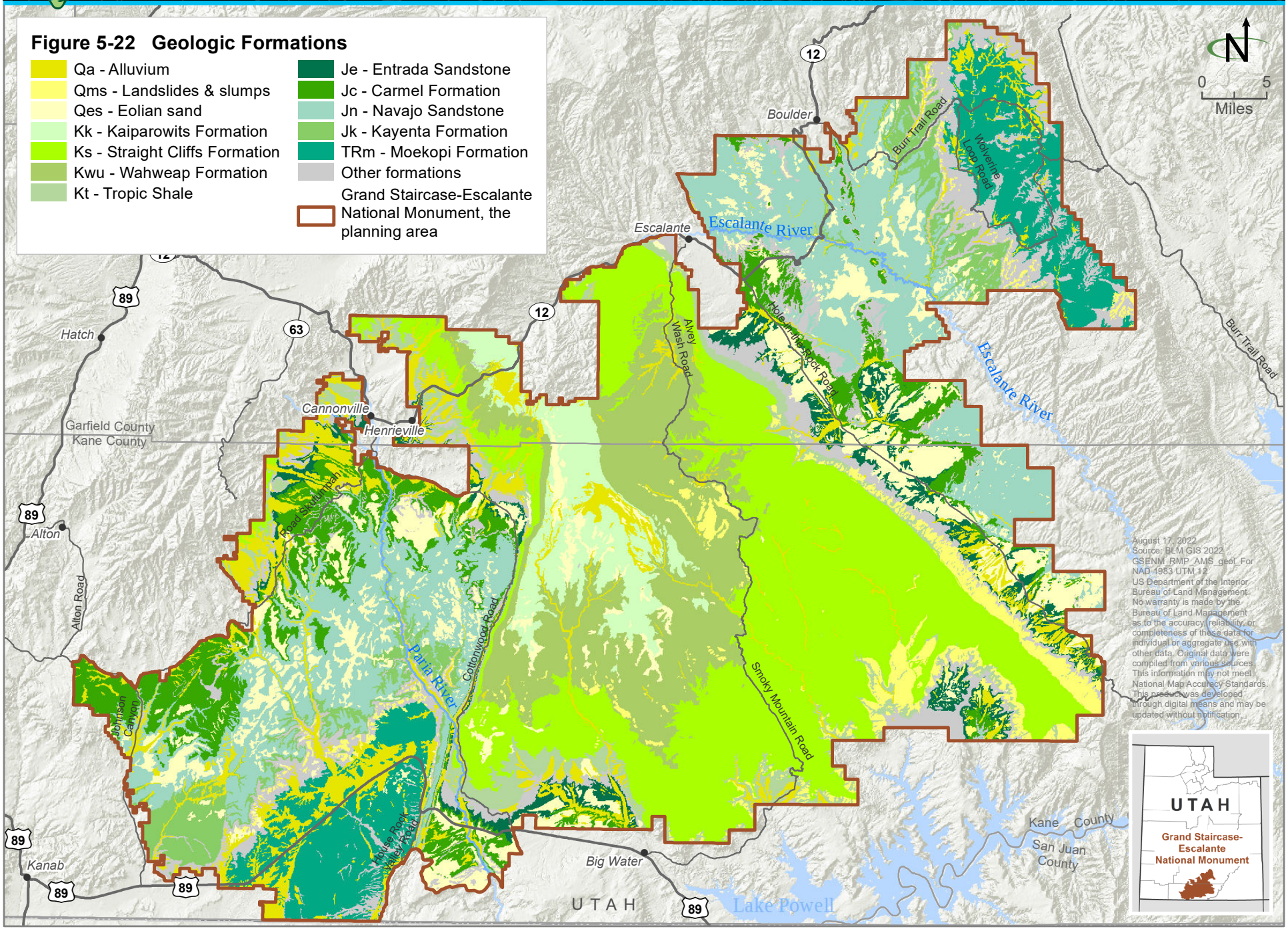
Figure 5-22 Geologic Formations
Qa - Alluvium
Qms - Landslides & slumps
Qes - Eolian sand
Kk - Kaiparowits Formation
Ks - Straight Cliffs Formation
Kwu - Wahweap Formation
Kt - Tropic Shale
Je - Entrada Sandstone
Jc - Carmel Formation
Jn - Navajo Sandstone
Jk - Kayenta Formation
TRm - Moekopi Formation
Other formations
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Burr Trail Road
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Alton
Alton Road
Johnson Canyon
Paria River
Cottonwood Road
Smoky Mountain Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 17, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_geol_For
NAD 1983 UTM 12
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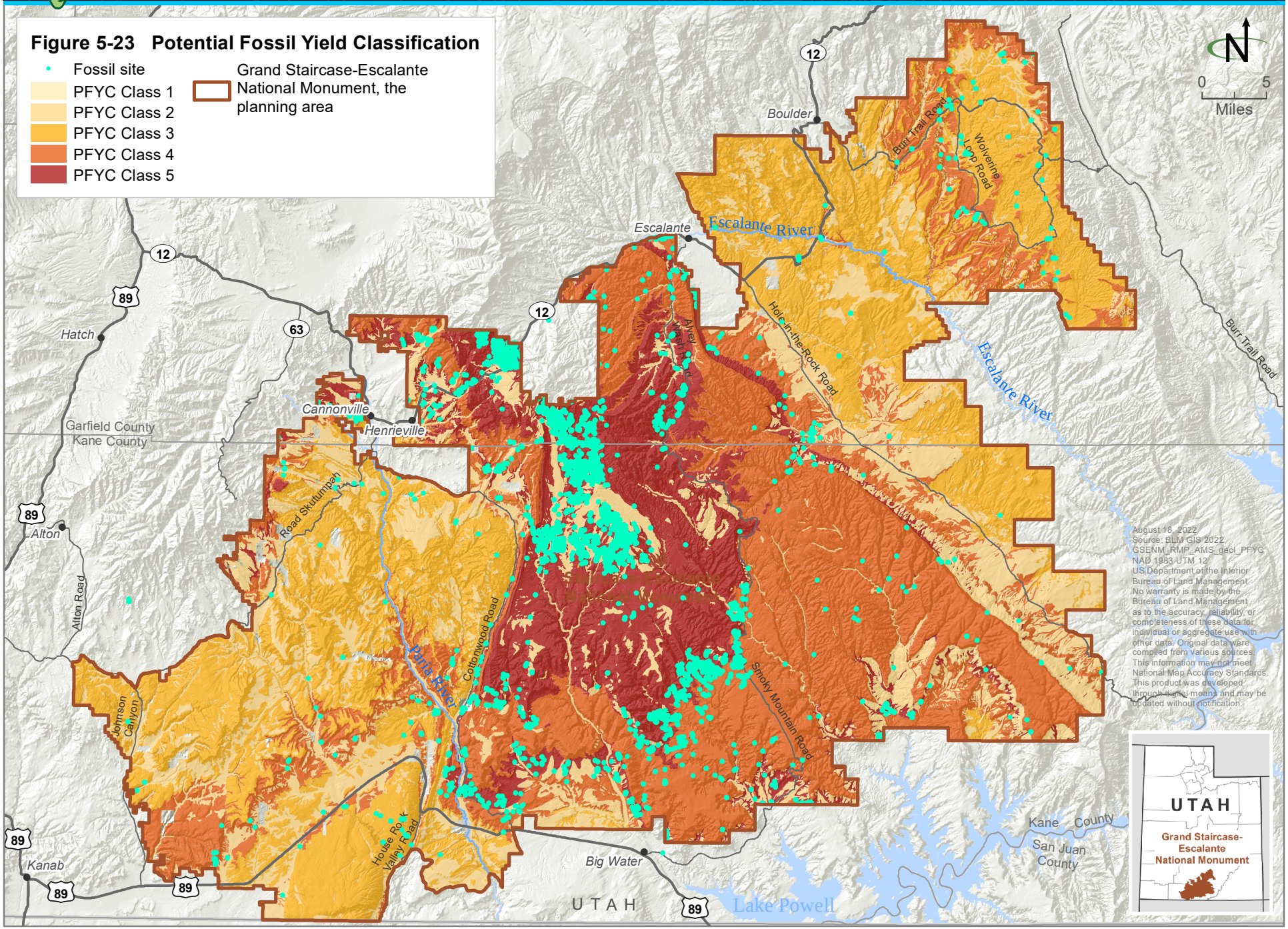
Figure 5-23 Potential Fossil Yield Classification
Fossil site
PFYC Class 1
PFYC Class 2
PFYC Class 3
PFYC Class 4
PFYC Class 5
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Burr Trail Road
Escalante River
12
89
63
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Alton
Alton Road
Road Skutumpah
Cottonwood Road
Paria River
Johnson Canyon
House Rock Valley Road
Smoky Mountain Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 18, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_geol_PFYC
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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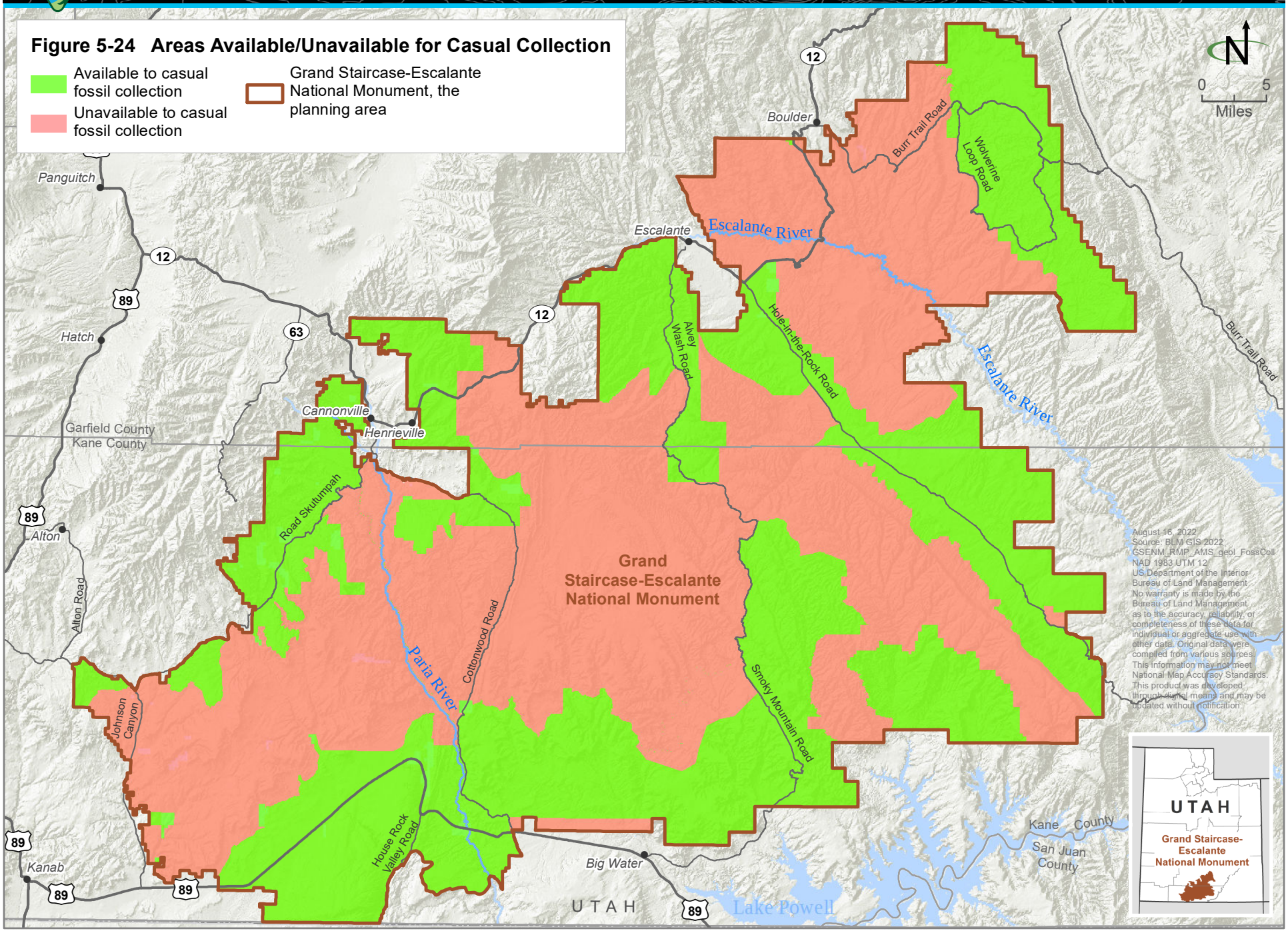
Grand Staircase-Escalante National Monument

Figure 5-24 Areas Available/Unavailable for Casual Collection



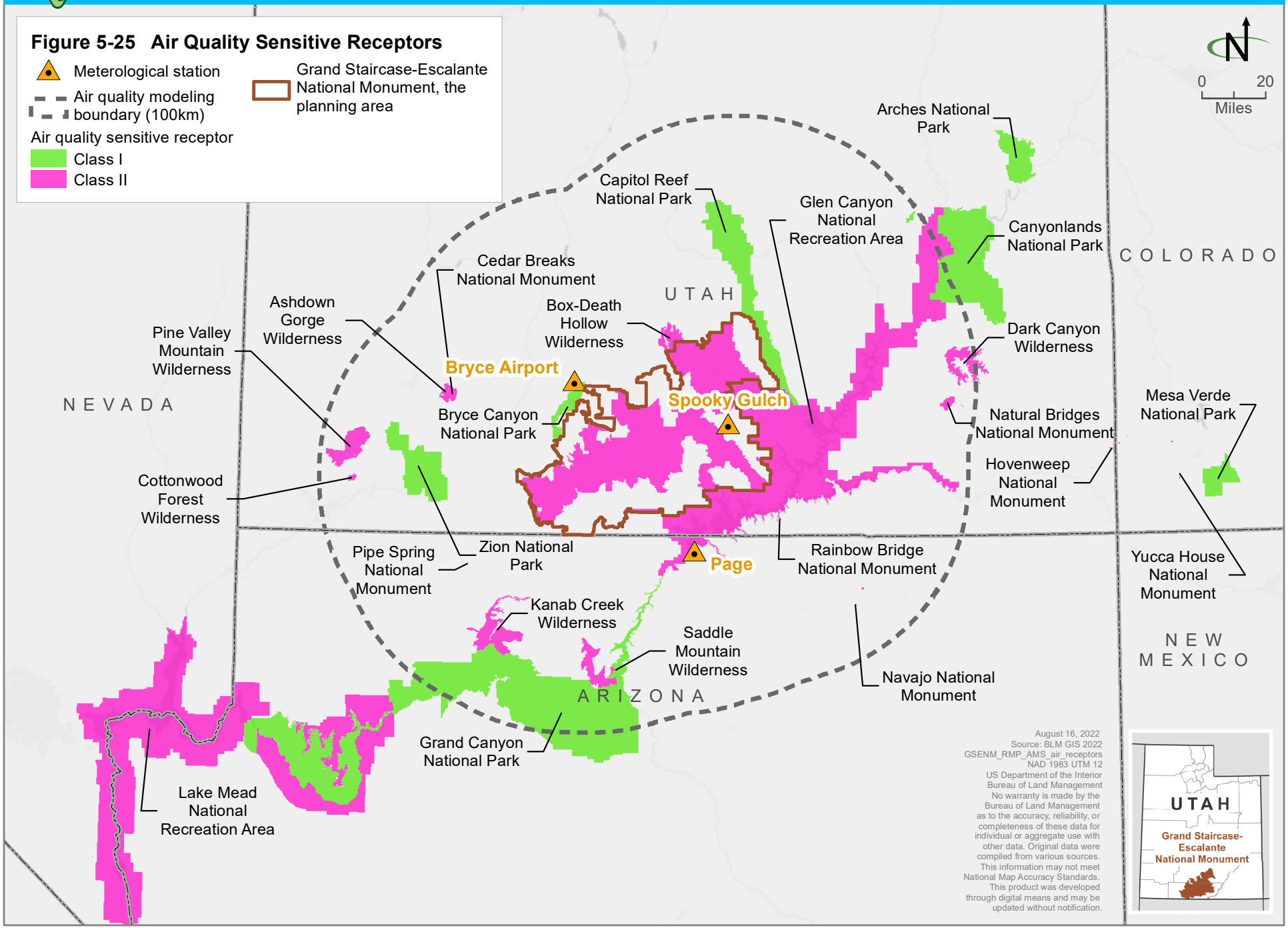


Figure 5-25 Air Quality Sensitive Receptors
Meterological station
Air quality modeling boundary (100km)
Air quality sensitive receptor
Class I
Class II
Grand Staircase-Escalante National Monument, the planning area
N
0 20
Miles
Arches National Park
Capitol Reef National Park
Glen Canyon National Recreation Area
Canyonlands National Park
COLORADO
Cedar Breaks National Monument
UTAH
Ashdown Gorge Wilderness
Box-Death Hollow Wilderness
Pine Valley Mountain Wilderness
Bryce Airport
Dark Canyon Wilderness
Spooky Gulch
NEVADA
Bryce Canyon National Park
Natural Bridges National Monument
Mesa Verde National Park
Hovenweep National Monument
Cottonwood Forest Wilderness
Zion National Park
Pipe Spring National Monument
Page
Rainbow Bridge National Monument
Yucca House National Monument
Kanab Creek Wilderness
Saddle Mountain Wilderness
NEW MEXICO
ARIZONA
Navajo National Monument
Grand Canyon National Park
Lake Mead National Recreation Area
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_air_receptors
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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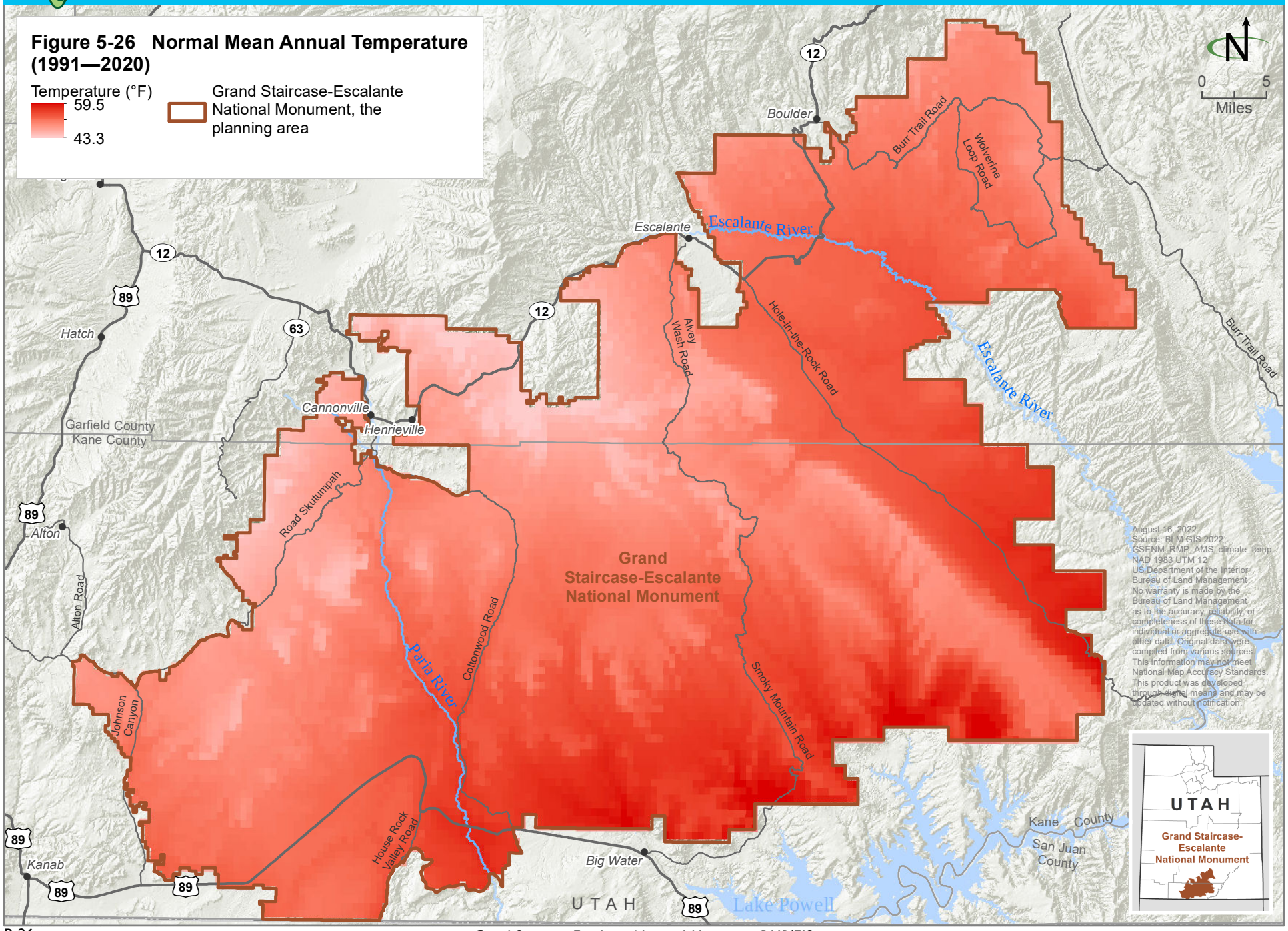
Figure 5-26 Normal Mean Annual Temperature (1991—2020)



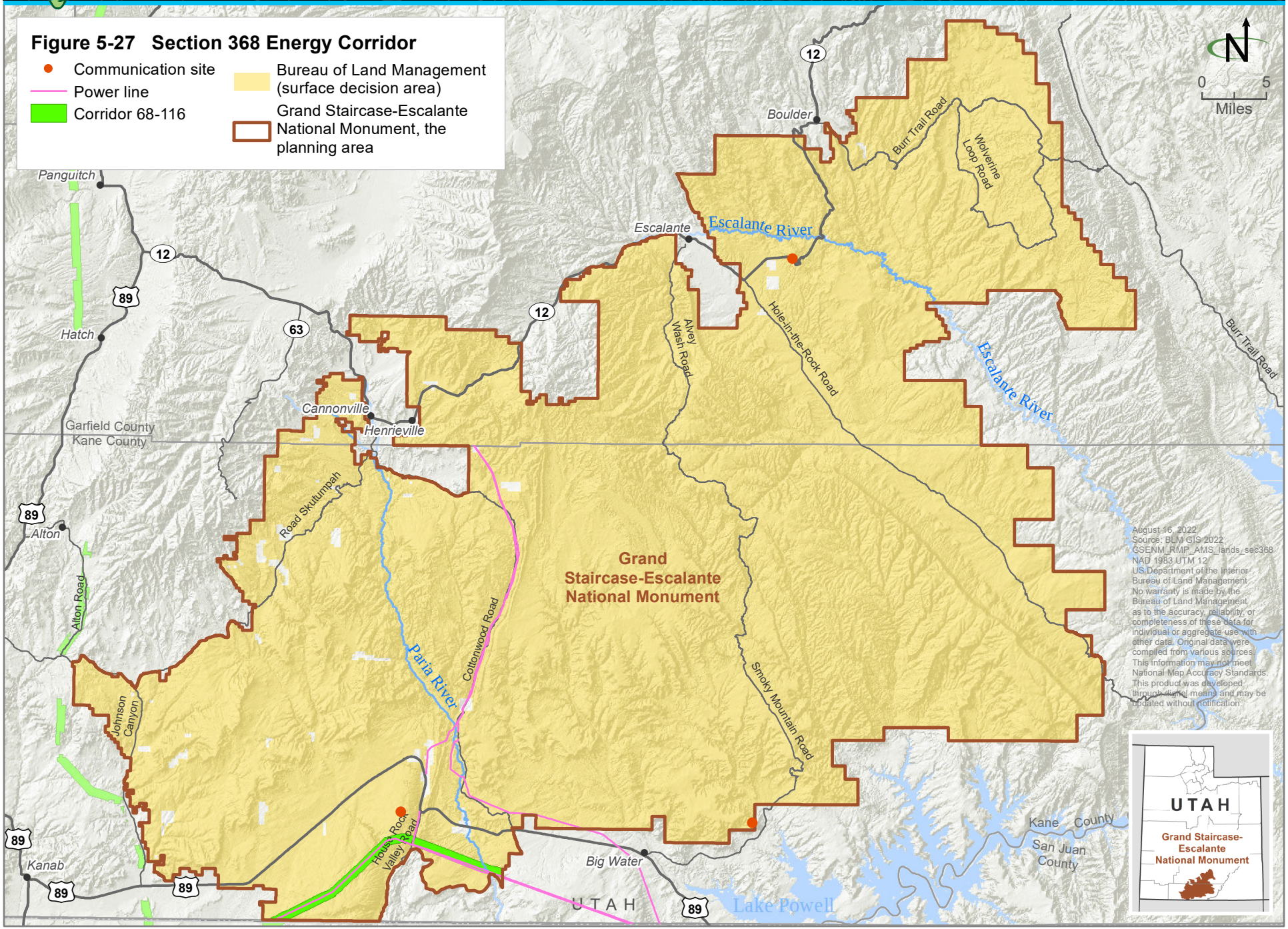


Figure 5-27 Section 368 Energy Corridor
Communication site
Power line
Corridor 68-116
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Panguitch
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
Hourn Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_lands_se368
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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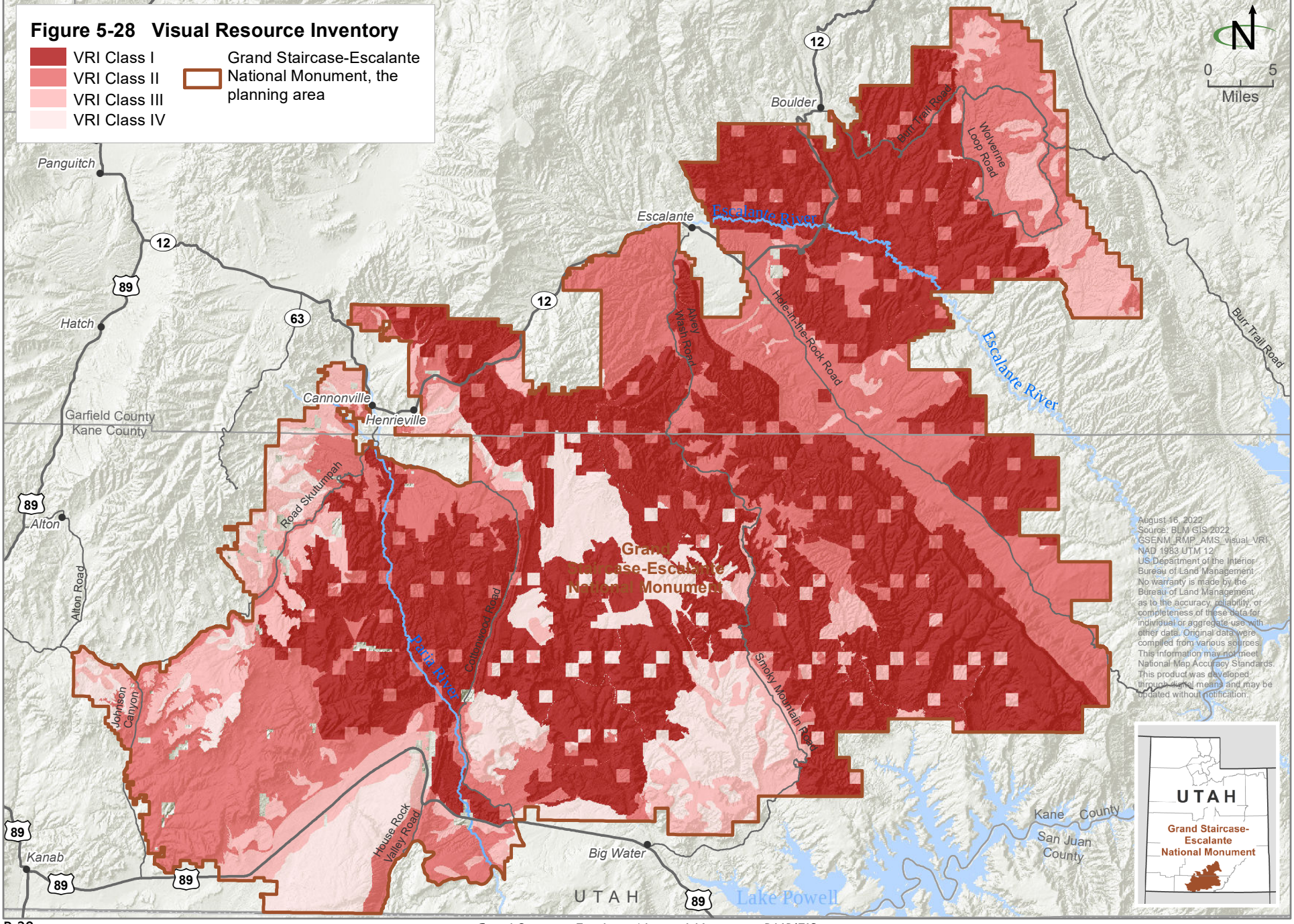
Figure 5-28 Visual Resource Inventory



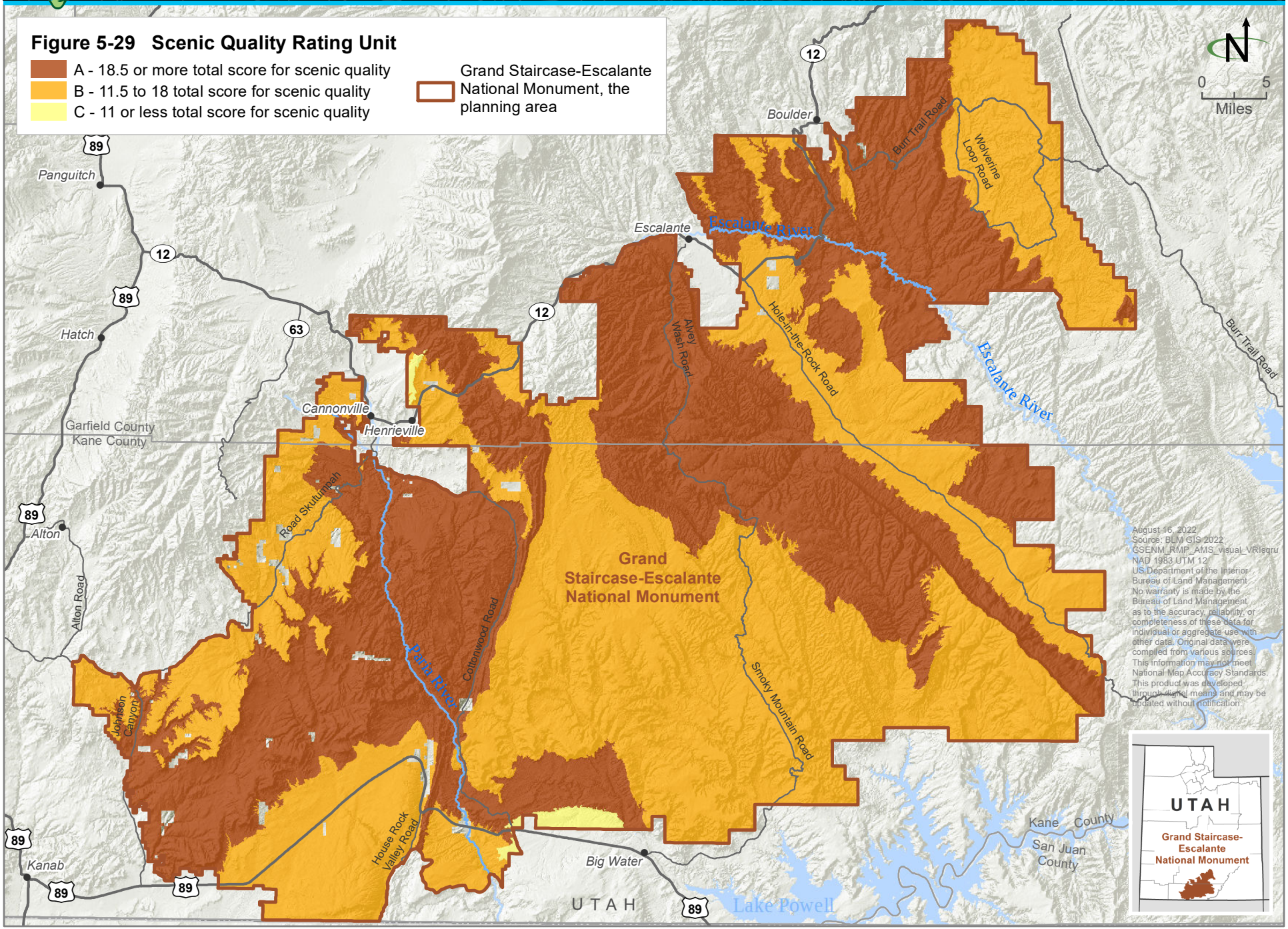


Figure 5-29 Scenic Quality Rating Unit
A - 18.5 or more total score for scenic quality
B - 11.5 to 18 total score for scenic quality
C - 11 or less total score for scenic quality
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Hole-in-the-Rock Road
Alvey Wash Road
Panguitch
Hatch
Cannonville
Henrieville
Garfield County
Kane County
Alton
Alton Road
Road Skutumpah
Johnson Canyon
Paria River
Cottonwood Road
Grand Staircase-Escalante National Monument
Smoky Mountain Road
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_visual_VRIsgru
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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Figure 5-30 Sensitivity Level Rating Units

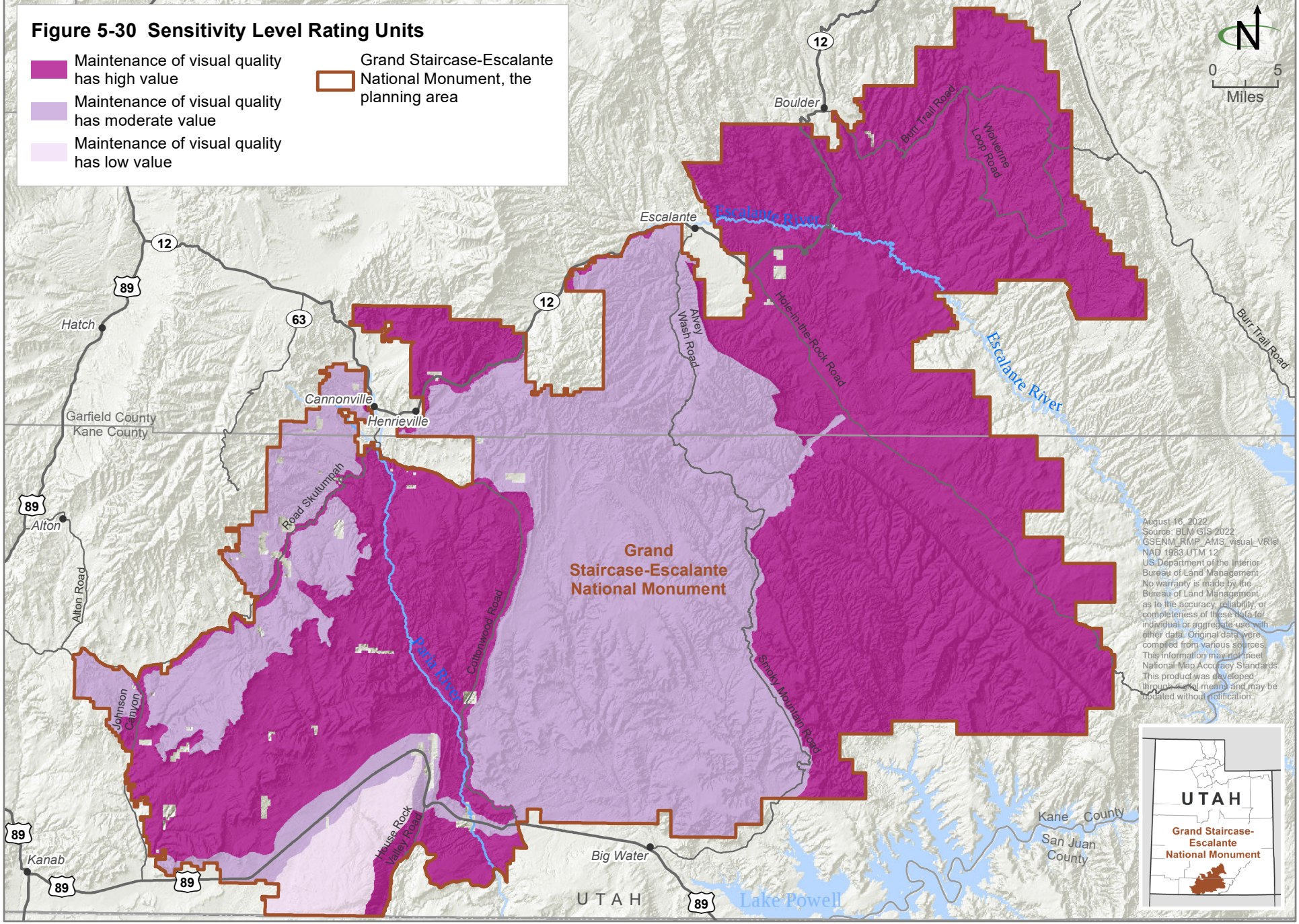
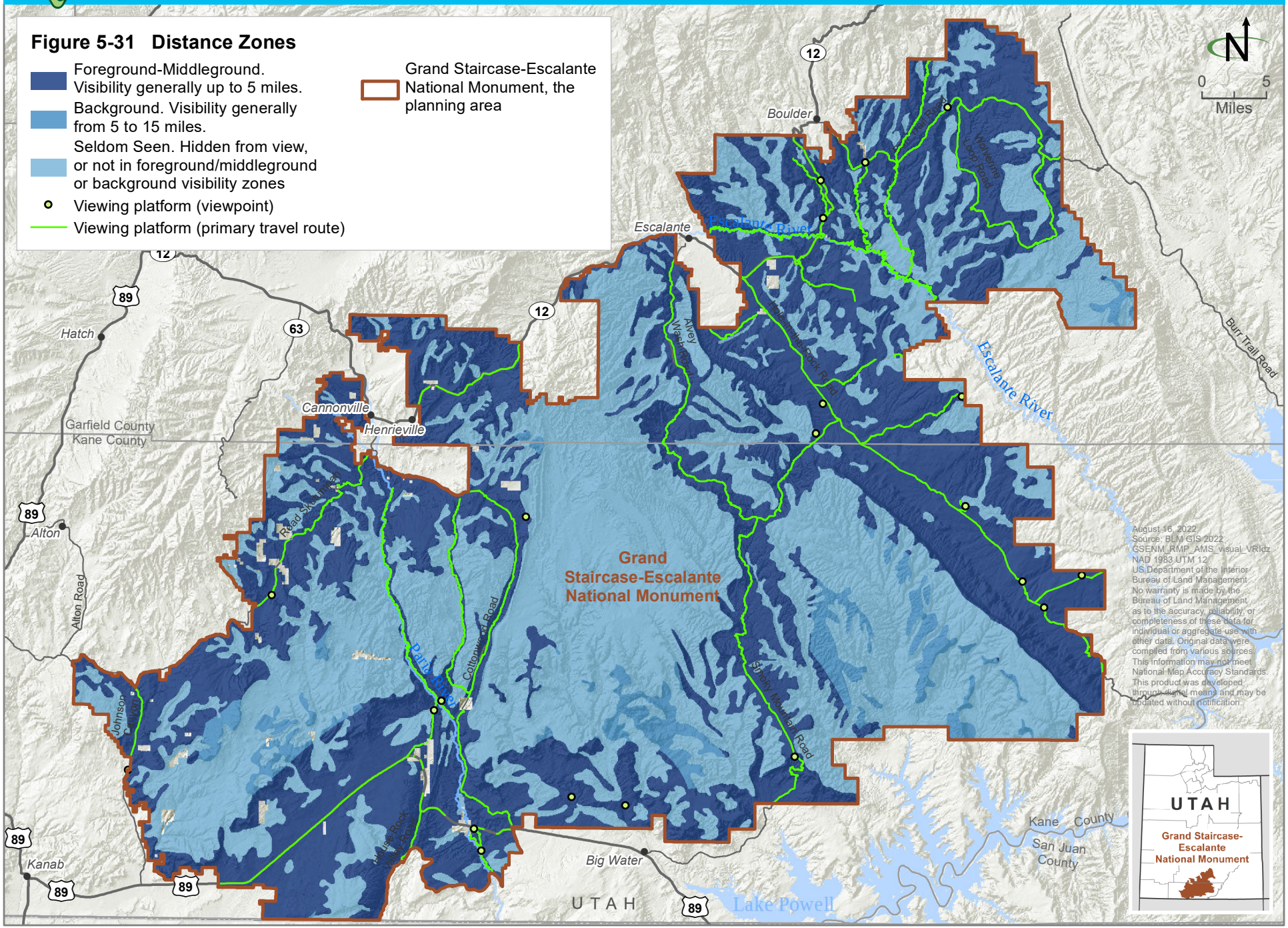


Figure 5-31 Distance Zones



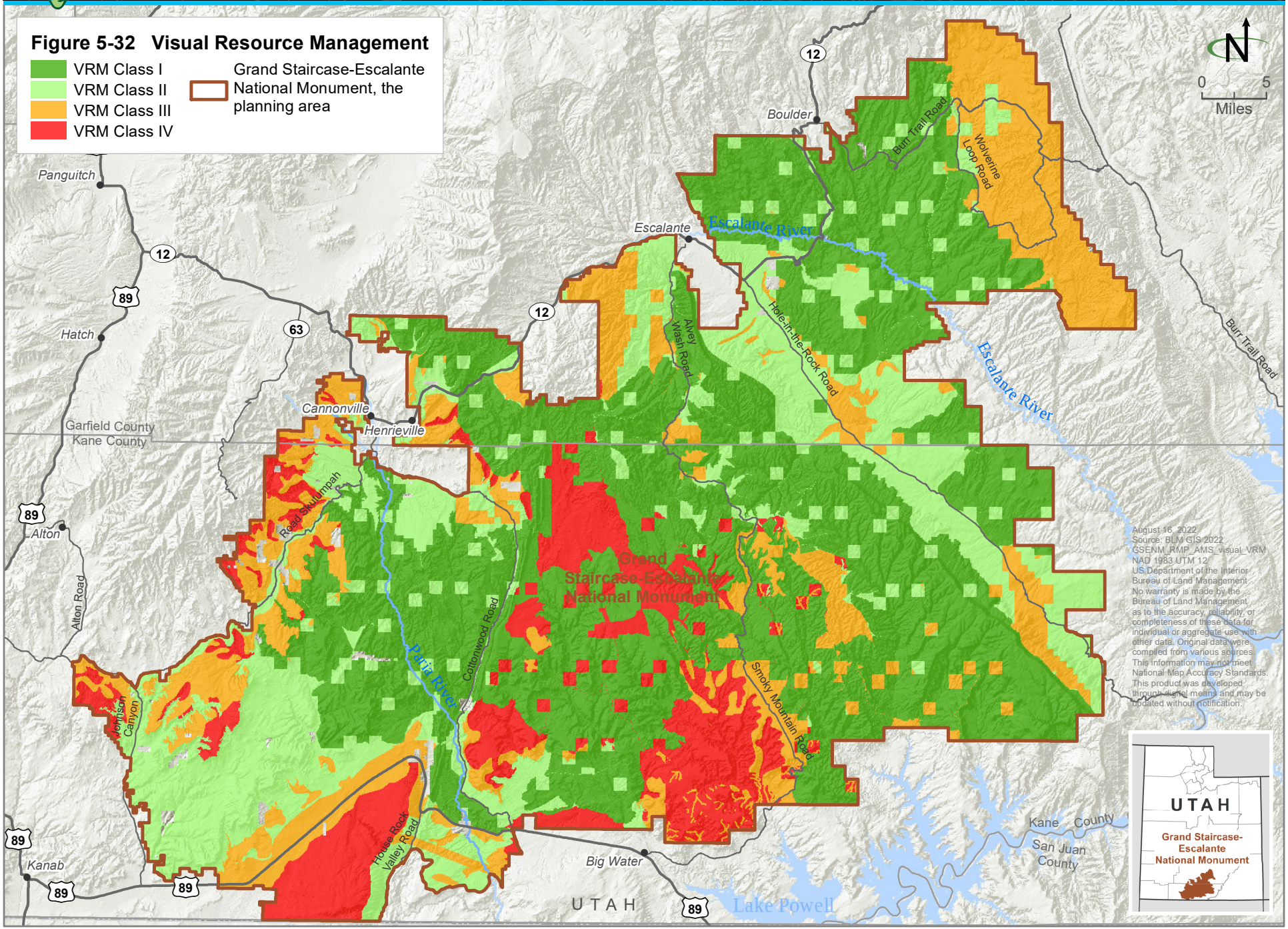


Figure 5-32 Visual Resource Management
VRM Class I
VRM Class II
VRM Class III
VRM Class IV
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Escalante
Escalante River
Panguitch
12
89
63
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Alton
Alton Road
Skutumpah Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
Kane County
San Juan County
UTAH
Lake Powell
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_visual_VRM
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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Grand Staircase-Escalante National Monument

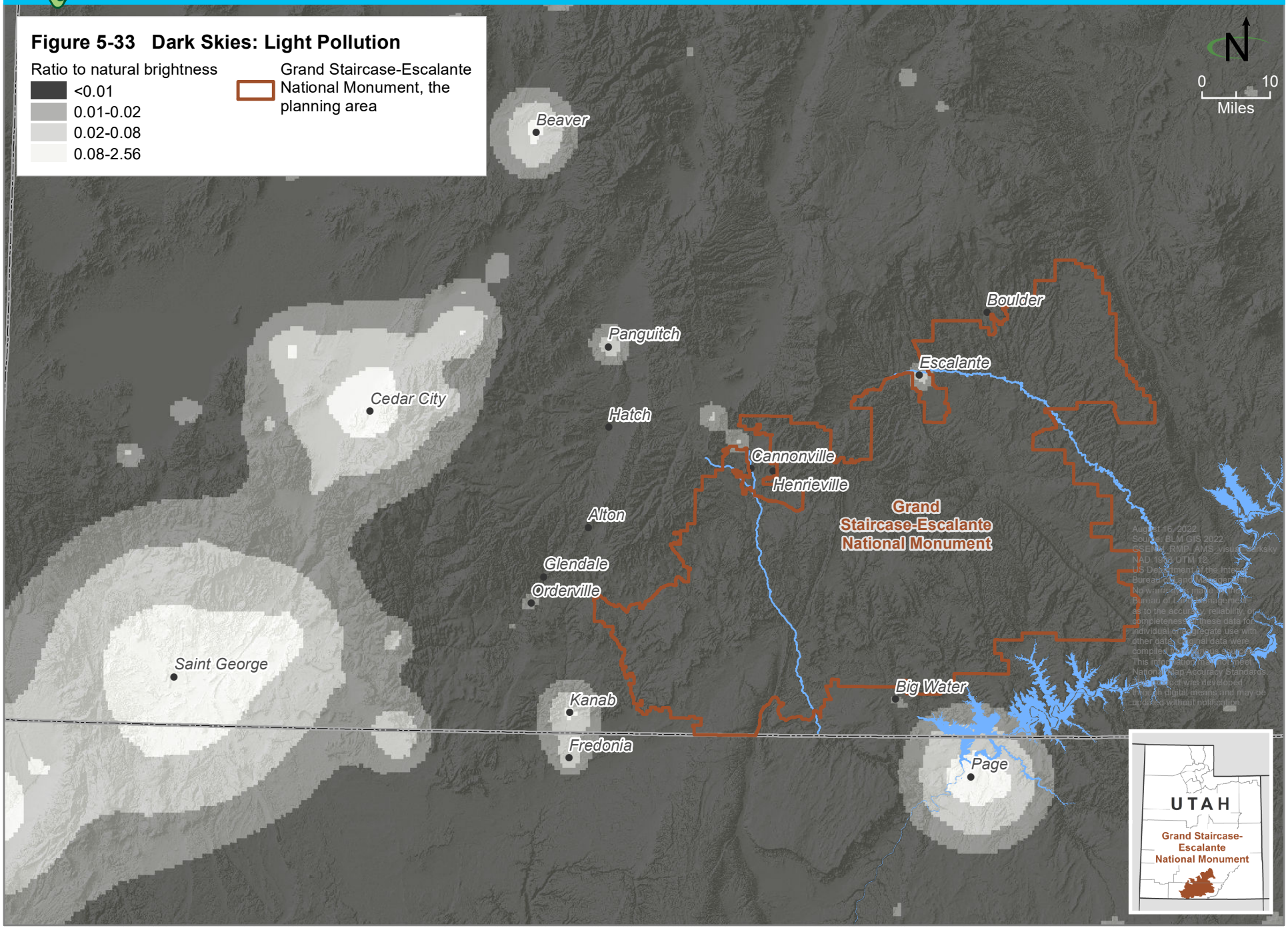
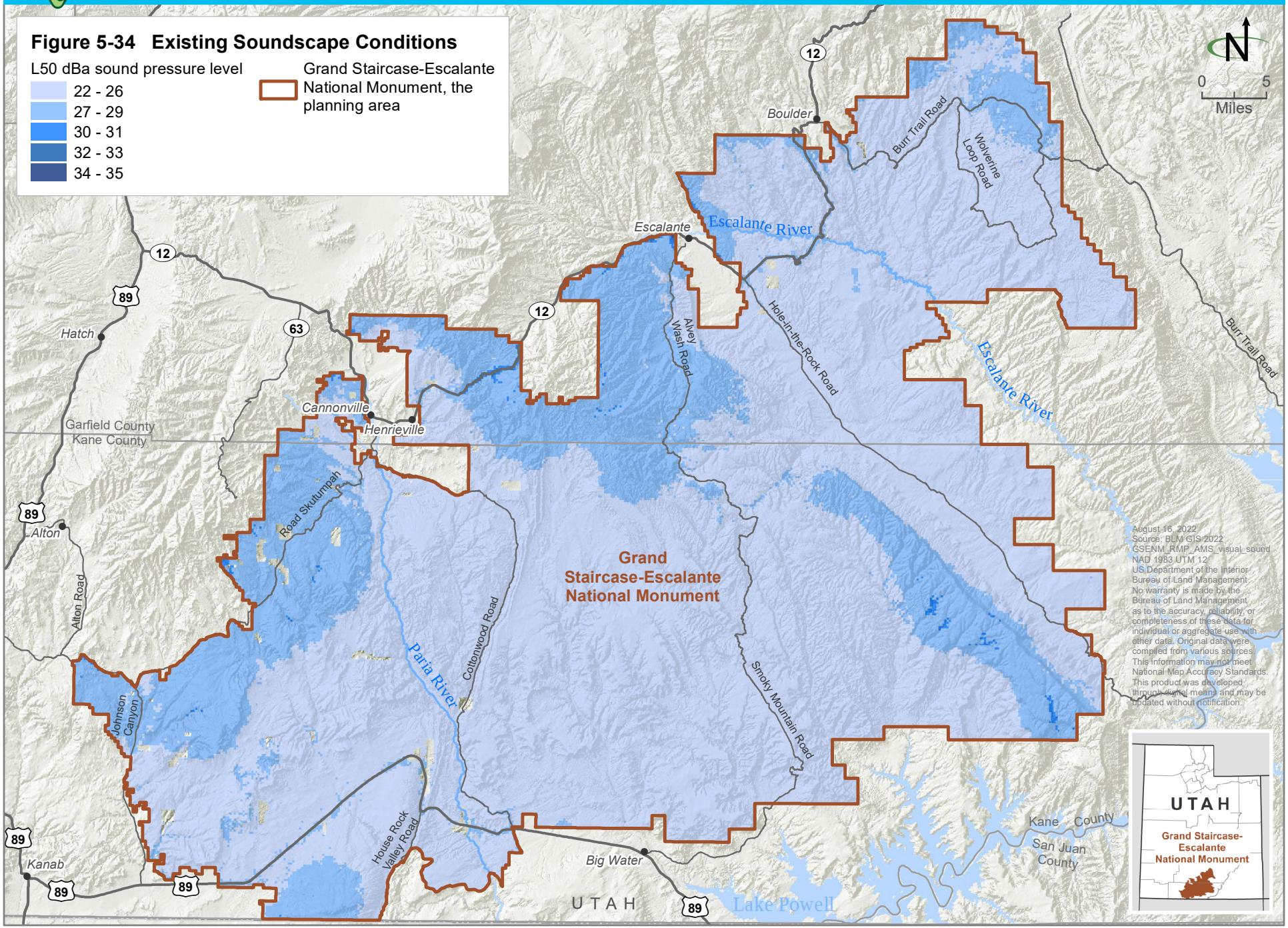


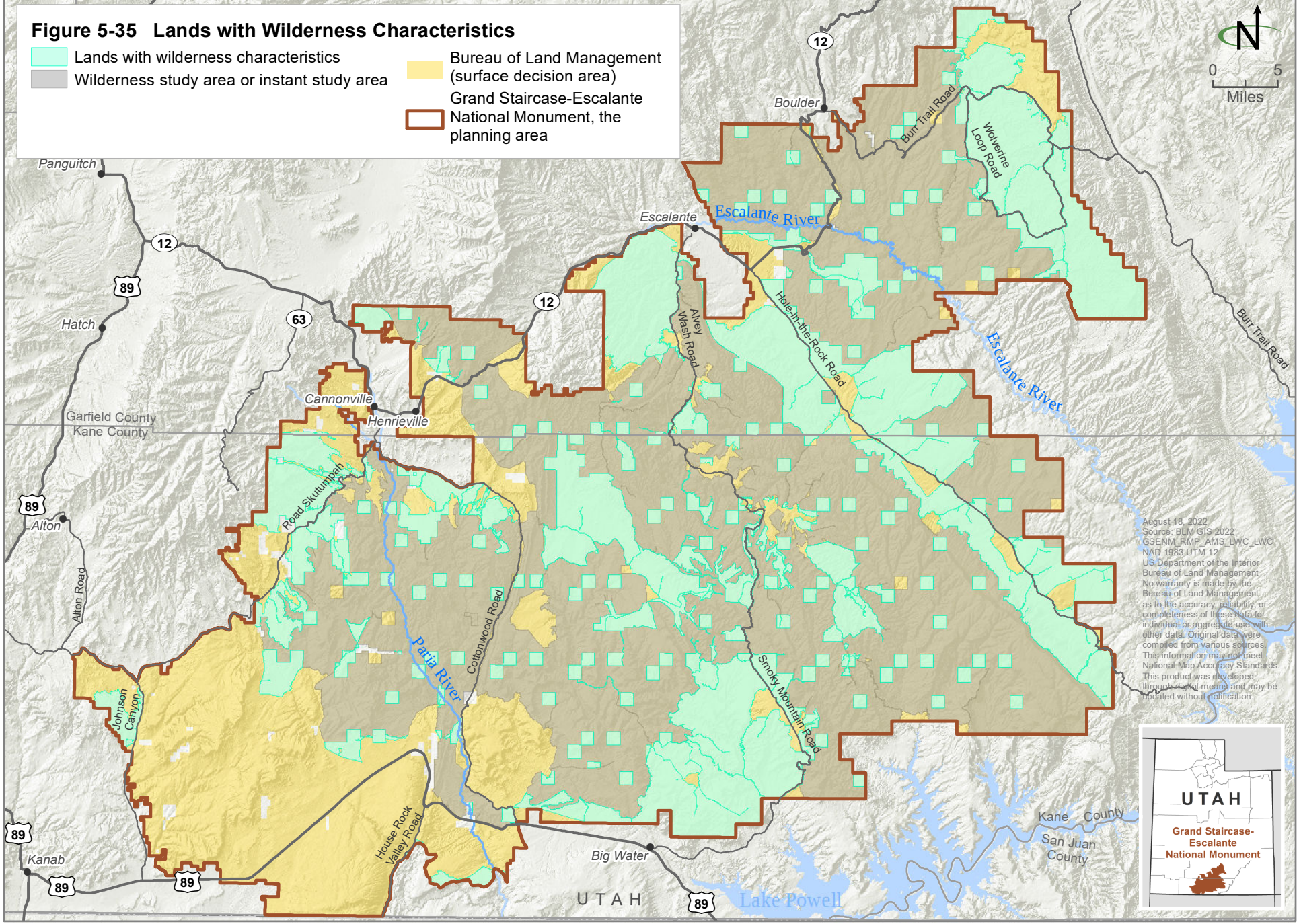
Figure 5-33 Dark Skies: Light Pollution
Ratio to natural brightness
<0.01
0.01-0.02
0.02-0.08
0.08-2.56
Grand Staircase-Escalante National Monument, the planning area
N
0
10
Miles
Beaver
Boulder
Panguitch
Escalante
Cedar City
Hatch
Cannonville
Henrieville
Alton
Grand Staircase-Escalante National Monument
Glendale
Orderville
Saint George
Kanab
Big Water
Fredonia
Page
UTAH
Grand Staircase-Escalante National Monument

Figure 5-34 Existing Soundscape Conditions



Grand Staircase-Escalante National Monument

Figure 5-35 Lands with Wilderness Characteristics



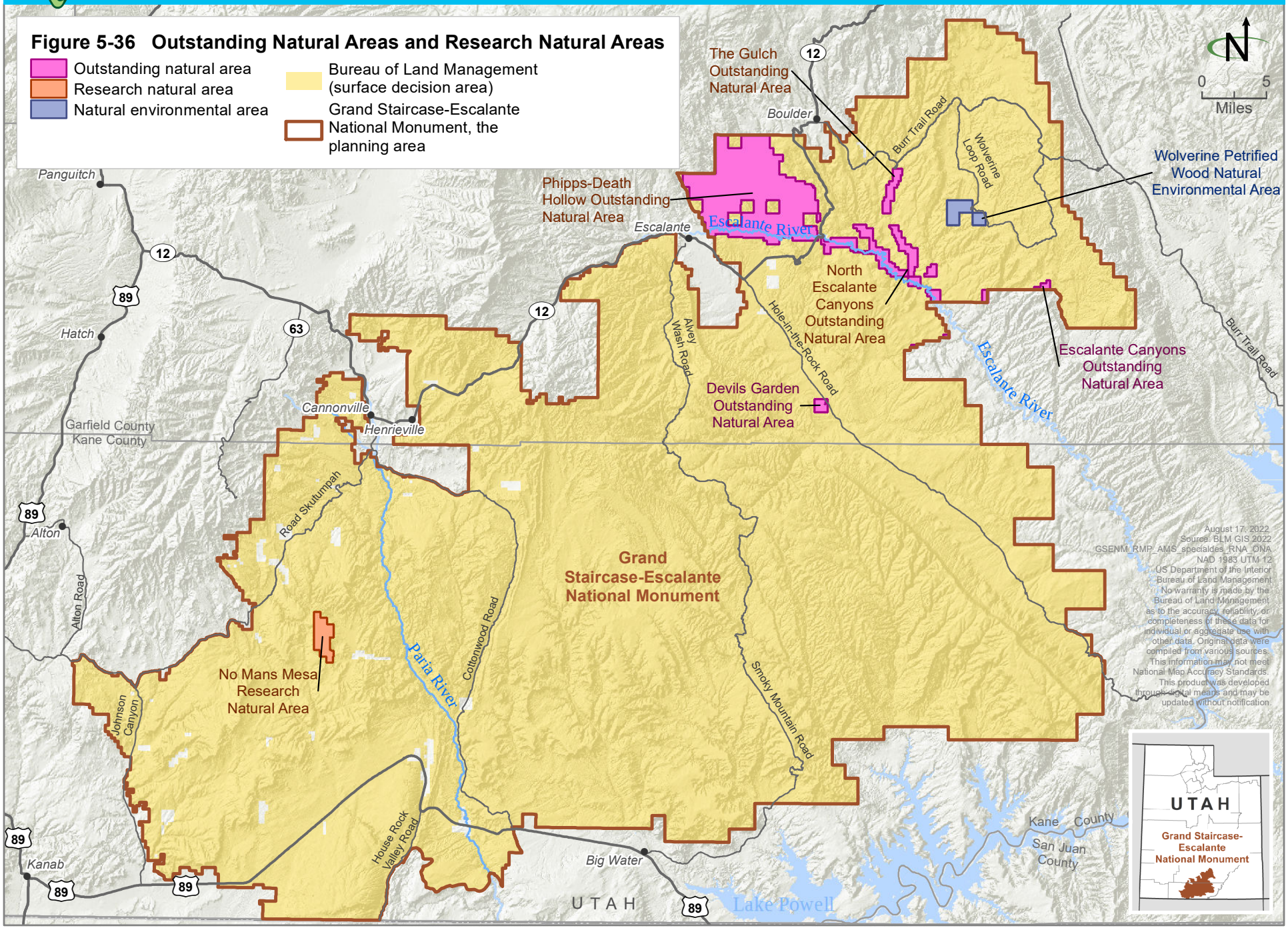


Figure 5-36 Outstanding Natural Areas and Research Natural Areas
Outstanding natural area
Research natural area
Natural environmental area
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
The Gulch Outstanding Natural Area
Boulder
Burr Trail Road
Wolverine Loop Road
Wolverine Petrified Wood Natural Environmental Area
Phipps-Death Hollow Outstanding Natural Area
Escalante
Escalante River
North Escalante Canyons Outstanding Natural Area
Escalante Canyons Outstanding Natural Area
Panguitch
12
89
Hatch
63
Alvey Wash Road
Hole-in-the-Rock Road
Devils Garden Outstanding Natural Area
Cannonville
Henrieville
Garfield County
Kane County
Alton
Road Skutumpah
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
No Mans Mesa Research Natural Area
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
August 17, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_specialdes_RNA_ONA
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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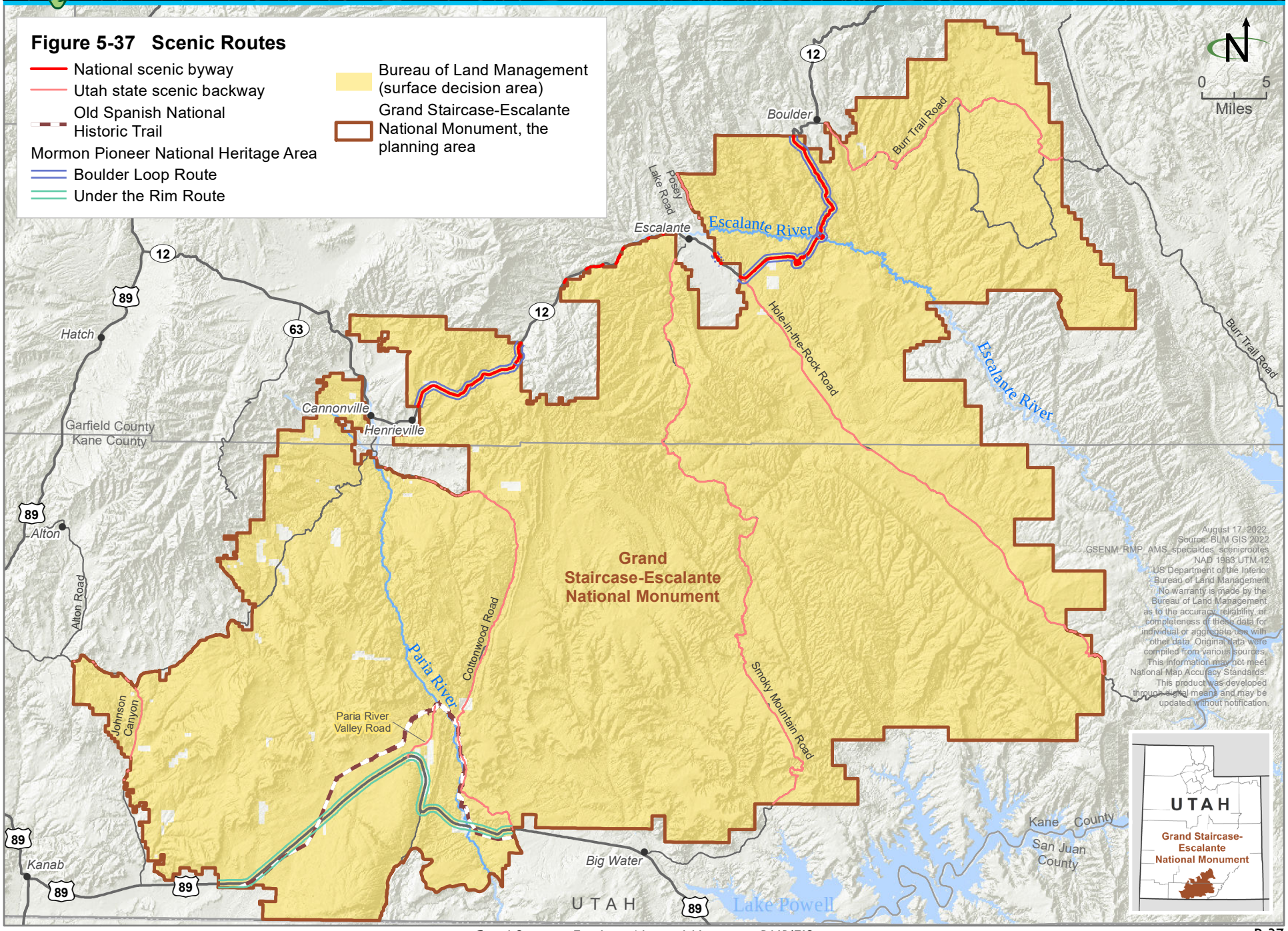
Figure 5-37 Scenic Routes



Grand Staircase-Escalante National Monument

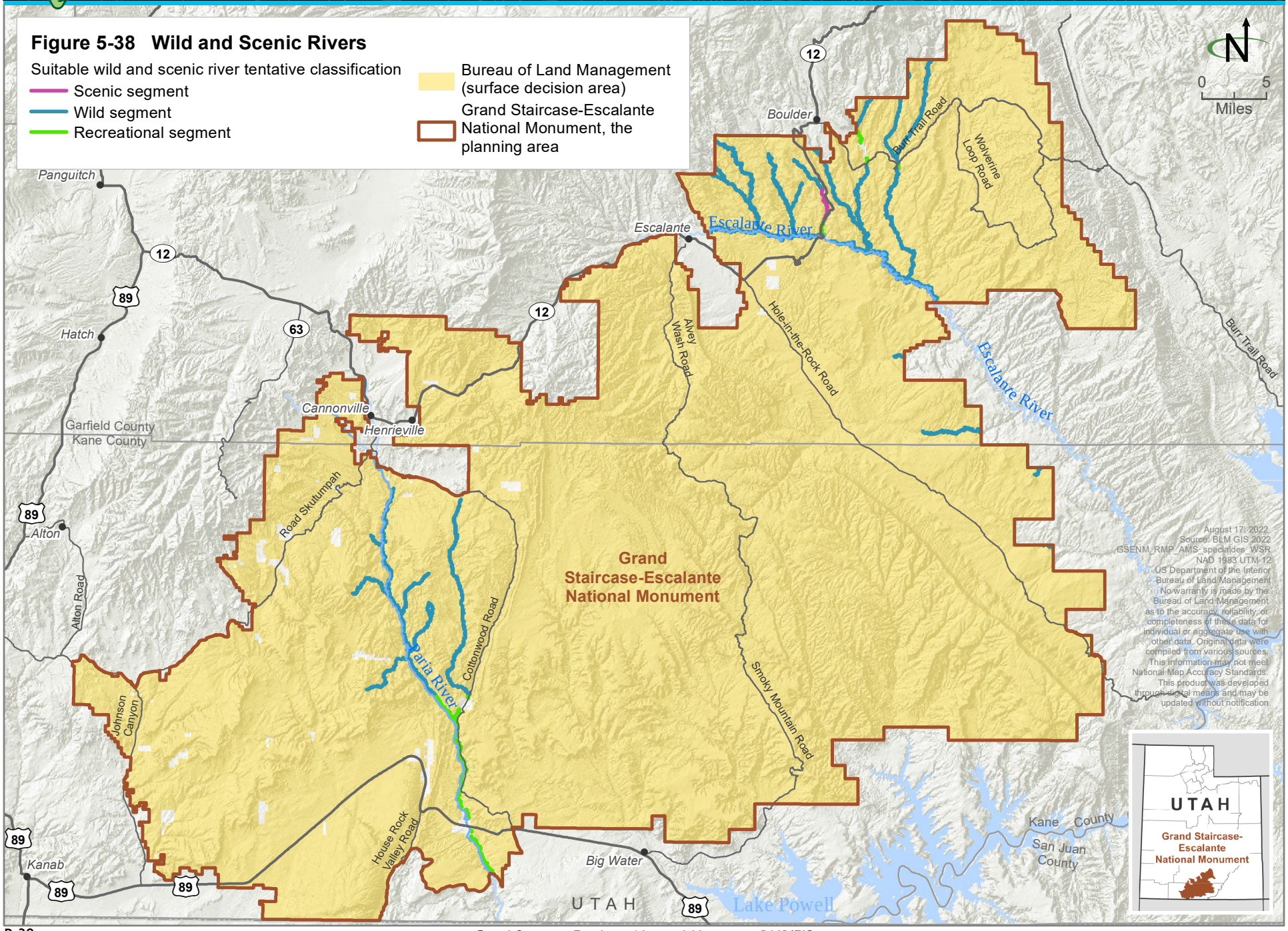
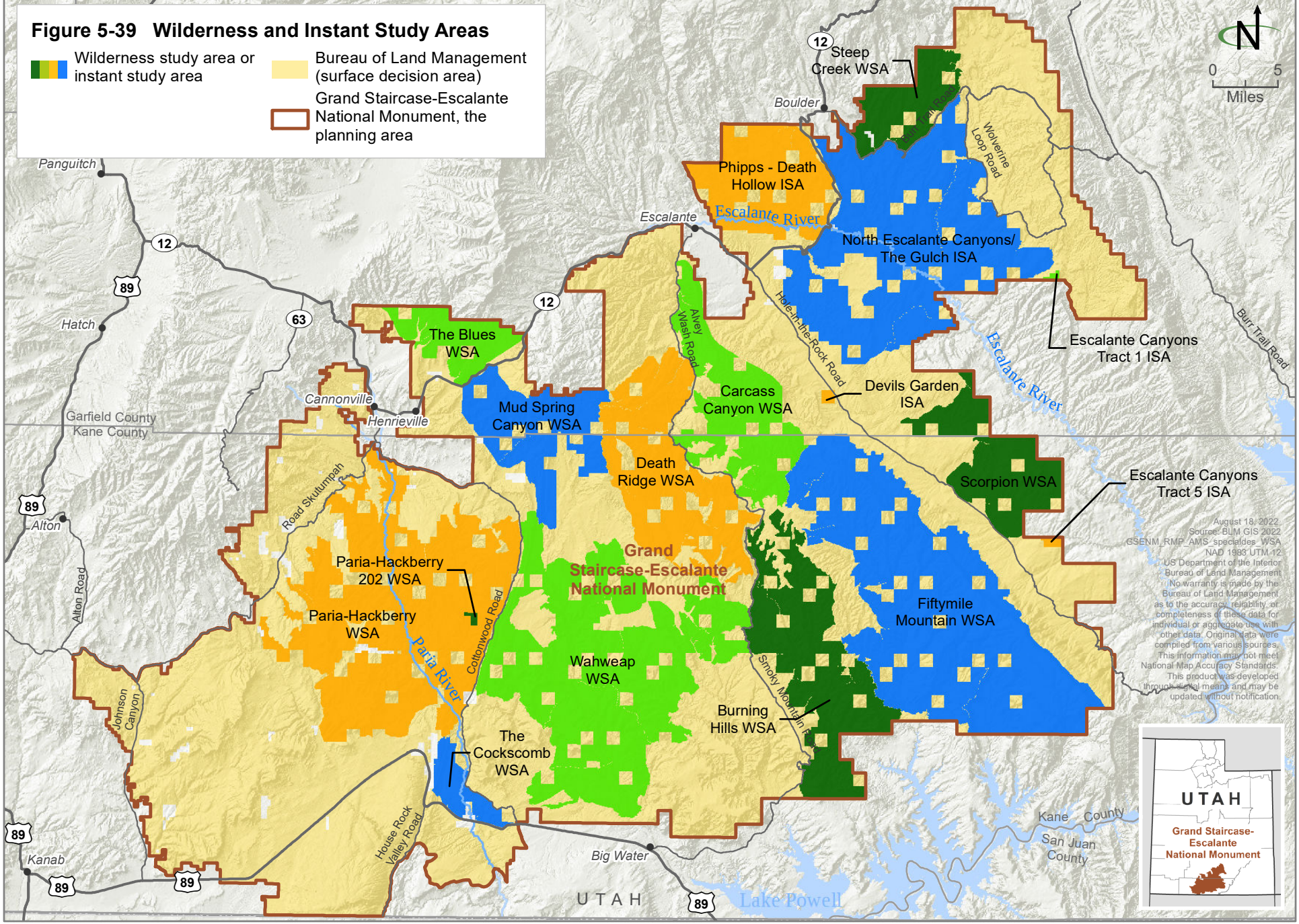


Figure 5-39 Wilderness and Instant Study Areas



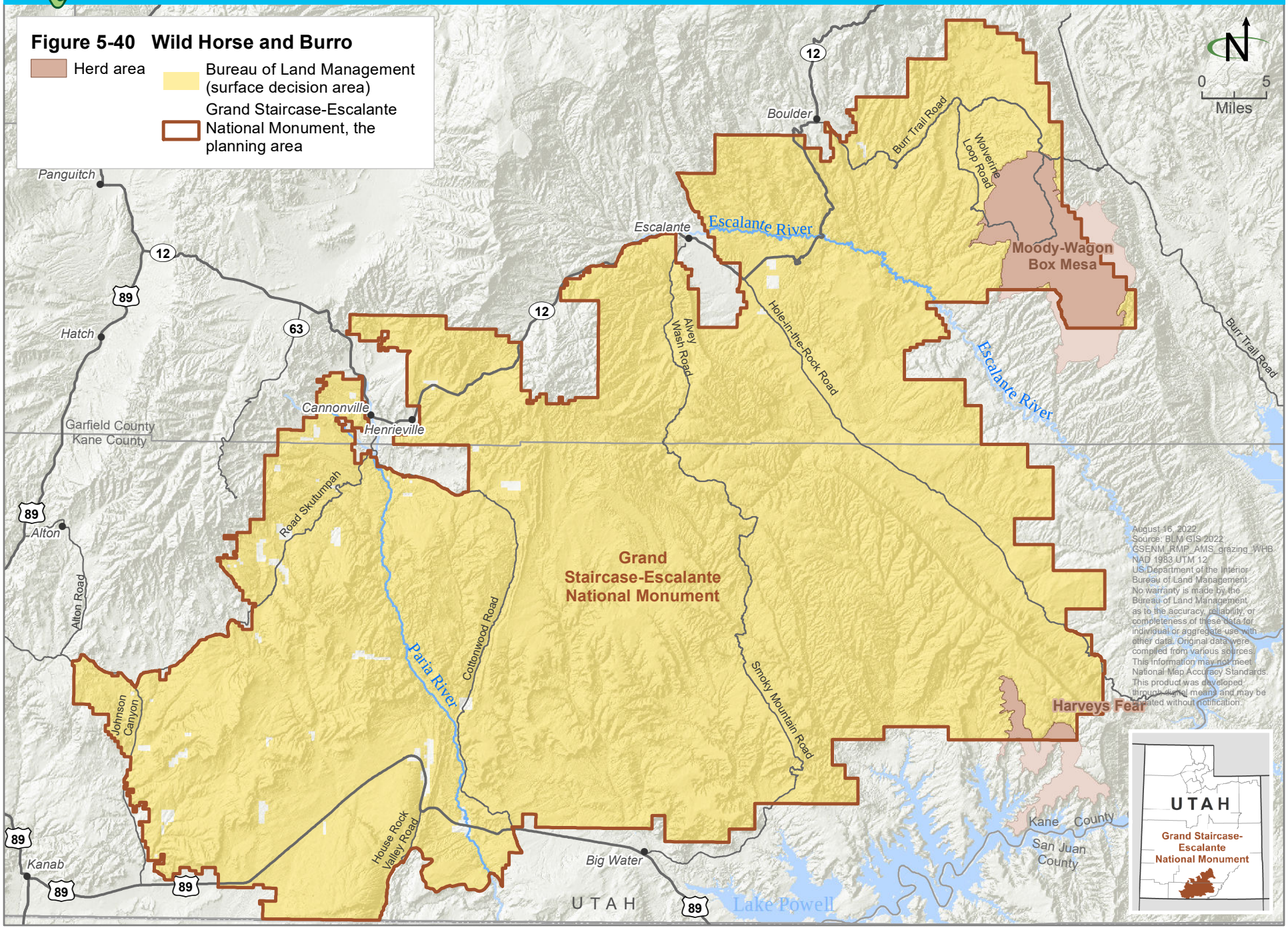


Figure 5-40 Wild Horse and Burro
Herd area
Bureau of Land Management (surface decision area)
Grand Staircase-Escalante National Monument, the planning area
N
0 5
Miles
Boulder
Burr Trail Road
Wolverine Loop Road
Panguitch
Escalante
Escalante River
Moody-Wagon Box Mesa
Hatch
Alvey Wash Road
Hole-in-the-Rock Road
Cannonville
Henrieville
Garfield County
Kane County
Road Skutumpah
Alton
Alton Road
Grand Staircase-Escalante National Monument
Paria River
Cottonwood Road
Smoky Mountain Road
Harveys Fear
Johnson Canyon
House Rock Valley Road
Kanab
Big Water
UTAH
Lake Powell
Kane County
San Juan County
12
89
63
August 16, 2022
Source: BLM GIS 2022
GSENM_RMP_AMS_grazing_WHB
NAD 1983 UTM 12
US Department of the Interior
Bureau of Land Management
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Appendix C
Paleontology

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Appendix C. Paleontology

C.1 Formation Summaries and Potential Fossil Yield Classification

C.1.1 Permian System

Permian strata are regionally exposed only in the central portion of the Circle Cliffs and on the Buckskin Mountain-Fivemile Mountain areas of the northern Kaibab Anticline. In the Circle Cliffs only the Kaibab Limestone is exposed, while in the Buckskin-Fivemile area, Doelling and Davis (1989) recognized equivalents of the Hermit, Coconino, Toroweap, and Kaibab Formations exposed in the deeply incised Buckskin Gulch. Buckskin Gulch used to be called Kaibab Gulch and is the original type section for this important formation (Gregory and Moore 1931), made famous by virtue of it forming the rim of much of the Grand Canyon. The fossil content of these formations reflect their shallow marine, tidal, and onshore coastal origins approximately 270 to 280 million years ago. Fossils are abundant locally and consist mostly of typical Late Paleozoic shallow, warm water marine invertebrates (mollusks, brachiopods, echinoderms, coelenterates, and poriferans; Foster et al. 2001). Such fossils are widespread in Arizona, Nevada, Idaho, and Utah, wherever the Kaibab Formation is exposed; therefore, the southern Utah specimens have no known significance beyond those found elsewhere. No unusual invertebrate faunal elements are known from the Kane and Garfield County area, and vertebrates are virtually unknown. Important nautiloid and ammonoid cephalopod fossils (e.g., *Pseudogastrioceras mckeei* in Miller and Furnish 1958) are known from near Navajo Bridge in Arizona (Miller and Furnish 1958) but have never been reported in the planning area. Collectively the Permian units rate as Potential Fossil Yield Classification (PFYC) 3.

C.1.2 Triassic System

The Triassic System in Kane and Garfield Counties consists of the Moenkopi and Chinle Formations and lower portions of the Dinosaur Canyon Member of the Moenave Formation and Wingate Sandstone.

***Moenkopi Formation*—**The Early Triassic Moenkopi Formation (240 to 249 million years ago) records extremely hot climatic conditions in a subequatorial setting during an especially chaotic and hot period of biological history, in the wake of the Permo-Triassic Boundary Extinction Event. Unlike the end-Cretaceous event and others, there appears to be no unequivocal evidence for an extraterrestrial impact associated with the end-Permian event. Regardless of its cause, the effects were devastating to the Earth's ecosystems. This massive biological catastrophe is recorded in the Moenkopi Formation, whose monotonous red nature and dearth of fossils records the ecologically bleak conditions that pervaded the low latitudes at the time. In general, fossils are uncommon in the Moenkopi Formation in the GSENM region. Notable exceptions include the portion of the Timpoweap Member that is subtidal marine and the distal tongue of the Virgin Limestone Member, which locally contains abundant mollusks, including nautiloids and ammonites (Foster et al. 2001). The tidal and terrestrial portions of the siliciclastic portions of the Moenkopi section yield sparse reptilian track fossils, mostly concentrated into single bedding horizons. Lacertoid (lizard-like), and chirotheroid (large feeding or swimming scrapes) type tracks are known from the GSENM area but are not common and confined to below the Virgin Limestone. The Moenkopi Formation rates throughout the planning area in the PFYC system as a 3.

Chinle Formation—The Chinle Formation dates to the Late Triassic (Norian and Rhaetian stages, 220 to 204 million years ago). It was deposited in north- or northwest-flowing rivers after the first major pulse of mountain building started in the western Cordillera. While the underlying Moenkopi Formation was deposited in a largely arid coastal setting, the Chinle Formation was deposited in an isolated continental interior with much higher rainfall. The wetter climate allowed dense stands of conifers (flowering plants had not evolved yet) to cover the landscape and animals to flourish. The Chinle Formation is justifiably famous for its vertebrate fossil content and petrified wood, but it also locally contains important plant and invertebrate fossils, as well as trace fossils including trackways. Within the planning area, the most common vertebrate fossils in the Chinle Formation are isolated bones, armored plates, and teeth of large, crocodile-like animals called phytosaurs, as well as metoposaurs (giant salamander-like amphibians), both of which dwelt more or less permanently in water. An isolated find of a fully articulated *Poposaurus* (a land-dwelling crocodile-like predator) in the Circle Cliffs area represents the potential of the formation to yield truly world-class, scientifically significant fossils. North America's oldest dinosaur fossils are also known from the Chinle, but not specifically from the planning area.

As elsewhere, the Chinle in the planning area contains an abundance of petrified wood. In fact, the Circle Cliffs area has been claimed to contain the second-largest Triassic-age petrified forest (concentrations of fossil logs) in North America, second only to Petrified Forest National Park (Ash 2003). Spectacular, intact logs occur throughout the Circle Cliffs and Vermilion Cliffs areas but are much more difficult to find in the latter because of poor exposures, and historic commercial scale collecting has taken many specimens. Overall, the Chinle Formation in the planning area ranks in the PFYC system as a 4.

Moenave/Wingate Formations—The Moenave and Wingate Formations are essentially time equivalent to each other, simply representing changes in environments that occurred from west to east. The Moenave is a largely riverine- and lake-deposited system in a tropical semi-arid interior climate, while the Wingate Formation (or Sandstone) was deposited as sand dunes to the east of the Moenave floodplain. In general, aridification of a landscape lowers fossil potential, and the Moenave and Wingate reflect that. In the western portion of the planning area (west of the Cockscomb along the Vermilion Cliffs), the Dinosaur Canyon Member (the thickest unit) has not yielded anything but occasional fish remains, fossil trackways, and microfossils. The overlying Whitmore Point Member, which occurs up in the cliffs west of Flag Point, is much more fossiliferous than the Dinosaur Canyon Member and contains an abundance of fish and other vertebrate remains and also mollusk and other invertebrates and stromatolites. Potentially the Whitmore Point could yield important vertebrate fossils, but it is difficult to inventory and collect because of its position in the cliffs and limited area of outcrop. Nearby in St. George, Utah, at the Dinosaur Discovery Site at Johnson Farm, tracks, bones, and teeth of several different kinds of animals have been collected from the Whitmore Point. Collectively the Moenave in the planning area (which only occurs west of the Cockscomb) would rate as PFYC 4 because of the potential for tracks and body fossils (especially in the Whitmore Point Member or its equivalents between Seaman Wash and the Paria River).

C.1.3 Jurassic System

Kayenta Formation—The Kayenta Formation is Early Jurassic in age (195 to 200 million years ago) and was deposited on the western margin of northern Pangea during its initial breakup. The climate at the time was tropical and semi-arid to arid, with most of the depositional environments representing seasonally wet rivers and lakes, similar to the modern Okavango River Basin in Africa. Three different

members are present in the planning area: the Springdale Sandstone, the main body of the Formation, and the Tenney Canyon Member. The formation is famous for its vertebrate fossils in Arizona and has yielded one of the most diverse Early Jurassic vertebrate faunas in North America. At least seven species of dinosaurs, three mammal-like reptiles, a pterosaur, protosuchids, a frog, and a turtle are all known. While the unit should, in theory, have potential to produce such significant fossils, no remains of tetrapods identifiable to genus have been identified within the planning area. Bone fragments, or even whole elements, do occur sporadically in the Springdale Sandstone Member and main body units (especially in intraclastic lags preserved in channel bottoms), but almost nothing of scientific significance has been found. By volume, the most important fossils are tracks and traces, which appear to have readily preserved in the rapidly alternating wet and dry cycles of the early Jurassic. Dinosaur tracks are locally abundant throughout the formation, although its ledge-forming nature frequently makes it difficult to see them. One particularly famous dinosaur track site in the Kayenta is northeast of Flag Point, where tracks co-occur with a tribal pictograph panel that appears to depict tracks associated with bird figures. Petrified wood occurs commonly in the Springdale Sandstone Member, less so in the main body. About two-thirds of the wood in the Springdale is silicified and an attractive olive green in color, while the remainder is preserved by a mixture of carbonate and iron minerals that do not preserve the original structure quite as faithfully. Because of its fossil vertebrate footprint content, the Kayenta locally rates as PFYC 4.

Navajo Formation (Sandstone)—The Navajo Formation was deposited more or less continuously with the underlying Kayenta Formation, recording a progressive drying out of the interior of North America heading into the later Early Jurassic between 180 and 195 million years ago. The unit is widespread through the planning area, underpinning some of the most spectacular scenery the region has to offer. By volume, most of the formation consists of windblown sand (dune) that accumulated in the largest erg system that ever existed on earth. This geological superlative translates into very poor conditions for preserving body fossils. Bones are almost unknown in the Navajo Formation in the planning area, although a fish locality in the Paria Box has recently been documented (Frederickson and Davis 2017). Outside the planning area, rare but spectacularly preserved specimens of dinosaur body fossils (*Seitaad, Segisaurus*) and tritylodont cynodonts do occur. By volume, the most important fossils in the formation are fossil tracks and traces, which preferentially preserved in moist inter-dune oases or playa lakes. Fairly high-diversity footprint assemblages are known from several locations, most of which are adjacent to the planning area (Moccasin Mountain, Lake Powell area), but the potential for such sites is equally high inside the planning area. Collectively, and largely because of the very low density of significant sites, the Navajo has a PFYC rating of 3.

Carmel Formation—The Carmel Formation is Middle Jurassic in age (170 to180 million years ago) and was deposited in a succession of shallow marine and coastal plain environments during an especially hot and arid time in southern Utah's history (Doelling and Davis 1989). It is present in all four of the planning units, providing a beautiful palate of color on top of the Navajo Formation. In western Kane County and Iron and Washington Counties, the lower portion of the formation has normal marine limestones and shales with a diverse marine invertebrate fauna. In the planning area, which was on the eastern and southern margins of this seaway, the water was shallow and tended frequently toward hypersaline, which was toxic to most normal marine animals. These conditions resulted in a series of sandstones, shales, bedded and diffuse gypsum, and occasional thin limestones with a very low diversity and abundance of fossils. In fact, the conditions were so poor for normal life that stromatolites, normally unable to compete in healthy marine ecosystems, made a comeback in the hot, salty waters. Conditions

on land seem to have been little better, as trace fossils are largely limited to invertebrate traces. Fossil vertebrate tracks are virtually unknown. Because of this, the Carmel Formation has a PFYC rating of 2 in the planning area. Its rating would be higher to the west.

Entrada Formation (including Associated Sub-Morrison Units: the Romana Sandstone, Henrieville Sandstone, and Summerville Formation)—The upper portion of the upper-most Middle Jurassic and early Late Jurassic succession in southern Utah is a complex of alternating shallow marine, coastal plain, and fluvial deposits that change character dramatically from west to east or from north to south. The climatic conditions were still hot, but the region started getting more rainfall as it transitioned to the semi-arid climate of the Morrison Formation. A regional sub-Cretaceous angular unconformity eliminates all of these units west of Skutumpah Creek, along the Skutumpah Terrace, but they are present everywhere else. The lower portion of the Entrada Formation (Gunsight Butte Member) consists of dune deposits. Fossils are rare in this interval. It is in the upper portion of the succession that fossils become more common. While body fossils are almost unknown, vertebrate trackways and traces are relatively common and widespread, occurring in the Romana Sandstone and Escalante Sandstone units over much of the southern margin of the Kaiparowits Plateau region and west of Hole-in-the-Rock Road, at the base of the Straight Cliffs escarpment. Root casts, colonial insect nests, and other invertebrate traces are also known. For its vertebrate track record, the upper units in the Entrada complex has a PFYC rating of 4.

Morrison Formation—The Late Jurassic age Morrison Formation is one of the most important dinosaur-bearing formations in the world (Foster 2007). It was deposited between 147 and 157 million years ago in semi-arid to semi-humid environments in an interior basin, with rivers generally flowing north or northeast. It is only present on and around Escalante, on the east side of the Kaiparowits Plateau, and along the southern margin of the Kaiparowits Plateau as far west as Wiregrass Canyon. It appears that in the vicinity of Escalante, the Morrison is a truncated section that only preserves the lower portion of the Brushy Basin Member equivalents. The upper portion, along with any diagnostic Early Cretaceous-age Cedar Mountain Formation is conspicuously absent in the planning area. Although no extensive bonebeds, such as the nearby Burpee Quarry in the Henry Basin, have been recorded from the local Morrison, dinosaur and other bone does occur, particularly around the Salt Wash-Brushy Basin contact. However, virtually no inventory has been done in the unit in the vicinity of GSENM, and no genus- or species-level diagnostic vertebrate material has been collected so far. It is certain that the area has high potential for important vertebrate fossils. The region's Morrison Formation is actually more famous for its gem-grade red jasper petrified wood, which occurs in the Escalante area. This resource is the basis for the Escalante Petrified Forest State Park, which has an interpretive trail and large numbers of logs preserved. While wood is fairly widespread in the Morrison Unit around the eastern portion of the planning area, much of it is black to gray. High-quality red jasper appears to be localized in the Escalante area. Regionally the Morrison Formation has a PFYC rating of 4, mostly because locally its potential is truly undetermined. Elsewhere in Utah it would have a PFYC rating of 5.

C.1.4 Late Cretaceous System

Overview

Vertebrate fossils from Late Cretaceous strata constitute one of the truly globally unique resources within the planning area. Many species have been found nowhere else, are rare, or are incompletely known elsewhere. This is because the Cretaceous climate and geography came together to create the perfect wet, sediment-loaded conditions that preserve body fossils. Unlike the entire Jurassic, during the

Cretaceous, the region was a humid tropical forest thriving with life large and small. Collectively the region's Cretaceous fossils paint one of the most complete pictures of terrestrial vertebrate evolution through the end of the dinosaur age in the world. The fossil preservation in the upper portion of the Late Cretaceous is truly exceptional. It is not unusual to find one or two sites annually that exhibit soft tissue. Thirteen new dinosaurs have been named from the Kaiparowits Plateau region in as many years, and it is still one of the most scientifically productive Cretaceous fossil areas in North America. Since 2000, the BLM has been actively managing these resources through partnerships with museums and its own in-house paleontology program as result of previous RMP decisions SCI-1, SCI-7, PAL-1, and PAL-3 (BLM 2000). The BLM in-house program manages the only working paleontology preparation and research lab in the BLM and a dedicated group of approximately two dozen volunteers.

Within the planning area, the most expansive and best-exposed Cretaceous outcrops occur in and around the Kaiparowits Plateau. As a generalization, the southern Utah Cretaceous section is mostly terrestrial in the western half, and to the east, mixed marine-terrestrial in the lower half and dominantly terrestrial in the upper half. Because of the potential for vertebrate fossils, none of the Cretaceous units in the planning area rate less than PFYC 4, with some units ranking at PFYC 5.

The most recent summary of available faunal data resulting from this, and other work is found in the 2013 Indiana University Press volume *At the Top of the Grand Staircase – The Late Cretaceous of Southern Utah* (Titus and Loewen 2013), and also in Titus et al. (2017), which are the basis for the faunal list at the end of this section. Because of the potential for vertebrate fossils, none of the Cretaceous units in the planning area rate less than PFYC 4. However, individual units, discussed separately below, do rate higher.

Cedar Mountain/Naturita Formations—The oldest Cretaceous unit in the planning area is the Cedar Mountain Formation, which, in the Kaiparowits region, is mostly limited to the pebbly conglomerate facies. The smectitic gray mudstone facies is absent, and even the pebbly unit is locally absent in the planning area, being discontinuous over much of the Kaiparowits region. It does thicken to the west and is more consistently present in the Skutumpah Terrace area. Thin, gravelly facies at the bottom of the Naturita in this region are probably reworked Cedar Mountain sediments. Most of the fossil material recovered from the Cedar Mountain Formation equivalents (Mussentuchit Member) consists of reworked bone and petrified wood from the underlying Morrison Formation or older Cedar Mountain units that are no longer present.

The overlying Naturita Formation (formerly called the Dakota Formation) is relatively thin, averaging only 98 to 115 feet thick in the planning area. Except for shark and fish remains, vertebrate fossils are largely confined to the lower member, occurring in river and lake deposits, which also host spectacular plant fossils and rare lagerstätte preservation of insects. Large vertebrate remains are generally uncommon and usually occur as isolated elements, but 1-foot-diameter turtle shells can be locally abundant, particularly in the southwestern portion of the Kaiparowits Basin. The Bulldog Bench area near Tropic is one of the only places where larger vertebrates besides turtles have been found in any quantity, and the Rim Rocks area along the Paria River (east of the Cockscomb) consistently produces small bonebeds with turtle, fish, crocodilian, and rare dinosaur remains. These are some of the only Cenomanian-age terrestrial vertebrate fossil sites known in North America, and their scientific significance is very high. Dinosaur trackways also occur sparingly in the middle unit (Titus et al. 2013). Petrified wood is rare but does occur as logs and even in-situ stumps in the middle part of the

formation. The marine upper portion of the Naturita is extremely fossiliferous with invertebrates (mostly mollusk shells). The western, northern, and southern exposures are famous for the up to 6-foot-thick "oyster reef" deposit of shells at the top of the formation. Other beds packed with brackish water and marine species of oysters, mussels, pen shells, and small clams, along with rare ammonites occur throughout the region. The marine portion also yields occasional sharks teeth and nondiagnostic bone, probably of marine reptiles. Because of the rarity of Cenomanian terrestrial vertebrates in North America and its consistent production of sites, the Naturita rates as PFYC 4.

Tropic Shale—The overlying Tropic Shale is up to 984 meters thick (Doelling and Davis 1989), entirely marine in origin, and spans late Cenomanian to middle Turonian time. The formation is dominantly gray weathering mudstone, but calcisiltites and calcarenites also occur throughout the formation, and numerous sandstone beds fill the upper part. Like the Naturita Formation, exposures of Tropic Shale in the planning area are mostly along the margin of the Kaiparowits Plateau and around the Skutumpah Terrace, Henrieville, Cannonville, and Tropic. Invertebrate fossils are abundant throughout the Tropic Shale but are best preserved in zones where early concretion formation preserves the more delicate shells in three dimensions. The concretion zones yield spectacular, pristinely preserved ammonite and other fossils. Vertebrate remains, mostly sharks teeth and fish remains, are only locally common, usually collecting in wind-formed erosional blowouts. Nonfish vertebrates are uncommon to rare, but long-term collecting over the last 16 years has revealed a highly diverse assemblage that includes five species of plesiosaurs, turtles, the earliest mosasaurs from North America, and rare dinosaur remains. Three significant trends/events in vertebrate evolution appear to be recorded in the Tropic: the demise of the archaic pliosaurids, the diversification of the polycotylid plesiosaurs, and the rise of true mosasaurs in North America. Collectively the Tropic Shale ranks as PFYC 5 because of its outstanding vertebrate record.

Straight Cliffs Formation—The Straight Cliffs Formation is a highly heterogeneous, 1,600-foot-thick unit that probably exhibits the most lateral variation of any formation in the Kaiparowits Basin. Spanning much of the later Turonian, as well as the entire Coniacian and Santonian, it also represents the longest time span (approximately 9 million years, between 92 and 83 million years ago) of any Cretaceous formation in the planning area. It is extensively exposed in the central portion of the planning area. In general, marine and marginal marine facies dominate the eastern outcrops, with shoreface, beach complex, estuarine, and deltaic beds interleaved with coastal mire and distributary fluvial units (Allen and Johnson 2010), while western outcrops are composed mostly of river and floodplain deposits. The typically ledge- and cliff-forming habit of the formation makes survey work difficult. Despite this, in the Kaiparowits Basin, all four members of the Straight Cliffs (Tibbett Canyon, Smoky Hollow, John Henry, and Drip Tank) have documented vertebrate fossil sites. Abundant microvertebrate remains are known mostly from the Smoky Hollow and John Henry Units in the western half. Macrovertebrate sites are somewhat rare. The highest densities of such sites occur in the southwest portion of the Kaiparowits Plateau where alluvial plain facies dominate and, again, are known mostly from the Smoky Hollow and John Henry members. Multiple sites yielding associated dinosaur material, including a multi-individual ornithopod bone bed, have been found, but these are much less common in the Kaiparowits region than in the same units on the Paunsaugunt Plateau. Locally, the Drip Tank Member produces larger isolated elements in stream channel lags, but material diagnostic to even family level has so far been elusive. Marine vertebrate tooth and bone lags (usually dominated by sharks teeth) are known to occur in the lower beds on the eastern half of the Kaiparowits Plateau. Dinosaur trackways are locally known, particularly in coal seams, but bone is quite rare in the eastern half of the plateau, leading to the

conclusion that either the depositional rates or soil conditions were unfavorable to preservation of large bone. Spectacular plant fossils and both freshwater and marine invertebrate shell beds (such as unionids, inoceramids, oysters, and ammonites) occur throughout the plateau in the lower three members. Locally, the Tibbett Canyon Member carries large, petrified logs, at least one of which formed a now collapsed natural bridge (east of the Paria River). The Straight Cliffs collectively rate as PFYC 4.

Wahweap Formation—In the Middle Campanian (81 to 77 million years ago), as the Late Cretaceous seaway retreated east into the Moab area, it left the planning area in a more upland, tropical wet lower alluvial plain setting that was more conducive to preserving bone. The resulting deposits of the Wahweap Formation, over 1,600 feet thick, are locally rich with bone, both large and small. The Wahweap Formation occurs widely in a broad U-shaped band across the western, southern, and eastern portions of the Kaiparowits Plateau in GSENM. The formation is fossiliferous throughout the planning area, with everything from petrified wood to large dinosaur skeletons, and it is the second most productive formation, behind the overlying Kaiparowits Formation, for vertebrate fossils in the entire planning area. The types of seven new kinds of dinosaurs and numerous smaller vertebrates are known from the formation. Until GSENM was established, nearly all the scientific collecting was of smaller vertebrates such as mammals, lizards, and fish. In 2000, crews supported by the BLM began intensive survey of the unit along the southern edge of the Kaiparowits Plateau, from Nipple Bench to Head of the Creeks and into the Last Chance Canyon area, for larger animal remains such as dinosaurs. Results were immediate, with several horned dinosaur skull and hadrosaur sites being found. Subsequent work west of Nipple Spring, on Brigham Plain, south of Alvey Wash, and along the Smoky Mountain Road has produced additional dinosaur sites, including the type specimens of *Lythronax*, *Machairoceratops*, and an unnamed nodosaurid ankylosaur. At least two different species of large alligatoroids and a pholidosaur-like crocodylian have also been recovered but await description. Dinosaur tracksites also commonly occur near the contact of the lower and middle members in thin bedded sandstone deposits of crevasse splay origin. Invertebrate fossils, including large terrestrial crab remains, mollusk shells, and traces, are locally abundant. Spectacular plant fossils, including substantial deposits of petrified wood, especially in the lower member, also occur widely. The Wahweap Formation has yielded so many important fossils that it ranks throughout the planning area as PFYC 5.

Kaiparowits Formation—At its type section, the Kaiparowits Formation is approximately 2,820 feet thick. Because of its higher clay content, the unit typically weathers into less cliffy topography than most formations. Dating of ash fall tuffs has demonstrated that the Kaiparowits Formation spans at least the lower half (76.6 to 74.5 million years) of the late Campanian (Roberts et al. 2013) but may range in age as young as 73 million years ago. The Kaiparowits Formation is by far the richest vertebrate fossil-producing unit in the entire region, and the preservation of individual Kaiparowits vertebrate specimens is sometimes spectacular. Complete or partial articulation and preservation of softer elements, such as epidermis and the keratinous portions of beaks and claws, is not rare, particularly in fluvial channel facies. The turtles *Adocus* (Knell et al. 2011) and *Basilemys* have both been found preserved with clutches of eggs. Unusual paleobiological information has also been gained from rare specimens showing predatory or behavioral traits (e.g., Boyd et al. 2013), including the first evidence that tyrannosaurs hunted in packs (Titus et al. 2021). The distribution of fossils is irregular throughout the formation, although the lower and middle portions of the middle member are by far the most fossiliferous.

The most common large dinosaur remains in the Kaiparowits are lambeosaurine (crested) and saurolophine (noncrested) dinosaurs. Ceratopsids are found in lesser numbers but are still clearly a

significant part of the ecosystem, displaying exceptionally high diversity. Most other dinosaur taxa are uncommon to rare, some being represented by a single specimen (e.g., *Hagryphus*). The only larger elements of the fauna besides dinosaurs are two taxa of crocodylians: a pholidosaur very similar to *Denazinasuchus* and *Deinosuchus*. Ongoing reconnaissance efforts in the Kaiparowits Formation continue to add to its diverse vertebrate fauna and have rapidly enhanced the macrovertebrate assemblages documented in previous published summaries. As of now, the Kaiparowits Formation holds the record for most diverse Late Campanian assemblages of turtles, mammals, squamates, and crocodylians in North America and is rapidly closing the gap with the diverse dinosaur assemblages known from the Dinosaur Park Formation. New discoveries continue to add fossil materials to previously documented macrovertebrate taxa, permitting more thorough comparison and phylogenetic evaluation, and add new forms to the overall assemblage. This includes many new, exquisitely preserved crocodyliform specimens that expand the documented diversity and completeness of the group; several associated pterosaur specimens that radically enhance the nonmarine record of pterosaurs; and new dinosaur materials that include several specimens of a new chasmosaurine ceratopsian and a possible small lambeosaurine hadrosaurid. These new finds, coupled with ongoing efforts to document the microvertebrate record, the plant macrofossil record, the invertebrate fossil record, and the geological record of the Kaiparowits Formation, promise to make it among the best-documented and understood terrestrial ecosystems in the Mesozoic. Comparison of the Kaiparowits vertebrate assemblage with contemporaneous faunas from southern Alberta (e.g., Dinosaur Park Formation) have documented significant differences in vertebrate taxa (e.g., Sampson et al. 2010 and Gates et al. 2010), attributed to possible physiographic barriers (Gates et al. 2012) or climatic/floral differences (e.g., Nydam et al. 2013 and Miller et al. 2013). The Kaiparowits Formation rates a PFYC of 5 throughout the planning area.

Late Cretaceous Vertebrate Faunal Lists for Southern Utah

Although the total number of taxa is known to be higher in every single Cretaceous formation of southern Utah's Paunsaugunt Plateau, faunal lists for this area summarized in Titus et al. (2017) were generated only from published papers that documented specific specimens from specific localities with certain taxonomic assignments. In general, these formations include the following major vertebrate taxa north of the planning area on the Paunsaugunt Plateau and in the planning area on the Kaiparowits Plateau:

- Naturita Formation, Cenomanian localities Utah Museum of Natural History (UMNH) VP 123/Museum of Northern Arizona (MNA) 939 on the Paunsaugunt Plateau and UMNH VP 27/MNA 1067/Oklahoma Museum of Natural History (OMNH) V808; UMNH VP 804 on the Kaiparowits Plateau include specimens of fish, salamanders, frogs, snake, multituberculates, and mammals (Brinkman et al. 2013; Cifelli and Eaton 1987; Eaton 1993a, 1993b, 1995; Gardner and Demar 2013; Kirkland 1987; Kirkland et al. 2013; Nydam 2013; Roček and Wuttke 2010).
- Smoky Hollow Member, Straight Cliffs Formation Turonian localities UMNH VP 129/MNA 995/OMNH V843; OMNH V4, 60, 1404 on the Kaiparowits Plateau include specimens of fish, salamanders, frogs, snakes, dinosaurs, and multituberculates (Brinkman et al. 2013; Cifelli 1990a; Cifelli and Gordon 1999; Eaton 1995; Gardner 1999; Gardner and Demar 2013; Gates et al. 2013; Kirkland et al. 2013; Nydam 2013; Nydam and Voci 2007; Roček and Wuttke 2010).
- John Henry Member, Straight Cliffs Formation basal Coniacian localities UMNH VP 417, 823, 856, 1064 on the Paunsaugunt Plateau and OMNH V856; UMNH VP 663 on the Kaiparowits Plateau include specimens of fish, salamanders, frogs, dinosaurs, and multituberculates (Eaton

2013; Gardner and Demar 2013; Gates et al. 2013; Kirkland et al. 2013; Roček and Wuttke 2010).

- John Henry Member, Straight Cliffs Formation Santonian localities UMNH VP 419, 420, 424, 426, 427, 569, 781, 799, 821, 843, 1144, 1156 on the Paunsaugunt Plateau and UMNH VP 98, 99, 567; OMNH V27; MNA 706 include specimens of fish, salamanders, frogs, snakes, dinosaurs, multituberculates, and mammals (Brinkman et al. 2013; Cifelli and Gordon 1999; Eaton 2006, 2013; Gardner and Demar 2013; Kirkland et al. 2013; Loewen et al. 2013a; Nydam 2013; Roček and Wuttke 2010).
- Wahweap Formation, Campanian localities UMNH VP 61, 77, 78, 80, 83, 807, 792, 1073, 1074; MNA 1073, 1074 on the Paunsaugunt Plateau and OMNH V2, 8, 11, 16; UMNH VP 82, 130; MNA 455, 456, 702, 705, 707, 1015, 1294 on the Kaiparowits Plateau include specimens of fish, salamanders, frogs, turtles, multituberculates, and mammals (Brinkman et al. 2013; Cifelli 1990b, 1990c, 1990d; Cifelli and Gordon 1999; Cifelli and Madsen 1986; Eaton 1993b, 2002, 2013; Evans et al. 2013; Gardner and Demar 2013; Gates et al. 2013, 2014; Holroyd and Hutchison 2016; Kirkland and DeBlieux 2010; Kirkland et al. 2013; Loewen et al. 2013b, 2013c; Lund et al. 2016; Nydam 2013; Roček and Wuttke 2010).
- Tropic Shale, Late Cenomanian-Middle Turonian localities on the Kaiparowits Plateau include specimens of fish, turtles, and dinosaurs (Albright et al. 2007a, 2007b, 2013; Schmeisser McKean 2012; Zanno et al. 2009).
- Kaiparowits Formation, Upper Campanian localities OMNH V5, 6, 9, 61; UMNH VP 24, 25, 51, 54, 56, 108, 1078, 1268; MNA 453, 454, 458, 697, 704, 1004, 1310; UCM 83240; 83258 on the Kaiparowits Plateau include specimens of fish, salamanders, frogs, turtles, crocodylians, alligatoroids, dinosaurs, and mammals (Boyd 2015; Brinkman et al. 2013; Carr et al. 2011; Cifelli 1990d, 1990e; Cifelli and Johanson 1994; Claessens and Loewen 2015; Eaton 2002; Evans et al. 2013; Farke et al. 2014; Gardner and Demar 2013; Gates and Sampson 2007; Gates et al. 2013; Irmis et al. 2013; Kirkland et al. 2013; Lively 2015a, 2015b; Loewen et al. 2013a; Nydam 2013; Nydam and Fitzpatrick 2009; Nydam and Voci 2007; Roček and Wuttke 2010; Roček et al. 2013; Sampson et al. 2010; Sampson et al. 2013; Loewen et al. 2013b; Wiersma 2016; Zanno and Sampson 2005; Zanno et al. 2011, 2013). Additional turtle localities are included in Hutchison et al. 2013 that are not listed here.

C.1.5 Neogene System

Unconsolidated alluvial sediments in floodplains and channels, as well as the colluvial floors of rock shelters, provide the context for Neogene (mostly Pleistocene) fossil resources, including occurrences of megafauna, which are documented in several places just outside the planning area (Glen Canyon National Recreation Area, BLM Kanab Field Office, and Utah State Institutional Trust Lands). No megafaunal sites have been documented inside the planning area, but this is almost certainly a function of a lack of inventory for such resources and not a lack of resource. The recent finding of a site preserving multiple mammoth skeletons near Big Water, less than 1 mile outside the planning area, confirms the certainty that such sites do occur in the planning area. Their rarity warrants the Neogene collectively to be assigned a PFYC of 2.

C.2 PALEONTOLOGICAL MANAGEMENT OPPORTUNITIES

The paleontological resources in the planning area are some of the most intensively managed within the BLM. Programs for proactive inventory, specimen preservation, research, and curation are all warranted

given the extremely important nature of the fossils found there. However, there are opportunities to manage these resources more effectively without adding significant costs to the program. This may include integrating the management of the fossil resources within the planning area and those found on adjacent BLM-managed lands. This is especially true for the Late Cretaceous formations and fossils, which do not end at the western boundary of the planning area but continue west into the BLM Kanab Field Office and Dixie National Forest. Key areas around the southern Paunsaugunt Plateau are known to contain Late Cretaceous vertebrate fossils, including dinosaurs, but have not been pursued with the same integrated support as they have within the planning area because of jurisdictional issues and differing management priorities. Expanding the areal scope of more intensive management of the paleontological resources to adjacent lands could further heighten their importance to the scientific community and the public, as well as document and protect important Turonian, Coniacian, and Santonian vertebrate fossil sites that currently receive little attention. Additional challenges and opportunities throughout the planning area are listed by formation below.

C.2.1 Permian System

Research Interest

The Toroweap and Kaibab Formations of GSENM offer insights into shallow marine invertebrate community structure and ecology, and the evolution of organisms and environments on the western tropical shore of Pangaea during the middle Permian. This is not limited to the fossils, but also includes the contextual data that accompanies them, including sedimentology and various forms of stratigraphy (chemical, isotopic, paleomagnetic, and cyclic). While each rock outcrop records the story of a unique place and event, there is probably very little that can be learned from these formations in the planning area that cannot be learned elsewhere. Because there is no continuous record across the defining Permo-Triassic Boundary extinction event in the region (or anywhere in the continental United States), the local geological record has little to say about the details of extinction, which drives the bulk of current research on this interval. However, the early Triassic rocks discussed below do give insight into its aftermath. The fact that the Kaibab Gulch is the established type section for the Kaibab Formation does give it elevated significance in the scientific community, as it is a reference with which all other sections should be compared. This being the case, it is foreseeable that the Buckskin Permian section could attract a fair amount of future research attention. Because geological studies on such sections generally involve drilling and removing cores, bulk sampling of rocks, and other potentially surface-disturbing activities, it is recommended that such methods be allowed for research purposes regardless of the administrative status of the type section.

Public Interest

Smaller fossils of invertebrates, such as brachiopods, corals, sponges, and clams, from this unit are a frequent target of casual collecting by hobby collectors or other interested avocationals. Most of this collecting is limited to picking up loose specimens preserved in nodular chert bodies. A significant number of specimens are also collected randomly by other recreationists as they recognize the obvious shapes of shells in the rocks. There are no known cases of high-impact casual collecting on these formations in the planning area.

Management Issues

Because their fossil content lacks elevated scientific significance for the specific region around GSENM, no special management issues have been identified.

C.2.2 Triassic System

Moenkopi Formation

Research Interest

The Moenkopi Formation is not particularly fossiliferous but does contain a fairly continuous record of events on the margin of Panthalassia (ancient global ocean) and western edge of Pangaea (ancient supercontinent) during a particularly fascinating time, the wake of the largest extinction earth has ever faced. Stromatolitic mounds found in the Timpoweap Member indicate that shallow waters in the tidal and subtidal environment were too hot for normal grazing gastropods to inhabit, allowing these relics of the early Precambrian to thrive briefly once again. Diversity in the terrestrial sediments is also low, presumably due to the hostile post-extinction low-latitude climate. While most of these features can be observed outside the GSENM region, the outcrops near the Paria River Box and Circle Cliffs areas are expansive and inviting to researchers. It is probable that many stratigraphic, sedimentological, geochemical, and isotopic studies will be conducted in those areas in the future.

Public Interest

Concentrations of invertebrates in the Timpoweap and Virgin Limestone Units could become the targets of hobby collecting, especially if well-preserved ammonite fossils are present. Vertebrate trackways and other vertebrate trace fossils are protected under the Paleontological Resources Preservation Act and are not open to collection without a research-grade permit.

Management Issues

Knowledge of the occurrence of scientifically important fossil concentrations is poor. Thorough inventories should be conducted on the lower three members (Timpoweap, Lower Red, and Virgin Limestone) for occurrences of cephalopods or other unusual invertebrates and vertebrate trackways throughout the planning area in order to locate these resources and provide for their protection or promotion to researchers. Weighed against the inventory priorities of other formations in the region, these can be conducted on an as-needed basis for compliance projects or as time and funding permit. A brief literature survey should also be conducted to bring the nomenclature and faunal data for the units up to date.

Chinle Formation

Research Interest

Inventory of the Chinle Formation has been highly selective and cursory. Yale University spent four short field seasons (2002 to 2005) surveying in both the Circle Cliffs and Vermilion Cliffs areas, finding numerous important sites, including the *Poposaurus* mentioned above. However, the Yale team was only looking for vertebrates and covered less than 10 percent of the total outcrop area. The evolution and ecology of early Mesozoic (Triassic) ecosystems continues to be a very hot research topic, and it is anticipated that research interest in this unit, particularly because it represents an understudied area and is generally older than units to the east, could increase significantly, especially if concentrations of identifiable vertebrate remains are found. No unit type sections for the formation exist in the area; however, the stratigraphy in the GSENM area has been recently revised by Martz et al. (2017). In that paper, three informal subunits were used, and at is conceivable that eventually type sections for these units could be established in the Vermilion Cliffs area where the outcrops are especially good. Paleobotanists have historically also been interested in the unit, and the exposures near the Paria River ghost town contain some of the only known Triassic coal deposits in the western United States. While

the coal is not economic grade, the associated shales contain well-preserved plant fossils (particularly *Zamites*). Excellent opportunities for paleobotanical, ichnological, and invertebrate studies (primarily on mollusks) within the context of a variety of topics (e.g., climate, evolution, and ecology) also exist within the planning area.

Public Interest

The silicified wood of the Chinle Formation has long been sought after by hobby and commercial collectors in the planning area. In general, it does not display the brilliant colors (red, yellow, orange, and blue) of the same age wood in Arizona or the Four Corners area, but logs sometimes contain amethyst- or citrine-filled vugs, a very desirable condition to collectors. However, even the rather plain, earth tone-colored logs in the planning area are sought by hobby and commercial collectors as landscaping material or accents to rock gardens.

Management Issues

The Chinle Formation needs a thorough inventory to assess its vertebrate fossil content and also the true extent and nature of the fossil wood resource. The potential scientific and interpretive significance of vertebrate and botanical specimens from the unit warrant making it a priority for such inventory when weighed against even the Cretaceous units, which are the most scientifically significant in the region. Active material support of outside institutions seeking to do research on the unit should be strongly considered. There are also opportunities to expand field-based interpretation of the petrified wood areas including the many undisturbed petrified wood sites in the Circle Cliffs area. Illegal collecting of petrified wood is a potential issue given the demand and generally low renewal rate of this resource through erosion; designated collecting areas will be exhausted quickly. Illegal collecting of smaller vertebrate specimens (especially phytosaur teeth, which look like dinosaur teeth) in the Vermilion Cliffs area has occurred since the 1960s but seems to have diminished in more recent years.

Moenave and Wingate Formations

Research Interest

Inventory of the Moenave and Wingate Formations is extremely difficult, as both units present themselves in ledges or cliffy terrain with very little accessible surface area. However, both units record conditions of western Pangea across the Triassic-Jurassic Period Boundary and a major extinction event responsible for the ascendancy of the dinosaurs in terrestrial ecosystems. This single fact will ensure that the units will be of future scientific interest. In addition, the known fossil content of the Whitmore Point Member, which includes rare dinosaur and other tetrapod material, will continue to attract researchers interested in the rise of dinosaurs in the early Jurassic and the evolution of early Mesozoic terrestrial ecosystems. Any diagnostic tetrapod skeletal material from these units would be of very high scientific significance.

Public Interest

Very little fossil resource in the Moenave or Wingate Formations has attracted legal hobby collecting. Cylindrical stromatolitic masses and root casts in the Whitmore Point Member are occasionally collected by rock hounds or hikers thinking they are dinosaur bones, but such activity has not become a management issue to date.

Management Issues

The Moenave and Wingate Formations need thorough inventory to assess their vertebrate fossil content. Presumably this will be limited to mostly tracks and traces in the Wingate. However, this is not a priority compared with Cretaceous units or even the Chinle Formation. While all vertebrate fossils in the Moenave and Wingate, including tracks and traces, are protected under the Paleontological Resources Preservation Act, the casual collecting of fish scales and small pieces of bone will almost certainly occur. The small nature of most Moenave bone and scales makes them almost invisible to an average hiker or outdoor recreationist, which may prevent such collecting from becoming a serious management issue.

C.2.3 Jurassic System

Kayenta Formation

Research Interest

Inventory of the Kayenta Formation is generally difficult because the unit, like the underlying Moenave and Wingate, is frequently expressed in ledges and cliffs. The lack of diagnostic body fossils in the unit within the planning area tends to limit its usefulness to researchers, and this is reflected in the largely desultory publication and project history. Notwithstanding, the potential for such sites to occur in the formation is definitely there. Should such sites be found, research interest will spike, as any information on early Jurassic tetrapods and the evolution of early Mesozoic terrestrial ecosystems would be very important.

Public Interest

The fossil dinosaur tracks in the Kayenta Formation generate a great deal of interest in the public, who enjoy seeing the in-situ specimens, which are frequently in very scenic contexts. Sites in the Vermilion Cliffs area (e.g., Flag Point, Hackberry Canyon, and Seaman Wash) have long attracted the public's attention. Other fossil resources in the Kayenta are unlikely to attract much collecting or visitation interest.

Management Issues

The Kayenta Formation needs thorough inventory to assess its regional potential for vertebrate body fossils and other fossil content. However, this is not a priority compared with Cretaceous units or even the Chinle Formation. Visitation to dinosaur track sites in the formation can be substantial, creating management issues around fossil preservation, theft, vandalism, unintentional damage, and litter. One of the highest-impact activities is illegal/unauthorized molding and casting of footprints, which can accelerate erosion or leave residual plaster and release compounds in the rocks. Monitoring of high-traffic areas on an annual or more-frequent basis may be needed.

Navajo Formation

Research Interest

Inventory of the Navajo Formation is extremely difficult because it almost always occurs in ledge- or cliff-forming topography. The near lack of any body fossils in the unit within the planning area limits its usefulness to paleontologists other than track specialists (ichnologists).

Public Interest

Fossil dinosaur track sites in the Navajo Formation, such as those at north Moccasin Mountain or North Coyote Buttes, can experience large numbers of visitors seeking to view such tangible fossil behavior preserved in stone. Other fossil resources in the Navajo Formation are unlikely to attract much collecting or visitation interest.

Management Issues

The fossil resources of the Navajo Formation in the planning area are low enough in volume that inventory efforts would not yield a worthwhile return for the investment of time and resources. It would likely be better to let sites be documented through reporting by the public or other incidental methods. Visitation to dinosaur track sites can be substantial, creating management issues around fossil preservation, theft, vandalism, unintentional damage, and litter. One of the highest-impact activities is illegal/unauthorized molding and casting of footprints, which can accelerate erosion or leave residual plaster and release compounds in the rocks. Monitoring of high-traffic areas on an annual or more-frequent basis may be needed.

Carmel Formation

Research Interest

The dearth of paleontological resources in the Carmel Formation precludes it being the target of high-profile research. In fact, both Washington University (Jim Clark) and the Sam Noble Museum of Natural History (Brian Davis) spent two field seasons in the Carmel Formation looking for vertebrate fossils and found nothing. If terrestrial units in the upper portion of the formation (largely the Windsor Member) were ever to yield any body or trace fossils, they would be of extreme significance because almost nothing is known about Middle Jurassic terrestrial vertebrates in North America. However, at present, there is little to suggest this unit will be of any interest to researchers in the foreseeable future.

Public Interest

The lack of fossils in the planning area also precludes public interest or hobby collecting of fossils.

Management Issues

The lack of fossils creates a lack of issues with the Carmel Formation. Inventory in the formation would be largely unproductive and not a wise use of resources.

Entrada Formation (including Associated Sub-Morrison Units: the Romana Sandstone, Henrieville Sandstone, and Summerville Formation)

Research Interest

The Escalante Sandstone Member and the Romana Sandstone Units have been the subject of several studies on megavertebrate trackways by several different groups (Matthews et al. 2006; Milan and Loope 2007; Lockley and Gierlinski 2014). It is likely that such moderate interest in the vertebrate fossil track record and invertebrate trace record will persist into the future. The lack of skeletal remains (or any plant or animal body fossils for that matter) throughout the Entrada limits its usefulness to paleontologists seeking to document more precisely the diversity of the time, which is still largely unknown.

Public Interest

Public interest in visiting Entrada tracksites like the Twentymile Wash tracksite west of Hole-in-the-Rock Road is high. In such cases, large, spectacular tracks are abundant and accessible. The site is even featured on websites (e.g., https://www.thewave.info/Twentymile%20Tracksite%20Code/Map.html) and is promoted by GSENM as a tourist destination. Tracksites in the Romana Sandstone near Wiregrass Canyon, just outside the planning area in Glen Canyon National Recreation Area, have been visited by commercial tour operators.

Management Issues

Inventory should be conducted on the upper portion of the Entrada complex to assess more accurately the site's density, distribution, and significance. Tracksites that receive frequent visitation from the public should be prioritized for site management, monitoring, and interpretation. Monitoring can be cost effectively conducted through coordination with backcountry patrols or using volunteer site stewards. Twentymile Wash is currently on the list of annual monitoring for the in-house paleontology program at GSENM.

Morrison Formation

Research Interest

The area's Morrison Formation could potentially yield diagnostic dinosaur and other vertebrate fossils. While the Morrison is one of the best studied Mesozoic Formations in the world (with over 100 years of intensive work), the Kaiparowits area represents a western portion of the basin that was more upland and potentially inhabited by different species than are found in the classically studied eastern outcrops. Any sign that this is the case, and that the animals preserved in the planning area are new or different, would spur intense scientific interest. Also, the diversity and ecology of the plants, including the petrified wood, has never been studied.

Public Interest

Morrison fossils have long fascinated the public. This is easily substantiated by the high numbers of tourists that visit famous Morrison sites like the Fruita Paleo area (Colorado), Cleveland Lloyd (Utah), Dinosaur National Monument (Utah), and even the Escalante Petrified Forest State Park. The Morrison dinosaur fauna includes some of the largest animals to ever walk on dry land, which in and of itself is amazing to most of the public. Locally, there is a long tradition of hobby collecting Morrison fossil wood for landscaping and lapidary purposes, and Kaiparowits Unit wood sites are still featured in rockhound guides for Utah. There is also a substantial local interest in visiting large logs that are still in the ground, particularly west of the town of Escalante.

Management Issues

The Morrison Formation in the planning area is known to contain fossils but, as stated above, has never been inventoried in more than a cursory way. The formation should be thoroughly inventoried to assess its overall fossil content and scientific significance both to stimulate research interest and also to establish a baseline for resource monitoring. Looting of Morrison bone and petrified wood for illegal commercial and hobby purposes is a longstanding systemic problem in Utah, and the planning area is no exception. Illegal hobby collecting of petrified wood around Escalante can be an almost daily occurrence during certain times of the year. In addition, known bone sites around Escalante show the highly

desirable bluish and reddish hues in the bone that are highly sought after by illegal gem bone collectors. Similar bone in the nearby Henry Basin has been the subject of intense looting for decades.

C.2.4 Late Cretaceous System

Cedar Mountain/Naturita Formations

Research Interest

The Cedar Mountain Formation in the area has only yielded reworked fossils from older formations, which are useful to the stratigrapher trying to work out the geologic history of the area, but not so much to the paleontologist because they lack a primary context.

The Naturita Formation has yielded some of the oldest placental and marsupial mammal fossils in North America. Study of these fossils has led some researchers to hypothesize that marsupials may have actually originated in North America during the Cretaceous. The turtles, crocodylians, and dinosaurs remain little studied, even though good specimens or new sites are now known. The discovery of any larger skeletal remains in the formation would be hugely important.

Public Interest

The main public interest in the Naturita Formation is fossil collecting. The abundant invertebrates of the upper portion are well known to hobby collectors and are easy and fun to collect. The plant fossils of the middle and lower units are also locally spectacular and targeted by hobby collectors. The public also enjoy visiting in-situ fossil sites, such as those featured in a local road log for the Cottonwood Canyon road (Gillespie and Sadler 2012).

Management Issues

The vertebrate fossils in the lower portion of the Naturita are a rare resource globally and particularly rare in North America. Additional inventory is warranted to establish the exact extent of the significant vertebrate fossil resources. Commercial or illegal bulk collecting of invertebrates in the upper formation is a potential problem in the Cottonwood Canyon and Escalante areas, especially if the collecting sites are visible from well-traveled roadways.

Tropic Shale

Research Interest

The vertebrate fossil record from the Tropic Shale includes some of the most significant Cenomanian and Turonian Cretaceous marine fossil specimens collected in North America. This includes the new species of plesiosaurs; the oldest and most primitive mosasaurs from North America; the most complete therizinosaur dinosaur ever collected from the Late Cretaceous of North America; and numerous complete or partially complete turtles, fish, sharks (including one that preserved soft tissue), and spectacular invertebrates including large and small ammonites. These fossils provide numerous opportunities for researchers to test ideas about evolution, ecology, and marine biospheric response to one of the hottest periods in earth's history. A minor mass extinction is also recorded in the Tropic Shale, and this has been the subject of numerous papers. Because of the significance of this extinction and the superior nature of the Tropic Shale's stratigraphic and fossil record, it will probably continue to be an important target of research for the foreseeable future.

Public Interest

Because they are abundant and obvious to most visitors, the larger invertebrate fossils are the target of frequent hobby collecting. In particular, the ammonite and oyster fossils are featured in rock hounding guides. The shark teeth, where locally common, also attract a great deal of attention from collectors and fossil hounds. The public are also interested in the overall interpretative story such as is presented at the Big Water Visitor Center, and also in seeing field sites, such as the oyster reefs.

Management Issues

Large areas of Tropic Shale, especially along the Cockscomb, around the Croton Road and Little Valley, and along the Straight Cliffs, have not been extensively inventoried for vertebrates. In addition to the inventory, as in the past, the BLM has an opportunity to pursue a proactive program of partnership and research on this unit to promote its scientific utilization. The area along the southern margin of the Kaiparowits Plateau between the Paria River and Last Chance Canyon have been inventoried to some degree over the last 21 years. Managing both illegal and legal collecting in and out of GSENM will probably present itself as one of the biggest future challenges.

Straight Cliffs Formation

Research Interest

The Straight Cliffs Formation has an international reputation for being a showcase of coastal and coastal plain geology. The fossils, on the other hand, have not gained quite the international reputation, largely due to the rarity of macroskeletal sites. In the planning area, a handful of actual dinosaur bonebeds and associated individual specimens are known from the west side of the Kaiparowits area, both near the Paria River and around the town of Tropic. None of these have yielded diagnostic cranial material that will facilitate scientific naming of the specimens. Such sites are probably much more common on the Paunsaugunt and Markagunt Plateaus, farther from the coastal facies, but remain elusive because of more extensive vegetative cover in those areas. As a result, most paleontological interest to date has been on the microvertebrate fossils and invertebrates, both of which were used mostly for biostratigraphic purposes (dating of rock layers). Many of the microvertebrate species were described in detail in Titus and Loewen (2013). Despite their small size, the microvertebrate record of the Straight Cliffs remains one of the most complete, best-documented Turonian-Santonian-aged successions in the world (Titus et al. 2017). The discovery of any macroskeletal site with diagnostic cranial or other material would immediately elevate interest in this unit and trigger a small "bone rush," as these would all be animals that are new to science. Very little is known about larger animals in Straight Cliffs time, and yet the evolution of key dinosaur and other groups (e.g., tyrannosaurids, hadrosaurids, and ceratopsids) must have occurred at that time.

Public Interest

Public interest in Straight Cliffs fossils has largely been confined to hobby collecting of shark teeth from the lower portion, as well as occasional collecting of invertebrates and leaf fossils from the John Henry Member.

Management Issues

The actual fossil content of the formation is still largely unknown over much of the planning area. Inventory should be conducted in all four members, with an emphasis on the western portion of the Kaiparowits Plateau where macroskeletal remains are already known. It would be efficient to support a

joint inventory effort between the planning area and Kanab Field Office lands along the Skutumpah Terrace and Glendale Bench areas, where the probability of macroskeletal remains is higher, to gain a comprehensive understanding of Straight Cliffs fossil resource in the entire region. Hobby collecting has been intermittent and low impact but does include the looting of shark teeth and other smaller vertebrate remains from shoreface lags in the lower portion of the formation around Tropic and Escalante. Vertebrate remains and petrified wood occur in densities below the thresholds that generally trigger illegal commercial collecting.

Wahweap Formation

Research Interest

Because the Wahweap Formation has yielded numerous diagnostic skeletons of larger vertebrates, there is high interest in it among the research community. In addition, the fossils date to a time that puts them as just older than most other classically studied faunas in North America. Because the formation spans at least three different potential faunal zones (two in the middle Campanian and lower-most upper Campanian) and has such high potential to produce sites through its entire thickness, the probability of finding animals new to science is very high. This payout potential versus investment in the field ratio will keep researchers interested in the formation for the foreseeable future. The paleobotany and invertebrate paleontology have never been adequately studied and are a glaring piece of the knowledge gap. Unlike wood in the Chinle or Morrison Formations, wood of Wahweap age is relatively rare in the Colorado Plateau region.

Public Interest

The public has shown intense interest in the dinosaur and larger fossil animal species from the Wahweap Formation, such as the giant alligator, *Deinosuchus*, of which two species are known. Plastic figurines of the horned dinosaur *Diabloceratops* are now made by major toy makers. *Lythronax*, as the oldest *Tyrannosaurus rex*-like animal ever found, has also generated widespread interest. Historically, large petrified logs in the lower member at Head of the Creeks have been the target of collecting (including illegal poaching) by locals in the Big Water-Church Wells-Page area. Because the wood is not gem grade, this has largely been for landscaping and structural or ornamental use in walls.

Management Issues

The Wahweap Formation's fossils are of such elevated global significance that support for all aspects of their inventory and research would reap great benefits to the resource. Large areas, particularly away from main travel routes, have never been inventoried and remain almost unknown as to their fossil potential. These areas should be prioritized for future inventory work. Interpretation of the formation should also be a high priority because of the high diversity and significance of its dinosaur fauna, which would foster public appreciation. Protection of particularly rich areas already inventoried should be priority.

Kaiparowits Formation

Research Interest

The Kaiparowits Formation (the geological formation, not the Kaiparowits Plateau landform) has attracted more research attention than any other formation in the planning area since 2000. It may be one of the most heavily studied formations on the entire Colorado Plateau. This is because the

likelihood of a large payout (that is new species and new insight) is very high if a program invests in field time in the Kaiparowits Formation. The Kaiparowits Formation has the highest density of bone, the best preservation, and the highest diversity of any formation in the planning area.

Public Interest

The public has shown intense interest in the dinosaur and larger fossil animal species from the Kaiparowits Formation, including *Nasutoceratops titusi*, a star in the latest Jurassic Park film franchise. Numerous toys available to the public represent the dinosaurs of the Kaiparowits, which further capture the public's attention. The Kaiparowits Formation, as likely the richest vertebrate fossil-producing unit in the entire region, has frequent unusual fossils discoveries, such as turtles with egg clutches and evidence of tyrannosaurs hunting in packs, that regularly receive publicity. In 2014, the National Geographic released a "Digging Utah's Dinosaurs" article concentrated on the Kaiparowits Formation capturing the public's imagination. With the high concentration of fossil bones and teeth exposed at the surface, fossils are likely illegal collected on occasion by the interested public.

Management Issues

The Kaiparowits Formation's fossils are of such elevated global significance that support for all aspects of their inventory and research would reap great benefits to the resource. Large areas, particularly away from main travel routes, have never been inventoried and remain almost unknown as to their fossil potential. These areas should be prioritized for future inventory work. Interpretation of the formation should also be a high priority because of the high diversity and significance of its dinosaur fauna, which would foster public appreciation. Protection of particularly rich areas already inventoried should be priority.

C.2.5 Neogene System

Research Interest

The unpredictable and rare nature of Pleistocene fossil site occurrence has discouraged researchers from systematic investigation. Sites are mostly found incidentally to other work or by the public and, when found, are generally investigated intensely. This is not likely to change. There seems to be a current apathy among scientists toward Colorado Plateau Pleistocene fossil research.

Public Interest

The public is very interested in Pleistocene megafauna and the story of the Pleistocene in general. Mammoths, sabre-tooth tigers, camels, horses, and giant bison roaming the region thousands of years ago create a compelling story for interpretation. Nonvertebrate fossil resources are rare enough in the region that hobby collecting has not been documented.

Management Issues

Almost no systematic inventory for Pleistocene fossil resources has been undertaken in the planning area. Such inventory should be undertaken. Sites, particularly those with megafaunal remains, are extremely rare, much less predictable in occurrence, limited in areal extent, and frequently vulnerable to even light weathering or disturbance. The bones of such animals are generally not permineralized and are very brittle or soft. Bluff shelters can contain soft tissues or traces (e.g., dung) that have mummified in the desert climate. Curation of such specimens in museums can require elaborate climate control and other expensive measures. The small area of bluff shelters, combined with the tendency of illegal artifact

hunters to dig in them for other reasons, makes these resources particularly vulnerable. The association of any megafaunal sites with Paleo Indian artifacts or traces would elevate a site's status possibly to world heritage level.

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