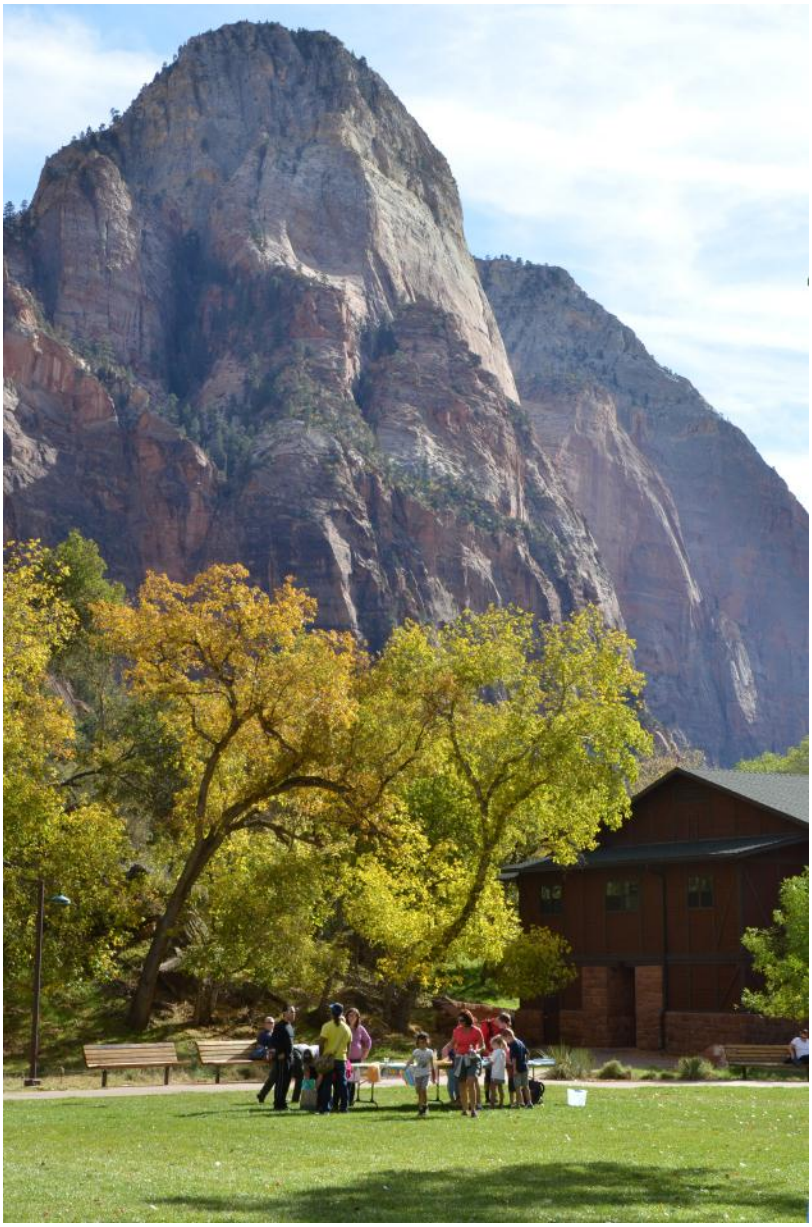
National Park Service
U.S. Department of the Interior

State of the Park Report

Zion National Park
Utah



2016

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On the cover: Visitors enjoy the cultural landscape setting at the Zion Lodge beneath the natural splendor of the Mountain of the Sun in Zion Canyon.

Disclaimer. This State of the Park report summarizes the current condition of park resources, visitor experience, and park infrastructure as assessed by a combination of available factual information and the expert opinion and professional judgment of park staff and subject matter experts. The internet version of this report provides the associated workshop summary report and additional details and sources of information about the findings summarized in the report, including references, accounts on the origin and quality of the data, and the methods and analytic approaches used in data collection and assessments of condition. This report provides evaluations of status and trends based on interpretation by NPS scientists and managers of both quantitative and non-quantitative assessments and observations. Future condition ratings may differ from findings in this report as new data and knowledge become available. The park superintendent approved the publication of this report.

Executive Summary

The mission of the National Park Service is to preserve unimpaired the natural and cultural resources and values of national parks for the enjoyment, education, and inspiration of this and future generations. NPS Management Policies (2006) state that "The Service will also strive to ensure that park resources and values are passed on to future generations in a condition that is as good as, or better than, the conditions that exist today." As part of the stewardship of national parks for the American people, the NPS has begun to develop State of the Park reports to assess the overall status and trends of each park's resources. The NPS will use this information to improve park priority setting and to synthesize and communicate complex park condition information to the public in a clear and simple way.

The purpose of this State of the Park report is to:

- Provide to visitors and the American public a snapshot of the status and trend in the condition of a park's priority resources and values;
- Summarize and communicate complex scientific, scholarly, and park operations factual information and expert opinion using non-technical language and a visual format;
- Highlight park stewardship activities and accomplishments to maintain or improve the State of the Park;
- Identify key issues and challenges facing the park to help inform park management planning.

The purpose of Zion National Park (ZION) is to preserve the dramatic geology including Zion Canyon and a labyrinth of deep and brilliantly colored Navajo sandstone canyons formed by extraordinary processes of erosion at the margin of the Colorado Plateau; to safeguard the park's wilderness character and its wild and scenic river values; to protect evidence of human history; and to provide for scientific research and the enjoyment and enlightenment of the public.

Significance statements express why ZION resources and values are important enough to merit national park unit designation. Statements of significance describe why an area is important within a global, national, regional, and systemwide context. These statements are linked to the purpose of the park unit, and are supported by data, research, and consensus. Significance statements describe the distinctive nature of the park and inform management decisions, focusing efforts on preserving and protecting the most important resources and values of the park unit. ZION is significant because:

- ZION is a geologic showcase of brilliantly colored strata highlighted by sheer Navajo sandstone cliffs that are among the highest in the world and expose ancient remnants of the largest known sand dune system. Geologic processes continue today as the free-flowing Virgin River rapidly cuts into the margin of the Colorado Plateau, incising a multitude of deep, narrow canyons. An abundance of canyon springs, fed by groundwater, create hanging gardens and grottos that support endemic varieties of flora and fauna. These exceptional features and processes contribute to the outstanding scenery and scientific value of the park.

- The range of topography in ZION and location at the juncture of the Colorado Plateau, Mojave Desert, and Great Basin ecoregions have created the environment for a wide variety of life forms, including rare and endemic species that exist only in this small geographic area. This diversity of life forms provides opportunities for valuable scientific research.

- The Zion Wilderness preserves the undeveloped character and natural environment of the spectacular network of colorful deep sandstone canyons, high forested plateaus, and striking rock towers, as well as opportunities for visitors to experience a strong sense of solitude and remoteness from civilization.

- Utah's first designated wild and scenic rivers flow through the park carving a colorful labyrinth of canyons across layers of time. These rivers, fed by natural undiminished spring flows from the Navajo sandstone aquifers and sculpted by unimpeded torrents of flood waters, have an ecological value that far exceeds their spatial extent in the park.

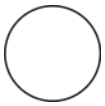
- In a canyon environment, ZION preserves human history of the Ancestral Puebloan, Paiute, pioneers, early 20th-century tourism, and NPS development along the Virgin River. The remarkable integrity of these resources provides a setting ideal for future education and research.

- ZION is a world-renowned destination that offers opportunities for a range of recreational and educational experiences including passive activities and high adventure excursions. Visitors are able to step inside the scenery and can find themselves surrounded by narrow cliff walls in places of extraordinary scale such as the Virgin River Narrows. These experiences often create profound emotional and personal connections for a diversity of visitors.

The summary table, below, and the supporting information that follows, provide an overall assessment of the condition of priority resources and values at ZION based on scientific and scholarly studies and expert opinion. The internet version of this report, available at http://www.nps.gov/stateoftheparks/zion/, provides additional detail and sources of information about the resources

summarized in this report, including references, accounts on the origin and quality of the data, and the methods and analytical approaches used in the assessments. Reference conditions that represent “healthy” ecosystem parameters, and regulatory standards (such as those related to air or water quality) provide the rationale to describe current resource status. In coming years, rapidly evolving information regarding climate change and associated effects will inform our goals for managing park resources, and may alter how we measure the trend in condition of park resources. Thus, reference conditions, regulatory standards, and/or our judgment about resource status or trend may evolve as the rate of climate change accelerates and we respond to novel conditions. In this context, the status and trends documented here provide a useful point-in-time baseline to inform our understanding of emerging change, as well as a synthesis to share as we build broader climate change response strategies with partners.

The Status and Trend symbols used in the summary table below and throughout this report are summarized in the following key. The background color represents the current condition status, the direction of the arrow summarizes the trend in condition, and the thickness of the outside line represents the degree of confidence in the assessment. In some cases, the arrow is omitted because data are not sufficient for calculating a trend (e.g., data from a one-time inventory or insufficient sample size).

Condition Status		Trend in Condition		Confidence in Assessment	
	**Warrants Significant Concern**		**Condition is Improving**		**High**
	**Warrants Moderate Concern**		**Condition is Unchanging**		**Medium**
	**Resource is in Good Condition**		**Condition is Deteriorating**		**Low**

State of the Park Summary Table

Priority Resource or Value	Condition Status/Trend	Rationale
Natural Resources		web ▸
Air Quality		Vistas at ZION are at times obscured by pollution-caused haze. Ozone sometimes reaches levels that can make breathing difficult for sensitive groups and cause injury to ozone-sensitive plants. Arid ecosystems and grasslands are particularly vulnerable to changes caused by nitrogen deposition. Interactions between nitrogen, invasive exotic annual grasses, and fire have implications for changes to biodiversity in non-fire adapted areas of the park. Airborne toxics, including mercury, can deposit with rain and snow and accumulate in organisms, such as fish and birds. A recent study found elevated mercury levels in small prey fish (speckled dace) at ZION.
Geologic Features and Processes		Geologic features and processes, including soils, are in substantially natural condition and function. Exceptions include the relatively small developed portions of the park, and stream channelization in Zion Canyon. The status would be scored as green except for the large number of geologic hazards always present in the park that pose a threat to all facilities, visitors and employees. These hazards include flash floods, debris flows, rockfall, landslides, collapsing soils, expansive soils, gypsiferous soils, seismic shaking, surface rupture and liquefaction. Mitigation is implemented for some of these hazards.

Priority Resource or Value	Condition Status/Trend	Rationale
Paleontological Resources		Paleontological Resources are abundant and well documented in portions of the park. Additional inventory is needed in other areas. The exceptionally high rate of natural erosion in the park causes many fossils to be freshly exposed, and then lost to erosion in a matter of a few years. To date, all paleontological inventory and monitoring in the park has been conducted by paleontological interns or opportunistic partnerships with state paleontologists. A more consistent and professional approach is needed.
North Fork Virgin River – Main Canyon		The total flow of river is protected under the Zion National Park Water Rights Settlement Agreement (1996). As a result, the flows are substantially natural and protected from human impacts (Sharrow 2013). Exceptions include, levees channelizing 2 miles of the river near Zion Lodge, levels of *E. coli* originating upstream of the park that cause it to exceed state standards, and some trends in flow that appear to be a response to a warming climate. Native fish appear to be doing well.
Other Rivers and Tributaries		All of the 76.1 miles of perennial streams in the park outside of Zion Canyon are relatively free flowing with only Kolob Creek substantially influenced by reservoir storage. The fact that this condition exists, and that new reservoirs upstream of the park are prohibited by the terms of the water rights settlement agreement, results in a good condition, steady trend and high confidence rating. With the exception of high pH in North Creek, water quality in ZION meets state standards and is presumed to be largely natural. Aquatic invertebrates and native fish appear to be present in natural conditions and abundance.
Wild and Scenic River		In March of 2009, 144 miles of the Virgin River and tributaries within Zion National Park were designated as Wild and Scenic Rivers and added to the National Wild and Scenic River System. These are the first wild and scenic rivers designated in Utah. Although perceived to be in good condition and stable, periodic monitoring of Outstandingly Remarkable Values must be implemented to ensure wild and scenic qualities do not erode.
Plant Communities		The flora of ZION is rich and diverse. Many of the plant communities are thriving. Of concern is the presence of non-native invasive plants and altered wildland fire frequency. These conditions have the potential to drastically change plant communities.
Wildlife Communities		Presence has been confirmed in ZION for the majority of vertebrate species and all seem to have relatively stable populations and distributions. Although some non-native species are present, these are all found in low numbers and are not of concern at this time.
Special Status Species		While all species are currently stable or increasing, concerns remain regarding their future vulnerability due to increased visitation, exposure to environmental contaminants, disease, and climate change.
Ecosystem Processes and Land Status		Fire activity, climate, diseases, pests, and humans can cause sweeping changes in park landscapes. The park is most concerned with the ecosystem being able to function within the natural range of variability. Development and land use on inholdings within and adjacent to the park can affect wildlife patterns and availability of natural resources. The current rate of development is a concern.
Dark Night Sky		Modeling by the NPS Natural Sounds and Night Skies Division shows that night sky in ZION is in “good” condition, confirming the nighttime view seen from within the park. Trend is deteriorating based on increased light pollution from nearby towns and counties (largely related to high population growth rates over the last 2 decades).

Priority Resource or Value	Condition Status/Trend	Rationale
Acoustic Environment		The mean acoustic impact level (L_{50} dBA), a measure of noise contributed to the existing acoustic environment by man-made sources, is 0.7 dBA in ZION, meaning that acoustic resources are in condition. Overall, long-term projected increases in ground-based transportation and aircraft traffic indicate a downward trend in the quality of acoustic resources, but specific measures described in Zion NP's Soundscape Management Plan are likely to produce a neutral trend.
Cultural Resources		web
Archeological Resources		Most of the archeological projects conducted in the park are for Section 106 purposes. Research-focused investigations are fewer and funding acquisition is problematic for these efforts. Archeological information would be improved through the preparation of a comprehensive Archeological Overview and Assessment. Approximately 19% of the park has been inventoried for sites, and of the 535 sites documented, 77% are in good condition. Documentation for all sites is comprehensive, and generally high-quality, but not without some errors. Data editing is a constant need.
Cultural Anthropology		A narrowly focused ethnographic study was completed in the mid-1990s. A comprehensive approach to ethnographic research is needed to further define and determine resources and/or places of special concern to current tribal peoples and/or other non-native cultural groups. The park actively conducts required consultations for Section 106 purposes, and is increasingly reaching out to local tribes to engage in youth education opportunities. An ethnographic overview and assessment study is suggested to document baseline cultural anthropology data for the full spectrum of park resources and traditionally associated tribes and communities.
Cultural Landscapes		Two cultural landscapes have been formally documented: the Zion Canyon Cultural Landscape Inventory, and the Zion Lodge/Birch Creek Cultural Landscape Inventory. Both are eligible for listing in the NRHP, with SHPO concurrence, dated 2006. Both are currently in good overall condition. Preservation treatment plans are needed. Additional evaluations could be made on other potentially significant landscapes. An administrative history is scheduled to begin in FY 2015, which will advance research efforts in identifying and understanding cultural landscapes and historic contexts.
Historic Structures		The LCS contains 94 structures for ZION. All of these are currently listed in the NRHP, or have been formally determined eligible for listing. Baseline documentation, such as HSRs, is needed to develop a better understanding of historic contexts. An administrative history is scheduled to begin in FY 2015, which will advance research efforts in identifying and understanding additional historic contexts. During recent fieldwork to update existing LCS records in 2014, many additional structures were identified that have yet to be evaluated for NRHP significance.
History		Overall, there is an abundance of historical information available regarding the history and development of the southern Utah region surrounding ZION, but it is widely scattered among many sources and facilities. The park lacks a consolidated, focused analysis of its administrative history and significance, particularly as germane to regional development. Oral histories offer a profound way to create links to the past and an understanding of the significance of place. Each year we lose these connections as memories fade. Oral histories are needed among both native and non-native groups. An administrative history is scheduled to begin in FY 2015, which will advance research efforts in identifying and understanding historic contexts and unit significance.

Priority Resource or Value	Condition Status/Trend	Rationale
Museum Collections		The park's Scope of Collection Statement is current and accurate. Approximately 61% of the known objects and archives have been cataloged. The largest contributor to backlog is archives, and there are two projects currently underway that will result in a large number of them being cataloged. The park has a current Scope of Collection Statement, Fire Protection Survey and Housekeeping Plan. A draft Collection Management Plan was created in 2011; however, major revisions were necessary and are ongoing. The park lacks a Collection Condition Survey, Storage Plan, security survey and a museum specific emergency operation plan. Overall, the collection is in very good condition. The storage area is environmentally stable and at very little risk of fire or security breach. A Collection Condition Survey and Storage Plan will identify and address any unknown deficiencies.
Visitor Experience		web ▸
Number of Visitors		The total of 3,186,696 visitors to the park in 2014 is an increase of 19.5% from 2010 (2,665,972 visitors). The 2014 total is 17% higher than the 10-year average of 2,718,666 visitors for 2004–2013.
Visitor Satisfaction		Based on the standard visitor satisfaction survey conducted each year, the percentage of visitors satisfied in FY14 was 99.0%, which is similar to the average for the previous five years (99.0%) and ten years (98.4%). Source: 2004–2014 Visitor Survey Card Data Reports.
Visitation Impacts to Resources		Increasing visitation has led to concerns among park managers about overcrowding, infrastructure limitations, and resource protection. Increasing visitation also affects the availability of recreational opportunities for visitors. The park's ability to purchase inholdings is decreasing as land values increase.
Interpretive and Education Programs – Talks, Tours, and Special Events		Over 155,000 visitors were reached in FY14 through all personal interpretive services. The Education Program at ZION continues to expand. All interpretive programs offered to the public are of very high quality. Current staffing levels are insufficient to meet demand for interpretive and educational programs (reliance on seasonal staff to meet nearly year-round demand), and much of the education program is funded by donations and grants.
Interpretive Media – Brochures, Exhibits, Signs, and Website		ZION produces a quarterly newspaper and a wilderness guide each year. The park also offers four foreign language newspapers. Over a dozen brochures are printed for distribution at park visitor centers. Nearly 200 waysides are found throughout the park, but many are outdated or in need of replacement. Park directional signs (on and off-site) are in poor condition, and the visitor center needs new exhibits. Nearly six million people visit the park website. ZION also has a strong presence on social media.
Scenic Resources		Most scenic views in and around the park are generally high quality and in good condition. The park has experienced some recent development adjacent to the park that has affected scenic views.
Universal Access		All new facilities in the park have been designed to be as universally accessible as possible. Shuttle buses are handicap accessible and provide frequent service much of the year. Virtual experiences that by their nature are physically impossible to make accessible are available on-line. Closed captions are available for most audio/ visual programs and a brochure contains the narration of the shuttle tour. Universal symbols and icons are used throughout the park to accommodate non-English speaking visitors.

Priority Resource or Value	Condition Status/Trend	Rationale
Safety		The ZION law enforcement staff is specially-trained for handling Search and Rescue, Emergency Medical Services and Structural Fire. Responses to incidents are rapid and professional; however, incidents continue to climb with increasing park visitation while the number of responders has remained the same. The majority of the permanent park staff is trained in Operational Leadership and many in CPR, First Aid, Wilderness First Aid, and Wilderness First Responder.
Partnerships		The park works closely with several partners on various projects. The Zion National Park Foundation is the park's fundraising partner. It raises money primarily for the park's youth education initiative, art in the park project, and bighorn sheep protection project. The park is part of the Interagency Internship Cooperative with other federal land agencies and local universities.
Park Infrastructure		web ▸
Overall Facility Condition Index		The overall facility status, trend and confidence level score at ZION is due to the park's continued success at using the FLREA and other special program funds to upgrade and rehabilitate structures and utilities in a timely manner. No comprehensive condition assessment has been completed in the last 3 years. This data not being loaded into the system has skewed the FCI numbers and does not accurately depict the park's current FCI.
Park Carbon Footprint		ZION belongs to a network of parks nationwide that are putting climate friendly behavior at the forefront of sustainability planning. The park is a member of the NPS climate action plan. The Environmental Management System plan describes commitments to reduce emissions of greenhouse gases at the park by 2020. Combined emissions from park and concessioner operations and visitor activities within the park during the 2008 baseline (9,280 metric tons of carbon or carbon equivalent) year were roughly equivalent to the emissions from the energy use of 847 households each year (Greenhouse Gas Equivalencies Calculator).
Wilderness Character and Stewardship		web ▸
Overall Wilderness Character		Baseline wilderness character monitoring was conducted in 2011. The monitoring will be repeated in 2016 to determine a trend. Values used for this process are not exact. Trends for all five qualities of wilderness character appear to be stable or improving. The amount of trammeling actions authorized by the NPS, NPS structures in wilderness, livestock trespass, and motorized equipment use have all dropped in recent years. Visitor demand for recreational use of the wilderness continues to rise even though use levels through much of the wilderness are limited through a permit system.
Wilderness Stewardship		All key stewardship documents are complete including a wilderness stewardship plan and boundary description. Wilderness character is integrated into planning, management, and monitoring. An ongoing wilderness character monitoring program is in place. The park should host a Carhart regional training and the superintendent should attend the Carhart national training.

Summary of Stewardship Activities and Key Accomplishments to Maintain or Improve Priority Resource Condition

The list below provides examples of stewardship activities and accomplishments by park staff and partners to maintain or improve the condition of priority park resources and values for this and future generations:

Natural Resources

- Obtained Congressional Wild and Scenic River designations for 144 river miles within the park, the first designations in the state of Utah. A River Management Plan was completed to protect the free-flowing condition of rivers, water quality, and the outstanding natural and recreational values for future park visitors.
- ZION Wilderness was Congressionally designated in 2009. ZION completed a standards based wilderness management plan in 2007, which allows the park to manage use limits based on resource conditions and visitor experiences. The standards were incorporated into a baseline wilderness character monitoring program, which was completed for the Zion Wilderness in 2011. A wilderness narrative was completed as a part of the park's foundation document in 2013. Wilderness character has been integrated into all management decisions affecting the Zion Wilderness.
- Zion National Park Water Rights Settlement Agreement signed in 1996 provides long term protection of stream flows, while accepting a relatively low level of present and future impact. This protects overall stream flow, flood peaks (by preventing construction of new reservoirs), and periods of low flow. It carries an affirmative requirement for the park to monitor changes in water rights.
- Worked with FAA and St. George airport to minimize the effects of commercial flight paths over the park, the first time airspace over a national park unit has been considered in an airport EIS.

Cultural Resources

- All concessioner buildings underwent a comprehensive condition assessment in 2012, which will be repeated every five years. Maintenance needs into the future were identified, prioritized and classified and are being met by NPS and the concessioners.
- Two historic dormitories at the lodge have been remodeled to reintroduce historic character defining features, rehabilitate structural condition, and improve employee comfort.
- Developed a diverse array of heritage educational and outreach opportunities including a lecture series, participating in state sponsored events (Utah Archaeology Week), archeology workshops, cultural demonstrations, and an archeology traveling trunk for schools.

Visitor Experience

- The shuttle system keeps hundreds of thousands of private vehicles from entering Zion Canyon, which greatly reduces traffic congestion, resource damage from parking, noise levels, etc. The system is very efficient and well-run; it does a great job of moving large numbers of people every day. The park is currently working with transportation experts to quantify visitor use of the transportation system and development alternative management strategies that move large numbers of visitors efficiently while protecting important park resources and maintain a quality visitor experience.
- Zion Youth Programs have significantly increased since 2010: approximately 300 education programs are conducted annually, reaching 7,000 to 9,000 visitors each year through school and outreach programs. The second year of the Concrete to Canyons program brought students from four urban middle schools to ZION for a multi-day camping and learning experience.
- ZION is recognized worldwide for its sustainability efforts. Highlights include: the propane-powered shuttle fleet which eliminates thousands of private automobiles from driving in the park every day, highly efficient buildings, water bottle filling stations to reduce waste (the first in the NPS), photovoltaic panels which provide ≈12% of the park's electricity needs, electric and alternative fuel vehicles, a park composting program, and an extensive recycling program for residents and visitors.
- Wilderness permitting operations have added a last minute drawing to the reservation and lottery system. This system eliminates the need for visitors to wait in long lines over multiple days to obtain canyoneering permits, allowing them to get out into the park more to experience the resource.
- Over the past four years, ZION has greatly increased its social media presence. The park has a Facebook page with over 228,000 likes (seventh most followed NPS site), a Twitter page with over 31,000 followers (fifth most followed NPS site), and an Instagram account with over 43,000 followers (third most followed NPS site). The park also has a YouTube channel, a Flickr page, and a Flickr group where visitors can donate their photos to the park.

Park Infrastructure

- The sustainability and maintenance program revised and implemented an Integrated Solid Waste Alternatives Plan (ISWAP) program.
- ZION has maintained a 30–35 percent landfill diversion rate since 2010.
- 85 kW of photovoltaics have been installed at 3 different park facilities.

- There has been a switch to LED lighting in administrative buildings, and in indoor and outdoor public spaces through an American Recovery and Reinvestment Act (ARRA) grant.
- ZION conducts an annual hazardous waste pick up to remove unapproved materials from the park that have been left by visitors or residents.
- Thermal audits of park facilities were conducted to improve efficiency.

Key Issues and Challenges for Consideration in Management Planning

Challenges and issues for current and future management planning fall into four major categories: increasing visitation, transportation, operational budget shortfall, and external influences.

Increasing Visitation – The park is rapidly becoming a year-round destination with an ever-shrinking slow season in December and January. The past five year trend in visitation from 2010–2014 has shown a 19.37% increase. Increased visitor density accelerates wear and diminishes facility lifecycles. The park now routinely receives negative comments about crowding. The number of resource impacts monitored by staff such as campsite sprawl, human waste, additional canyoneering anchors, illegal campfire scars, and braided or multiple trails have greatly increased in recent years. Aggressive wildlife behaviors toward humans by deer and squirrels have been observed at popular, crowded park destinations, presumably due to feeding animals and their acclimation.

Transportation Issues – The park and adjacent town of Springdale have a limited amount of parking. A shuttle bus system was established in the town and within the park in 2000 to help move people and reduce traffic congestion; however, the buses are frequently at standing-room-only capacity. The highly successful shuttle system delivers many more people to trailheads and destinations than were possible with private vehicles, increasing social crowding conditions on park trails and increasing road and resource damage. Neither the park nor the town can simply build ourselves out of this situation by providing more parking lots, more buses, and heavier duty roads without sacrificing the local quality of life, the quality of park resources, and the quality of visitor experiences.

Budget Shortfall – Base budget increases for park operations have not kept pace with the demands on staff associated with increased visitation. The shortage in operational budget and staff level for what is becoming a year-round park is being felt in every division. ZION relies heavily on seasonal staff, limited to 6-month appointments. This requires the inefficient and costly practice of recruiting, hiring, and training two sets of seasonal workers each year to cover these expanded operations. This places a multiplied workload on supervisors and the Servicing Human Resources Office (SHRO) staff. This need to hire multiple sets of seasonal workers is felt throughout all aspects of park operations, including law enforcement and emergency response; maintenance of roads, trails, grounds, buildings and utilities; fee operations, and visitor information and education services. Budget and staff shortages also adversely affect the knowledge base and management of the resources for which the park was established and that visitors come to enjoy. There is also no funding for most data needs identified in the park foundation document.

External Influences – There are processes external to the park that could adversely impact park resources or visitor experience. Park managers need to maintain or develop working relationships with external agencies or partners for the conservation of park resources and visitor experience. There are natural or external forces that park managers have little to no ability to influence such as climate change, air quality and visibility, dark night sky protection, introduction of non-native species, and adjacent park development that affects wildlife populations and habitat, and visitor experience.

In the face of these challenges and issues stands a highly dedicated, skilled, competent, and passionate workforce that daily goes the extra mile to provide high quality services and experiences for park visitors and that is committed to the protection and preservation of park resources.

Chapter 1. Introduction

The purpose of this State of the Park report for Zion National Park (ZION) is to assess the overall condition of the park's priority resources and values, to communicate complex park condition information to visitors and the American public in a clear and simple way, and to inform visitors and other stakeholders about stewardship actions being taken by park staff to maintain or improve the condition of priority park resources for future generations. The State of the Park report uses a standardized approach to focus attention on the priority resources and values of the park based on the park's purpose and significance, as described in the park's Foundation Document or General Management Plan. The report:

- Provides to visitors and the American public a snapshot of the status and trend in the condition of a park's priority resources and values.
- Summarizes and communicates complex scientific, scholarly, and park operations factual information and expert opinion using non-technical language and a visual format.
- Highlights park stewardship activities and accomplishments to maintain or improve the state of the park.
- Identifies key issues and challenges facing the park to inform park management planning.

The process of identifying priority park resources by park staff and partners, tracking their condition, organizing and synthesizing data and information, and communicating the results will be closely coordinated with the park planning process, including natural and cultural resource condition assessments and Resource Stewardship Strategy development. The term "priority resources" is used to identify the fundamental and other important resources and values for the park, based on a park's purpose and significance within the National Park System, as documented in the park's foundation document and other planning documents. This report summarizes and communicates the overall condition of priority park resources and values based on the available scientific and scholarly information and expert opinion, irrespective of the ability of the park superintendent or the National Park Service to influence it.

Located in Washington, Iron, and Kane counties in southwestern Utah, ZION encompasses some of the most scenic canyon country in the United States. The park is characterized by high plateaus, a maze of narrow, deep, sandstone canyons, and striking rock towers and mesas. The North Fork of the Virgin River has carved a spectacular gorge through Zion Canyon, where sandstone walls rise 2,000 to 3,000 feet above the canyon floor. The southern part of the park is a lower desert area, with colorful mesas bordered by rocky canyons and washes. The northern sections of the park are higher plateaus covered by forests.

ZION is one of the earliest additions to the national park system. On July 31, 1909, President William H. Taft issued a proclamation setting aside 15,200 acres as the Mukuntuweap National Monument. In 1918 another presidential proclamation enlarged the monument to 76,800 acres and changed its name to Zion National Monument. Congress established the area as a national park in 1919. A second Zion National Monument (now called the Kolob Canyons) was established by presidential proclamation in 1937. Congress added the Kolob Canyons to ZION in 1956. The park currently encompasses 148,733 acres.

On March 30, 2009, the Omnibus Public Land Management Act (Public Law 111-11) designated the vast majority of ZION as wilderness. A total of 124,462 acres of ZION is designated wilderness (84% of the park), and 9,047 acres (6% of the park) are recommended for wilderness designation. This means that 90% of the park is managed as wilderness, as per NPS policy. The legislation also designated 144 miles of wild and scenic rivers in ZION, the first wild and scenic rivers designated in Utah.

The spectacular scenery of Zion attracts visitors from all over the world. Visitation to the park was 3.2 million people in 2014. Visitors to ZION enjoy deep cool canyons, high wooded plateaus, and vast warm deserts. ZION offers a variety of recreational opportunities and activities including driving scenic roads, hiking, backpacking, canyoneering, photography, and wildlife viewing, to name a few.

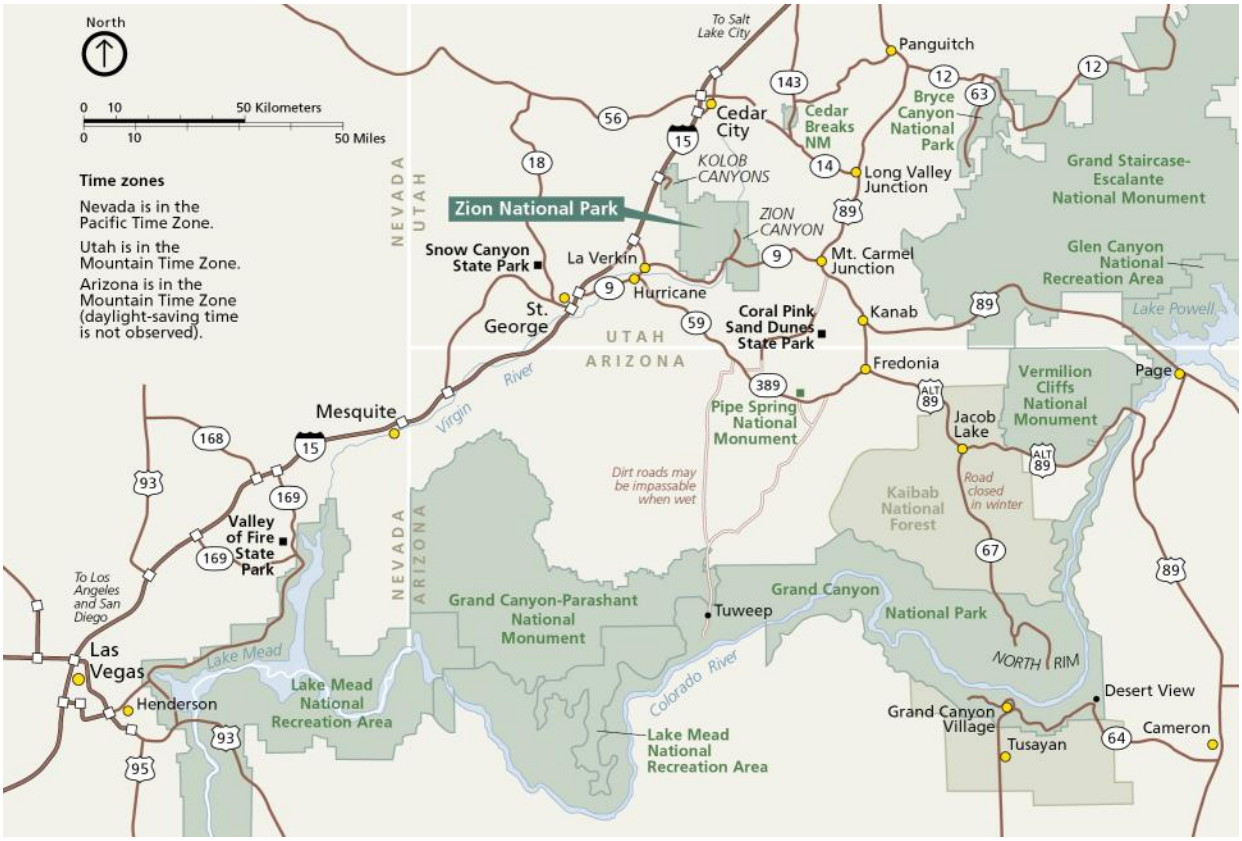
ZION is a leader in protecting natural resources and embracing sustainable practices that reduce the effects of park operations on climate change. In order to accomplish this, ZION has implemented sustainable policies and practices. Examples included eliminating the need to purchase bottled water in plastic containers by providing and publicizing water bottle filling stations; creating a recycling program for staff, visitors, and concessioners; installing solar panels that provide electricity to many of the park buildings; and using energy efficient vehicles. These actions will help ZION meet the challenge of the National Park Service to leave park resources unimpaired for the enjoyment of future generations.

The purpose of ZION is to preserve the dramatic geology including Zion Canyon and a labyrinth of deep and brilliantly colored Navajo sandstone canyons formed by extraordinary processes of erosion at the margin of the Colorado Plateau; to safeguard the park's wilderness character and its wild and scenic river values; to protect evidence of human history; and to provide for scientific research and the enjoyment and enlightenment of the public.

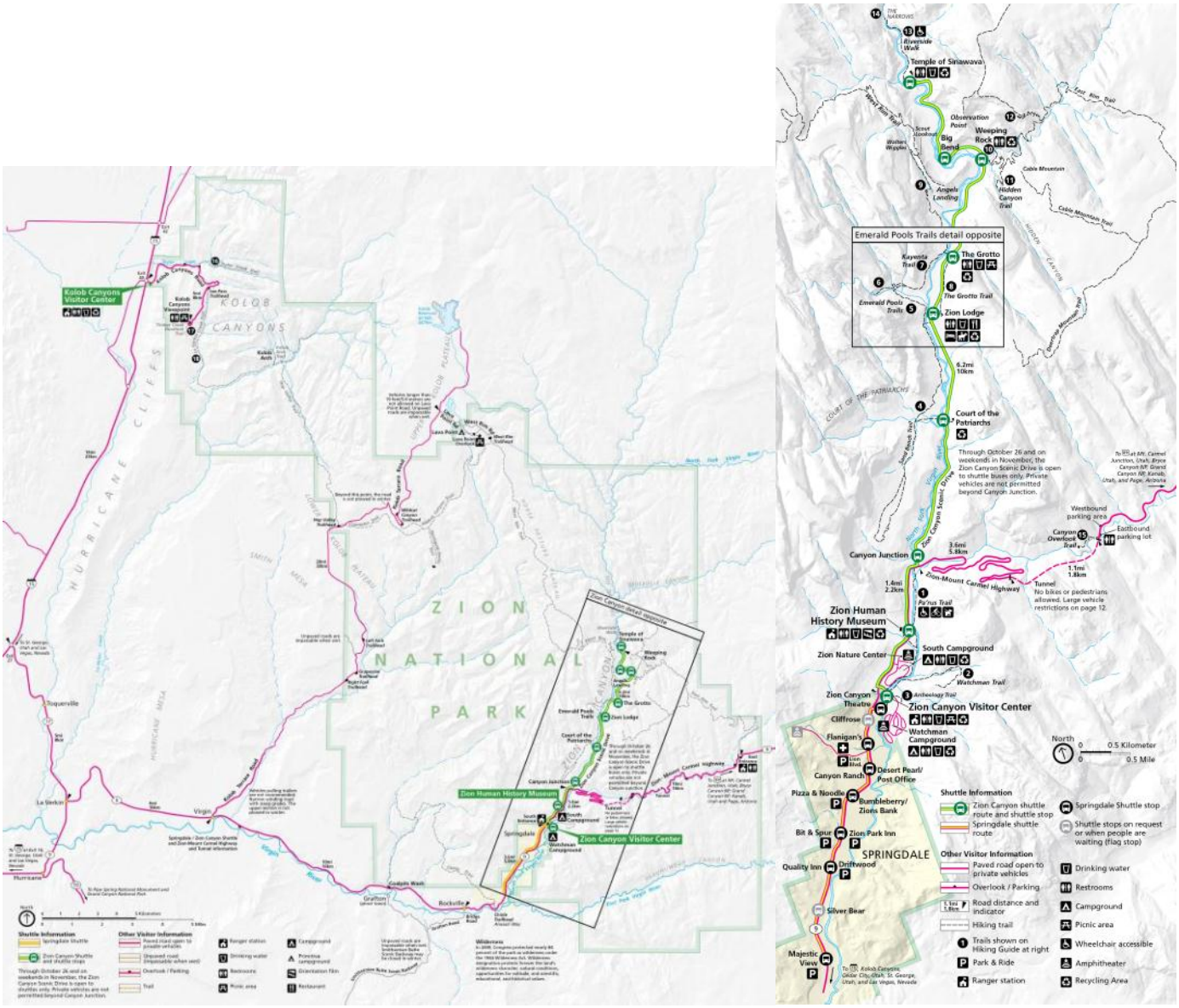
Significance statements express why ZION resources and values are important enough to merit national park unit designation. Statements of significance describe why an area is important within a global, national, regional, and systemwide context. These

statements are linked to the purpose of the park unit, and are supported by data, research, and consensus. Significance statements describe the distinctive nature of the park and inform management decisions, focusing efforts on preserving and protecting the most important resources and values of the park unit. ZION is significant because:

- ZION is a geologic showcase of brilliantly colored strata highlighted by sheer Navajo sandstone cliffs that are among the highest in the world and expose ancient remnants of the largest known sand dune system. Geologic processes continue today as the free-flowing Virgin River rapidly cuts into the margin of the Colorado Plateau, incising a multitude of deep, narrow canyons. An abundance of canyon springs, fed by groundwater, create hanging gardens and grottos that support endemic varieties of flora and fauna. These exceptional features and processes contribute to the outstanding scenery and scientific value of the park.
- ZION's range of topography and location at the juncture of the Colorado Plateau, Mojave Desert, and Great Basin ecoregions have created the environment for a wide variety of life forms, including rare and endemic species that exist only in this small geographic area. This diversity of life forms provides opportunities for valuable scientific research.
- The Zion Wilderness preserves the undeveloped character and natural environment of the spectacular network of colorful deep sandstone canyons, high forested plateaus, and striking rock towers, as well as opportunities for visitors to experience a strong sense of solitude and remoteness from civilization.
- Utah's first designated wild and scenic rivers flow through the park carving a colorful labyrinth of canyons across layers of time. These rivers, fed by natural undiminished spring flows from the Navajo sandstone aquifers and sculpted by unimpeded torrents of flood waters, have an ecological value that far exceeds their spatial extent in the park.
- In a canyon environment, ZION preserves human history of the Ancestral Puebloan, Paiute, pioneers, early 20th-century tourism, and NPS development along the Virgin River. The remarkable integrity of these resources provides a setting ideal for future education and research.
- ZION is a world-renowned destination that offers opportunities for a range of recreational and educational experiences including passive activities and high adventure excursions. Visitors are able to step inside the scenery and can find themselves surrounded by narrow cliff walls in places of extraordinary scale such as the Virgin River Narrows. These experiences often create profound emotional and personal connections for a diversity of visitors.



Location of the Park in Utah



Maps of the Park and Zion Canyon

Chapter 2. State of the Park

The State of the Park is summarized below for five categories—Natural Resources, Cultural Resources, Visitor Experience, Park Infrastructure, and Wilderness Character—based on a synthesis of the park's monitoring, evaluation, management, and information programs, and expert opinion. Brief resource summaries are provided below for a selection of the priority resources and values of the park. Clicking on the web ▸ symbol found in the tables and resource briefs below will take you to the internet site that contains content associated with specific topics in the report.

The scientific and scholarly reports, publications, datasets, methodologies, and other information that were used as the basis for the assessments of resource condition are referenced and linked throughout the report and through the internet version of this report that is linked to the NPS IRMA data system (Integrated Resource Management Applications). The internet version of each report, and the associated workshop summary report available from the internet site, provide additional detail and sources of information about the findings summarized in the report, including references, accounts on the origin and quality of the data, and the methods and analytical approaches used in data collection and the assessments of condition. Resource condition assessments reported in this State of the Park report involve expert opinion and the professional judgment of park staff and subject matter experts involved in developing the report. This expert opinion and professional judgment derive from the in-depth knowledge and expertise of park and regional staff gained from their being involved in the day-to-day practice of all aspects of park stewardship and from the professional experience of the participating subject matter experts. This expert opinion and professional judgment utilized available factual information for the analyses and conclusions presented in this report. This State of the Park report was developed in a park-convened workshop.

The status and trends documented in Chapter 2 provide a useful point-in-time baseline measured against reference conditions that represent "healthy" ecosystem parameters, or regulatory standards (such as those related to air or water quality). We also note that climate change adaptation requires us to continue to learn from the past, but attempting to manage for conditions based on our understanding of the historical "natural" range of variation will be increasingly futile in many locations. Thus, these reference conditions, and/or our judgment about resource condition or trend may evolve as the rate of climate change accelerates and we respond to novel conditions. Our management must be even more "forward looking," to anticipate plausible but unprecedented conditions, also recognizing there will be surprises. In this context, we will incorporate climate considerations in our decision processes and management planning as we consider adaptation options that may deviate from traditional practices.

2.1. Natural Resources

Air Quality

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Ozone	Annual 4th-Highest 8-Hour Concentration		Ozone can be a respiratory irritant, causing coughing, sinus inflammation, chest pains, scratchy throat, lung damage, and reduced immune system functions. Children, the elderly, people with existing health problems, and active adults are most vulnerable. Human health risk from ground-level ozone warrants moderate concern. This condition is based on NPS Air Resource Division benchmarks and the 2008–2012 estimated ozone of 71.5 parts per billion (ppb) (NPS-ARD 2015). For 2003–2012, the trend in ozone concentration at ZION remained relatively unchanged (no statistically significant trend).

	Vegetation Health: 3-month maximum 12-hour W126		Vegetation health risk from ground-level ozone warrants significant concern. This condition is based on NPS Air Resource Division benchmarks and the 2008–2012 estimated W126 metric of 15.9 parts per million-hours (ppm-hrs) (NPS-ARD 2015). Past surveys at the park located probable ozone injury on *Symphoricarpos oreophilus* (snowberry) and *Rhus trilobata* (skunkbush) (NPS 2000). There are at least 13 ozone-sensitive plants in the park (see list of ozone-sensitive plant species). For 2003–2012, the trend in the W126 metric at ZION remained relatively unchanged (no statistically significant trend).
Deposition	Sulfur Wet Deposition		Wet sulfur deposition is in good condition. This condition is based on NPS Air Resource Division benchmarks of 0.7 kilograms per hectare per year (kg/ha/yr) (NPS-ARD 2015). Ecosystems in the park were rated as having high sensitivity to acidification effects (Sullivan et al. 2011a, Sullivan et al. 2011b). Given the abundance of base cations in underlying park soils and rocks, surface waters in Zion NP are generally well-buffered from acidification (Binkley et al. 1997). Acidification effects can include changes in water and soil chemistry that impact ecosystem health. No trend information is available because there are not sufficient on-site or nearby wet deposition monitor data.
	Nitrogen Wet Deposition		Arid ecosystems and grasslands are particularly vulnerable to changes caused by nitrogen deposition. Invasive grasses tend to thrive in areas with high nitrogen deposition, displacing native vegetation adapted to low nitrogen conditions. Increases in N have been found to promote invasions of fast-growing exotic annual grasses (e.g., cheatgrass) and forbs (e.g., Russian thistle) at the expense of native species (Brooks 2003, Schwinning et al. 2005, Allen et al. 2009). Wet nitrogen deposition warrants significant concern. This condition is based on NPS Air Resource Division benchmarks and the 2008–2012 estimated wet nitrogen deposition of 1.7 kilograms per hectare per year (kg/ha/yr) (NPS-ARD 2015). Ecosystems in the park were rated as having high sensitivity to nutrient-enrichment effects relative to all Inventory & Monitoring parks (Sullivan et al. 2011c, Sullivan et al. 2011d). No trend information is available because there are not sufficient on-site or nearby wet deposition monitor data.

	Mercury/Toxics Deposition		Mercury and other toxic pollutants (e.g., pesticides, dioxins, PCBs) accumulate in the food chain and can affect both wildlife and human health. High mercury concentrations in birds, mammals, amphibians, and fish can result in reduced foraging efficiency, survival, and reproductive success. Elevated levels of mercury in humans can affect the brain, kidneys, and reproductive function. Mercury/toxics deposition is a significant concern at the park. A recent study found elevated mercury levels in small prey fish (speckled dace) at three sampling sites along the Virgin River at ZION. Mercury concentrations in 20 percent of the fish sampled at ZION exceeded the most conservative health threshold established for fish toxicity, and mercury levels in 90 percent of fish sampled at ZION exceeded the most conservative health threshold for fish-eating birds (Eagles-Smith et al. 2014). No trend information is available because there are not sufficient on-site or nearby mercury wet deposition monitor data.
Visibility	Haze Index		Average visibility warrants moderate concern. This condition is based on NPS Air Resource Division benchmarks and the 2008–2012 estimated average visibility of 3.5 deciviews (dv) above estimated natural conditions (NPS-ARD 2015). For 2003–2012, the trend in visibility remained relatively unchanged (no statistically significant trend) both on the 20% clearest days and the 20% haziest days. The Clean Air Act visibility goal requires visibility improvement on the 20% haziest days, with no degradation on the 20% clearest days.

Geologic Features and Processes

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Zion National Park is located where the Navajo Sandstone reaches its maximum thickness of over 2,000 feet, and where the Virgin River is aggressively cutting into the edge of the Colorado Plateau. The result is a geologic showcase of brilliantly colored strata highlighted by sheer Navajo sandstone cliffs that are among the highest in the world, and exposure of ancient remnants of the largest sand dune system that ever existed on earth. Geologic processes continue today as the free-flowing Virgin River rapidly cuts into the margin of the Colorado Plateau, incising a multitude of deep, narrow canyons. An abundance of canyon springs create hanging gardens and grottos that support endemic varieties of flora and fauna. These exceptional features and processes contribute to the outstanding scenery and scientific value of the park.

One of the geologic traits that influences park management is the abundance of geologic hazards that exist due in part to the composition of the rock layers and to the exceptionally high rate of natural erosion, which has been documented at 1,300 feet in the last one million years. Some of the geologic strata can weather into soils that variously expand, contract or collapse when they are wetted or dried, creating significant problems for structures built on them. High cliffs and strata with weak clay layers give rise to dramatic rock falls and landslides that can be large enough to dam entire canyons. Major faults exist east and west of the park so that the entire park is in an area of high seismic risk.

Some of the geologic strata preserved in the park contain abundant fossils. Fossil resources including plants, trace fossils and less commonly vertebrate fossils, are abundant in the sedimentary strata of Permian, Triassic and early Jurassic age that are exposed in most of the park. The Springdale sandstone member of the Kayenta formation has been identified as part of a regional "megatrack" site due to the abundance of trace fossils. A recently discovered fossil of one of the earliest flowering plants greatly expanded the time period when this species existed.

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Inventory	Geologic resource inventory and mapping Reports, and scientific publications		ZION has current geological maps for all portions of the park (1990 through 2002), a GIS geology layer, Geological Hazard Maps (2010), a Paleontological Resources Inventory (2003) and a Geological Resources Evaluation Report (2006). The geosciences community is very active in the park and vicinity with over 130 scientific publications on the geology of the park. Desired information for the future includes expanding the area of paleontological inventory and preparing an updated park-wide geology map for public sale.
	Soil Resource Inventory Map and Report, Field Observations		Soil maps (1976) for the park are dated and of poor resolution. The NRCS Richfield Office is currently preparing an updated soil survey for the park at the 3rd order level for most of the park with 2nd order mapping in Zion Canyon and other developed portions of the park. Specific condition assessments of soils do not exist for most the park, but observations indicate that natural conditions predominate. Biological soil crusts occur on many soil types in the park, particularly those dominated by sand and those high in gypsum. Some limited impacts from social trailing have been observed, but not quantified.

Geohazards	Facilities in rock fall hazard zones, floodplains and seismic hazard zones		ZION is an area of substantial geological hazards and this will always be a significant concern for the park. Geological hazard issues have been documented (Lund et al. 2010) and include: floods and debris flows, rock-fall, landslide, earthquake (shaking, surface rupture, and liquefaction), expansive soils, collapsing soils, and gypsiferous soils. At least some of these hazards affect all roads in the park and most structures. Facilities have been damaged by rock fall, floods, debris flows, and collapsing soils. An energy absorbing rock fall barrier was constructed in 2011 to provide protection to a portion of the historic maintenance buildings. Additional structures remain in rock fall hazard zones, though at a lesser degree of risk. When park structures are upgraded or replaced they generally remain in the same location, and are subject to the same geological hazards.
Condition	Area of surface disturbance Area of high fire intensity in past 5 years Abandoned Mine Lands in need of remediation		Natural processes dominate in the park, including an exceptionally high rate of erosion documented at 1,300 feet per million years. With the exception of levees along 2 miles of the North Fork, and short segments of bank armoring along major roads, floodplain function is natural in the park. No AML sites are in need of remediation.

Paleontological Resources

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Inventory	Percent of known fossil bearing Geologic Units adequately surveyed		Less than 25% of the park has been surveyed for paleontological resources, predominantly in Zion Canyon, Parunuweap Canyon, Kolob Canyons, and Coalpits Wash. This represents a substantial portion of the fossil-rich Triassic and early Jurassic strata. The rate of surface erosion is so high in ZION that an inventory can never be considered complete because new fossil resources are continually being revealed and lost to weathering processes.
Documentation	Percent of known sites with adequate documentation		The ZION paleontological database currently includes 162 sites with adequate documentation on 95% of the sites. Documentation includes entry in the Utah Geological Survey paleontological database. Tweet and others (2012) provided a detailed review of ZION paleontological resources.

Condition	Percentage of Paleontological Localities Documented in Good Condition using the NPS Paleontological Condition Assessment Form		A paleontological inventory report (Markle 2008) identified 20 of the most vulnerable paleontological sites in the park. When these were revisited four years later by Tarailo (2012), he found 3 of the sites in good condition, 15 in marginal condition, and 2 of the sites had been lost to natural erosion. None of the sites appeared to be impacted by human activities, but this rate of loss due to natural erosion in such a short period is a serious concern. It is expected that most of the other paleontological sites in the inventory are in more stable condition, and this is supported by informal observation. To date, all paleontological inventory and monitoring in the park has been conducted by paleontological interns or opportunistic partnerships with state paleontologists. A more consistent and professional approach is needed.

North Fork Virgin River – Main Canyon

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For most visitors the North Fork of the Virgin River in Zion Canyon represents the heart of the park. With its transportation system of roads and trails, and visitor services including lodging, visitor center, museum, and gateway communities, this part of the park attracts the vast majority of visitors. They come to see the high multi-colored cliffs and rock formations, and to enjoy the cool waters of the river. The North Fork has its headwaters several miles north of the park at the 10,000 foot cap of the Markagunt Plateau, but most of the water in the stream arises from the many springs that discharge in the park where river has cut into the Navajo Sandstone. Water from melting snows on the high plateaus percolates into the rock where it is stored in the porous sandstone, later to discharge into the river at perennial springs that support the year-round flow of the river.

Floods are a common occurrence due to the steep slopes of the watershed, and the abundance of slickrock surfaces where water absorption during heavy rains is poor. The surging waters are a direct threat to the lives of hikers in the Zion Narrows and other tributary slot canyons. They also are problematic for the many facilities on the canyon floor. In recognition of this the early park management undertook to channelize the North Fork from the Grotto to the Zion Lodge to protect facilities. These levees constructed in the 1930s were effective in protecting the facilities, but this approach also disconnected the river from its floodplain and prevented recruitment of new cottonwood trees. The levees are currently in disrepair and the park's intention is to remove them and establish flood protection along the scenic drive, and to permit the river more room for natural channel migration and floodplain function. Funding for this project has not been identified to date.

Park legislation identifies the river as one of the primary resources of the park. Recognizing this, the National Park Service has asserted federal reserved water rights for all waters in the park. A Water Rights Settlement Agreement was signed in 1996 with the state of Utah recognizing these rights, but the park also agreed to recognize junior non-federal rights that already existed on the watershed, and to limited new rights amounting to a total of about 6.2% of the annual flow of the North Fork.

A stream gage on the North Fork provides a record of stream flow dating back to 1924, which permits an analysis of long-term changes in flow patterns. Most of the consumptive use of water on the watershed dates to before 1924 so changes since that time are predominantly due to natural causes and climate change.

Aquatic organisms in the North Fork appear to be predominantly natural in their composition, density and function, primarily because the patterns of stream flow remain little altered. This includes the full complement of four species of native fish. Aquatic insect populations are less diverse than those found in more stable river systems, but this is seen as a natural response to river system dominated to flood disturbances. No aquatic invasive exotic species have been found in the North Fork.

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Geomorphology	Miles of river channel not altered by channelization or structures Sediment supply and transport as supported by a natural flood regime		Approximately 2 miles of the North Fork is channelized with armored levees extending from the Grotto to the Zion Lodge and dating from the 1930s. These levees are slowly deteriorating, leading to a static trend, and have been slated for removal in the ZION General Management Plan (2001). Funds have not been obtained to accomplish this project and the river will eventually damage the historic road and Zion Lodge. A major impact is that cottonwood tree recruitment has ceased in this reach. Sediment transport is considered substantially natural because the flood regime and sediment supply are little altered, and this condition is protected by the ZION Water Rights Settlement Agreement.
Water Quantity	Portion of flows with protected water rights Number of tributaries protected against future construction of large reservoirs Number of water withdrawal points, and the magnitude of those withdrawals		The total flow of rivers in ZION are protected under the Zion National Park Water Rights Settlement Agreement (1996), with the exception of quantified depletions of water specified in the agreement amounting to 6.2% of the total annual flow for the North Fork. This agreement also prohibits the construction of new large reservoirs upstream of the park. As a result, the flows of the river are substantially natural and protected from human impacts with the significant exception of climate change (Sharrow 2013). Withdrawal of water in lower Zion Canyon by downstream communities and the park affects 1.5 miles of stream in the park with flow reductions of 6.16 cfs during the irrigation season, or 10% to 20% of the flow during summer low flow conditions.
	Stream flow characteristics over time		When examining flow parameters over the 88 years of record on the North Fork, two approached significance at the 95% level; 7-day low flow showed a decreasing trend by 6 cfs, and the centroid of spring runoff was earlier by 11 days. The latter of these follows a pattern found in rivers throughout the western U.S. (Stewart and others 2004). It is notable that a large majority of water diversions from the river began before the stream was gaged in 1924 and they have remained relatively constant, so the patterns observed, in particular the earlier arrival of spring runoff, could be attributable to factors such as climate change.

Water Quality	Stream segments meet state water quality standards		The most prominent water quality issue is *E. coli*. on the North Fork of the Virgin River. The reach in the Zion Narrows upstream of Deep Creek has been placed on the 303d list of noncompliant waters since 2009, and the reach from Deep Creek to the Temple of Sinawava is in the process of being added. Extensive monitoring (Sharrow 2012a, Sharrow 2012b, Hackbarth and Weissinger 2013, Van Grinsven et al. 2010) has demonstrated the source of the fecal bacteria to be return flows from excessive flood irrigation on livestock pastures upstream of the park. The park is working with the State of Utah, private landowners, BLM, and the Utah Association of Conservation Districts to find a resolution to the problem. Construction of an improved irrigation system is being considered.
Biodiversity	Occurrence/Abundance /Species Richness of: Presence of aquatic invasive species Periphyton and aquatic macroinvertebrates Native and non-native fish population monitoring		While the information base on aquatic biodiversity for the North Fork in Zion Canyon is insufficient to identify a trend, the expectation is that because the hydrologic regime is substantially natural, and problematic aquatic invasive species have not been identified, the condition should be good and the trend static. The condition is rated as yellow due to the large numbers of visitors and developments in Zion Canyon and the large amount of in-stream visitor activity in the Zion Narrows. Studies of aquatic macroinvertebrates in the Zion Narrows found a species assemblage that would be considered depauperate in other settings, but are consistent with a habitat subject to frequent large floods and a mobile substrate. There was concern for the impacts of the many hikers in the narrows, and a significant level of impact was documented in the highest use areas, but these impacts were much smaller than the impact of natural flood events (Caries 2007, and Shakarjan and Stanford 1998). An inventory of aquatic macroinvertebrates is lacking on the North Fork in Zion Canyon outside of the narrows, as is any systematic inventory of aquatic invasive plants and invertebrates. The full complement of four native fish species is present in all park waters where they would be expected, and populations appear to be robust. Though a few exotic trout species have been introduced, they continue to be found in only low numbers and do not appear to be a significant detriment to the native fish.

Other Rivers and Tributaries

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Water shapes the landscape of ZION. The park's many free-flowing rivers carry powerful flash floods and tremendous sediment loads, which act together as the primary agents of erosion. These rivers continue to carve into the edge of the Colorado Plateau, shaping the dramatic scenery. By virtue of rivers cutting through the water-bearing Navajo sandstone, numerous canyon springs, fed by groundwater, create hanging gardens and seeping alcoves that form moist oases in a desert environment and sustain perennial river flows.

The major streams have their headwaters on the high plateaus north and east of the park where winter snows accumulate. Most of the stream flow in the park arises from the many springs that discharge where rivers have cut deeply into the Navajo Sandstone. Water from melting snows on the high plateaus percolates into the rock where it is stored as it moves through the porous sandstone, later to discharge into the river at perennial springs that support the year-round flow of the river.

Floods are a common occurrence due to the steep slopes of the watershed, and the abundance of slickrock surfaces where water runoff is large and rapid during heavy rains. The surging waters are a direct threat to the lives of hikers in slot canyons. Two park rivers have some alteration in their watersheds. The East Fork is lined by irrigated lands in the communities of Orderville and Glendale upstream of the park, but these have little influence on stream flow in the park because source water arises almost entirely as spring discharge downstream of those communities. Flow patterns in Kolob Creek are altered by Kolob Reservoir, the only large reservoir upstream of the park, because it captures spring floods, and releases that water during the summer and fall when natural flows would be much lower.

In order to protect the waters of Zion National Park a Water Rights Settlement Agreement was signed in 1996 with the state of Utah recognizing the federal reserved and state appropriative water rights held by the park. To reach this accord the park also agreed to recognize junior non-federal rights that already existed on the watershed, and to limited new rights amounting to a total of about 6.2% of the annual flow of the North Fork and 3.9% of the East Fork.

A stream gage on the Virgin River at the Town of Virgin provides a record of stream flow dating back to 1910, which permits an analysis of long-term changes in flow patterns. Most of the consumptive use of water on the watershed dates to before 1910 so changes since that time are predominantly due to natural causes and climate change. The stream gage on the East Fork began making measurements in 1994, too recent to permit long term trend analysis. Occasional measurements have been made on North Creek and La Verkin Creek; these also provide a record too limited for trend analysis.

Aquatic organisms in the rivers of ZION appear to be predominantly natural in their composition, density and function, primarily because the patterns of stream flow remain essentially natural. This includes the full complement of four species of native fish. Aquatic insect populations are less diverse that those found in more stable river systems, but this is seen as a natural response to river system dominated to flood disturbances. No aquatic invasive exotic species have been found in the rivers of ZION.

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Geomorphology	Miles of river channel not altered by channelization or structures Sediment supply and transport as supported by a natural flood regime		All of the 76.1 miles of perennial streams in the park outside of Zion Canyon are relatively free flowing. Within the watersheds feeding into the park, only one tributary (Kolob Creek) is substantially influenced by reservoir storage so that the flood regime and sediment transport in the park is substantially natural. Andrews (2000) estimates the annual sediment transport of the East Fork at 600,000 to 800,000 tons/year. The fact that this condition exists, and that new reservoirs upstream of the park are prohibited by the terms of the water rights settlement agreement, results in a good condition, steady trend, and high confidence rating.

Water Quantity	Portion of flows with protected water rights Number of tributaries lacking large reservoirs and protected against future construction of them Magnitude of water withdrawals		The total flow of rivers in ZION is protected under the Zion National Park Water Rights Settlement Agreement (1996), with the exception of quantified depletions of water specified in the agreement amounting to 3.9% of the total annual flow for the North Fork. This agreement also prohibits the construction of new large reservoirs upstream of the park so that only one tributary (Kolob Creek) draining about 30 square miles is influenced by reservoir storage, or 4% of the total area draining to the park of about 750 square miles. As a result, the flows of the river are substantially natural and protected from human impacts with the significant exception of climate change (Sharrow 2013).
	Flow characteristics over time		Flow patterns for the basin are provided by the Virgin River Gage at Virgin, Utah with 103 years of record. However, using the whole record includes a portion of the period 1900 to 1923, which was an exceptionally wet period on a multi-century scale. Beginning the analysis 1924 shows a small but significant increase in the 7-day low flow, possibly attributable to the construction of Kolob Reservoir in 1953. The stream gage on the North Fork in Zion Canyon showed that the centroid of spring runoff arrived earlier in the year by 12 days, but this pattern fell short of significance at the 95% level. Trends on the North Fork for 7-day low flow, 3-day spring high flow, and annual discharge were not found to be significant (Weissinger 2015). Earlier snowmelt has been found in rivers throughout the western U.S. (Stewart et al. 2004). Note that a majority of water diversions from the river began before the stream was gaged, so the patterns observed in the flow record could be attributable to natural factors and climate change.
Water Quality	Segments meet state water quality standards		Routine monitoring began in 2006 and there are several grab samples from many locations prior to that. With the exception noted below, water quality in ZION meets state standards and is presumed to be largely natural. North Creek has exhibited a persistent problem with high pH that became apparent after a fire in 2006. Blooms of filamentous algae that became apparent in the stream contributed to the higher pH levels. Fish were also extirpated from this reach of the river. By 2011, the fish had returned and the algae blooms subsided, but summer pH levels in excess of 9.0 have persisted. Water in the East Fork Virgin River and La Verkin Creek has exhibited no exceedances of water quality standards.

Biodiversity	Occurrence/Abundance /Species Richness of: Aquatic invasive species Periphyton and macroinvertebrates Native and non-native fish		While the information base on aquatic biodiversity for ZION is insufficient to identify a trend, the expectation is that because the hydrologic regime is substantially natural and problematic aquatic invasive species have not been identified, the condition should be good and the trend static. Inventories of benthic macroinvertebrates on rivers throughout ZION found no invasive invertebrate species. The evaluated streams were in good biological condition except that the species assemblage in the East Fork showed some influence of upstream agricultural practices (Judson and Miller 2012). The full complement of four native fish species is present in all park waters where they would be expected, and populations appear to be robust.

Wild and Scenic River

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Free-flowing Condition	Miles in free-flowing condition		The majority of the 33 WSR segments (144 miles) are natural and free-flowing. They have no developments, such as reservoirs, which would impede free-flowing condition. The exception to this are the North Fork Virgin River in Zion Canyon (9 miles where levees, bridges and bank armoring have restricted stream function), and Kolob Creek where a large reservoir has altered the flow. Since designation in 2009, no new bridges or bank stabilization actions have occurred that would affect the free-flowing quality of the river.
Water Quality	Concentration of *E. coli:* Primary Contact Recreation Class 2A: 30 day geometric mean of a minimum of five samples not to exceed 126 MPN/100mL Secondary Contact Recreation Class 2B: 30 day geometric mean of a minimum of five samples not to exceed 206 MPN/100mL		Of 44 miles designated for Primary Contact: 40.5 miles meet the measure / standard (3.5 miles of the North Fork Virgin River above Deep Creek does not meet the standard). Of 100 miles designated for Secondary Contact: 97 miles meet the measure / standard (3 miles of portions of Hop Valley Creek likely do not meet the standard, though documentation is lacking).
Outstandingly Remarkable Values	ORVs are protected and enhanced: recreational, scenic, cultural, geologic, ecological process, wildlife, and fish		The majority of the river segments (115 miles) are within Zion Wilderness. All projects proposed within WSR boundaries are assessed for impacts to ORVS through the NEPA compliance process. If potential impacts are identified, mitigation to lessen those impacts is identified.

Plant Communities

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Species Richness	Species richness Percentage of flora that is non-native species		A total of 1,074 plant taxa representing 98 families have been documented in ZION. Of those, 46 and 92 species are local and regional endemics, respectively. Only one species, Shivwits milkvetch (*Astragalus ampullarioides*), is listed as threatened or endangered. One hundred sixty-two (15.1 percent) are non-native species, ten of which are considered noxious by the state of Utah.
Invasive Plants	Number of non-native plants Percentage of flora that is non-native species		As of 2012, there were 162 known non-native plant species in ZION, making up 15% of the flora of ZION. This is slightly higher than the state average of 13.5%. Between 2008 and 2012 alone, 22 new non-native plants were identified in the park (Fertig and Alexander 2009, Fertig et al. 2012). The park is unable to treat all species and instead must prioritize. For those species that have been a high priority, the park in many cases has been able to successfully manage, but many species remain uncontrolled. Cheatgrass, nearly ubiquitous in the park, is of special concern because of its fire potential.
Ponderosa Pine	Fire condition Class Tree density		Generally low intensity fires occur in Ponderosa pine forest around every 2–3 years up to 20 years depending on elevation and environmental conditions (Brown et al. 2014). Over 25,000 acres of the park are Ponderosa pine and 90% of those acres have a fire frequency that is significantly altered from historic range (Zion Fire Condition Classes 2004). Ponderosa pine forests are fire adapted and alterations in the fire frequency can change the composition and structure of the forest and is therefore of concern. In addition to fire, heavy grazing may be a cause of conversion from ponderosa pine savanna into closed forest as indicated by a study of Horse Pasture Plateau (Madany and West 1983). Reynolds et al. (2013) defined desired composition to include 11–124 trees per acre and basal area of 22–90 ft^2 per acre for Southwestern ponderosa pine based on analysis of early forest inventory. Staff observations indicate that following fire, such as the Clear Trap fire, some ponderosa pine forests are being converted to Gambel Oak. If the ZION vegetation map were to be updated, these type conversions may be quantified in the future.
Pinyon-Juniper	Invasive plants occurrence and percent cover Percent tree cover Seedling density Percent dead trees		NCPN uplands monitoring of PJ community from 2011–2013 shows an average tree cover of 22.3% with 6.5% cover of exotics. Seedling densities were 135 juniper and 317 pinyon pine seedlings/ha. Of the plots sampled 12.7% had >20% dead trees; these plots are located primarily in the area burned by the Kolob Fire. The PJ burned by the Kolob Fire is struggling to recover with low seedling recruitment and high exotic plant cover (>5%). The abundance of annual exotic grasses may hinder the recovery after fire and shorten the fire return interval, which together has the potential to greatly alter the condition and prevalence of this plant community.

Gambel Oak/ Mountain Shrub	Invasive plants occurrence and percent cover Percent cover of vegetation		NCPN uplands monitoring of Gambel oak community from 2011–2013 recorded the following percent cover on average: 53.6% native shrubs, 7.4% native perennial grass, 11.7% native perennial forbs, and 8.4% exotics. Half of the plots had >5% cover of exotics. In the burned, lower elevation Gambel oak plots, the dominant exotic grass was cheatgrass while in the higher elevation plots (unburned) Kentucky bluegrass was dominant. The presence of exotic annual grasses in Gambel oak communities is of concern as the potential effects are unknown. Anecdotal evidence suggests that as a result of fire Gambel oak may be expanding and is supported by observations of the prevalence of Gambel oak following the Clear trap fire.
Riparian Zone	Invasive plants occurrence and percent cover Percent cover of vegetation Tree density		Stretches of riparian habitat along the Virgin River through the main canyon and Hop Valley Creek are not in the desired condition due to alteration and disturbances. Fremont cottonwood recruitment along the Virgin River in the main canyon is not sufficient to sustain the population and there will be a loss of the cottonwood canopy over time (Steen-Adams 2002). Riparian vegetation along a reach of Hop Valley Creek is regularly disturbed by cattle grazing on inholdings and adjacent park lands. Exotic vegetation is present in the riparian zone but many of the invasive species, such as tamarisk and Russian olive, are being actively managed. The riparian habitat along the East Fork of the Virgin River appears to be in good condition. NCPN monitoring showed 34% total cover of vegetation with 3.5% exotic cover. Cottonwood densities were 1,411 seedlings/ha, 104 saplings/ha, and 110 overstory trees/ha. Other riparian zones have not been monitored but are assumed to be in similarly good condition if not regularly disturbed.
Hanging Gardens	Species richness Invasive plant occurrence		Welsh (1989) surveyed 9 hanging gardens and wrote site descriptions for another 17 hanging gardens. Species richness ranged from 3–26. The vital link between these habitats and water make them vulnerable to changes in water discharge. It is estimated that one plant species would be lost with a 10% reduction in water discharge. Many of the hanging gardens are in locations frequented by visitors and as such are susceptible to disturbance (e.g. trampling, collection). Hanging gardens have not been specifically surveyed for exotic vegetation but staff observations indicate that some exotics may be encroaching on the floor of the gardens but not on the walls.

Wildlife Communities

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Amphibians and Reptiles	Species richness		According to NPSpecies, 29 species of reptiles are present in ZION, consisting of 16 lizards, 12 snakes, and one turtle. All of these species are native to the park with the exception of Agassiz's Desert Tortoise, a federally threatened species whose native status remains unknown. Six native species of amphibians have been confirmed as present in ZION, leaving only one potential native species unconfirmed (Woodhouse's Toad).
Birds	Species richness		NPSpecies lists a total of 257 native bird species as present or probably present in ZION, with an additional 37 native species yet to be confirmed. Only three non-native bird species have been confirmed in the park.
Mammals	Species richness		As reported in NPSpecies, 67 native species of mammals are confirmed present in ZION, three more are probably present, and eight are unconfirmed.
Fish	Species presence/absence Number of adult fish		NPSpecies lists 9 species of fish in ZION, four native and five non-native species. The native species represent the full complement of species historically native to the park and all appear to be present in good numbers and reproducing. Non-native fish are represented primarily by a low number of salmonids that are a relic of past stocking upstream, and are not well suited to the warmer waters of the park. Native fish have been monitored since 1994, but numbers are quite variable so no trend can be reported. Mercury levels were recently found to be very high in Speckled Dace, a small omnivorous native fish (Eagle-Smith 2014). This raises concern because the fish is consumed by birds and warrants further study.

Special Status Species

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
California Condor	Number of resident birds Successful fledging		The southwest population of California Condors is currently stable due to existing management practices; however, in the absence of this management, the population would likely decline. There are currently 74 free-flying condors in the southwest population. This number has ranged from 72 to 80 over the past five years. All of these birds spend some time in ZION. There were three nesting pairs in the population in 2014 and one nest was located within the park. Unfortunately, the ZION chick was the only one of the three that didn't successfully fledge. Fourteen chicks have been produced in this population over the past five years, with only seven of those surviving today. Lead poisoning is the most significant challenge to the recovery of this species. The Peregrine Fund attempts to capture each individual annually for lead testing and then treats birds with high lead levels through chelation. Both Arizona and Utah have voluntary non-lead ammunition programs that provide education and non-lead ammunition to hunters drawing tags for areas within the condor's range. Results from 2013 lead testing showed the positive influence of these programs, as the number of birds with toxic lead levels was at a nine-year low.
Agassiz's Desert Tortoise	Number of breeding adults Evidence of reproductive success		ZION is home to a small population of federally threatened Agassiz's Desert Tortoises. The park monitors this population using radio telemetry. There are currently 33 adult tortoises marked, nine of which have radio transmitters. New tortoises are continually located; this includes juveniles and hatchlings that are not marked nor included in the total count. Desert Tortoises face many threats throughout their range; habitat loss due to development outside the park is the most significant threat to this population.
Mexican Spotted Owl	Occupied PACs Productivity		The slot canyons of ZION provide breeding habitat for a high density of federally threatened Mexican Spotted Owls. Surveys are conducted annually within established Protected Activity Centers (PACs) to determine occupancy and productivity. Over the past five years, average occupancy of monitored PACs was 81.6% and average productivity was 1.73 young per breeding pair. The primary threat to this species in ZION is the increasing popularity of canyoneering. Although impacts have not been documented, the influx of visitors into these fragile canyon ecosystems could lead to habitat degradation and prey reduction.

American Peregrine Falcon	Occupied territories Productivity		Peregrine Falcon surveys are completed annually for nine territories in ZION. There are many additional known territories in the park but the park currently monitors only those territories identified for monitoring in accordance with the U.S. Fish and Wildlife Service (USFWS) Monitoring Plan and those where rock climbing closures have been established to protect peregrines during their breeding season. Over the past five years, average occupancy for monitored territories was 96.4% and average productivity was 1.93 young per breeding pair, which exceeds the goal of 1.25 young/pair proposed in the USFWS Recovery Plan. Nest failures have occurred occasionally over 30 years of monitoring but have not been documented in the last seven years.
Desert Bighorn Sheep	Population trend Lambing rates Detection of pathogens		Desert Bighorn Sheep were likely extirpated from ZION by the 1950s, but were reintroduced through a cooperative effort in the 1970s. The bighorn sheep found in ZION are part of a larger herd that also uses BLM land southeast of the park. The Utah Division of Wildlife Resources (UDWR) conducted aerial surveys in 2009 and 2013 yielding population estimates of 617 and 840 respectively. The current density and dispersal of bighorn sheep cause great concern for the health of the herd due to increased risk of exposure to pathogens carried by domestic sheep and goats. UDWR is actively working to reduce bighorn sheep density on BLM land. Disease testing has been completed on all translocated bighorn as well as one ram within ZION that was exhibiting symptoms of respiratory distress. Testing has revealed no pathogens of concern. Lamb recruitment and health are monitored regularly within the park through observation.
Bats	Species richness		A 2013 project to establish baseline bat data for ZION documented 18 species in the park through mist-netting and passive acoustic monitoring; six of these are sensitive species in Utah. The Little Brown Myotis and Greater Mastiff Bat were previously unconfirmed in the park and the Greater Mastiff Bat is not known to occur in Utah. Acoustic data showed bat calls of similar frequency and duration to Greater Mastiff Bats but capture is necessary to confirm this species. Acoustic monitoring yielded comparable results in 2014 and will continue on an annual basis. ZION is also recognized as home to Utah's only known nursery colony of Big Free-tailed Bats.
Shivwits Milkvetch	Number of mature plants		The majority of these federally endangered plants are found in two locations that are in very close proximity to each other. Monitoring of these populations started in 2006 and has been conducted nearly every year since. Population count of 6,625 mature plants in 2014 is a threefold increase from 2006 counts. Although the population is doing well, it is vulnerable with the majority of plants localized to one area. The non-native plant *Molucella laevis* is found amongst the Shivwits milkvetch and is becoming fairly abundant in areas. It is uncertain if this plant is impacting Shivwits milkvetch. With the help of modeling to identify potential habitat, additional small satellite populations have been found.

Human-Wildlife Interactions	Number of negative human/wildlife interactions Number of species involved (deer, squirrels, ringtail, etc.)		Three wildlife species (rock squirrels, mule deer, and ringtails) have become habituated to human activity in Zion Canyon, which has resulted in negative interactions with visitors and employees. These interactions are concentrated in high visitor use areas where animals have lost their natural fear of humans. Several squirrel bites have occurred along the Riverside Walk trail, where these animals are regularly fed by visitors and have become aggressive and dependent upon human food. Food begging and aggressive behavior toward humans have been observed in deer at the campgrounds, visitor center, and lodge. Ringtails gain access to structures where they cause damage to facilities and present a health hazard to visitors and employees from their droppings and ectoparisites. These issues may worsen as visitation increases.
Virgin Spinedace	Density of adults Reproductive success		Virgin Spinedace are found in the mid-elevation streams of the Virgin River System. They were placed under a Conservation Agreement in 1995 when they were found to have lost 40% of their stream habitat. They are present in perennial streams in ZION with a flow greater than 0.5 cfs. The North and East Forks have provided some of the most productive habitat for this species. They have been monitored annually since 1994 at two locations.
Flannelmouth Sucker	Density of adults Reproductive success		Flannelmouth suckers are distributed widely in the Colorado River system, but have been eliminated from many parts of their habitat and are managed under a Conservation Agreement. They are found in large numbers in the North and East Forks of the Virgin River, and these streams are important for spawning and rearing of these fish.

Ecosystem Processes and Land Status

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Fire Return Interval	Fire disturbance events are within natural range		ZION is home to multiple fire dependent species and ecosystems and fire is the most significant agent of change in this landscape. Four of ZION's plant communities—ponderosa pine forest, piñon-juniper woodland, big sagebrush shrubland, and Gambel oak—are still well outside the Historic Range of Variability (HRV) of the fire return interval. The condition is deteriorating due to the encroachment of invasive, exotic species, and proliferation of undesirable native species. These changes most likely will have correspondingly strong effects on behavior of future wildfires relative to historical conditions (Brown, Falk and Swetnam 2014). A Fire Regime Condition Class map completed in 2004 classified about 30% of the park in a significantly altered state from the historic range of fire return intervals. Currently only about 30% of ZION is classified as within the historic range. The National Park Service is charged through policy to allow fire to maintain its integral role in these ecosystems. At present there is a rapidly deteriorating ability to respond to undesirable ecosystem changes and manage natural fire return interval safely and appropriately. Lack of adequate staffing is the single most limiting factor in the ability to maintain natural and desirable fire return intervals.
Conversion of Native Plant Communities	Percentage of ecosystem type converted post wildfire due to exotic species proliferation Presence of exotic species and potential for proliferation and resultant wildfire conversion due to spread of exotics		Plant communities within Zion National Park are susceptible to type conversion from one ecotype to another due to influencing disturbance factors like fire, fire exclusion, historic timber harvesting, historic livestock grazing, introduction and establishment of non-native plant species, introduced insects and disease, or other management activities. The biggest threat to ecosystem conversion is exotic species proliferation. The species of most concern is "cheatgrass" (*Bromus tectorum*), a highly invasive, fire adapted exotic annual grass. In 2006 the Kolob Fire, fueled by cheatgrass, burned over 17,000 acres in and around the southwestern corner of Zion National Park. The Kolob Fire converted 24% of Zion's Pinyon Juniper Woodland to annual exotic grassland (10,516 acres). Through aggressive monitoring of the burn scar it is determined that 7% of Zion National Park will likely not return to prior conditions in the near future. Cheatgrass has become established throughout Zion National Park and is spreading in ZION at nearly all elevations and in all habitats. This proliferating exotic species threatens to alter the historic fire regimes significantly and type convert remaining desert and pinyon juniper communities to annual grasslands.

Private Inholdings	Acres of inholdings compatible with park purposes Rate of inholding acquisition (ac/yr)		Approximately 58% of inholdings (2,000 of 3,421 acres) are compatible with park purposes. Most of these private parcels are surrounded by or abut wilderness and have similar wilderness character due to the absence of grazing, roads, and structures. Trespass cattle from the Hop Valley inholding may adversely affect water quality and riparian vegetation. A large new residence was constructed on one inholding in the last 3 years; the concern for the park is there are no restrictions on potential development on others. Private Inholdings have 21 water rights associated with them, 14 of which include some element (a point of diversion or place of use) that is on park lands. Some of these uses are not legal on park lands or are of questionable authority. Of more than 3,400 acres of inholdings, only 40 acres have been acquired in the last ten years. Limited funding and opportunity are issues in acquiring inholdings.
Boundary Development Affecting Park Resources	Boundary housing density changes per decade		One of the larger areas of concern for development along/near ZNP boundary would be development in Springdale near the south entrance of the park. Continued development of commercial property near here could impact park resources along the Virgin River. Also, increased development in the Anasazi Plateau housing area might impact staff and hiker access to the Chinle Trail. The park view shed might also be affected by increased development in Springdale as larger buildings and more infrastructures could impinge upon the natural views. Increased development along the Kolob Terrace Road as well as near Kolob Reservoir might have an impact on how users are accessing the park and the impact visitors will have on the resources, due to more uncontrolled access. Additional houses, roads, and other developments will have an impact on how users experience the park, as well as impacting viewsheds. Development on the east side boundary of the park could impact groundwater and water quality. On the North Fork watershed there are an average of 10 water right changes each year moving from irrigation and livestock uses to use for single and multiple dwellings. Increased grazing along the park boundary is not currently an issue, but if it does increase it could have a detrimental impact on park resources. Cattle escaping into the park from the Sunset Ranch on the Kolob Terrace Road has been an issue.

Dark Night Sky

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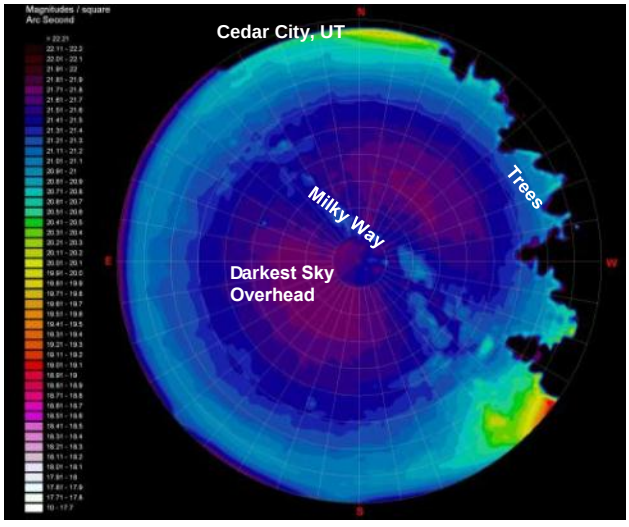
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Anthropogenic Light	Light pollution from area towns (domes, skyglow) visible from within ZION (size, brightness) Anthropogenic Light Ratio (ALR) — Average Anthropogenic Sky Glow: Average Natural Sky Luminance		The NPS Natural Sounds and Night Skies Division uses the Anthropogenic (or human-caused) Light Ratio (ALR, see brief below) as one measure of light pollution. The ALR is calculated as the ratio of the median sky brightness levels across a park to the average natural night sky luminance. The ALR can be directly measured with ground based measurements, or modeled when these data are unavailable. Models for ZION indicate ALR of 0.24 and an ALR for Wilderness of 0.32 (a measure of 90% of the Wilderness area). ALR values of < 0.33 are considered "good" condition for a night sky. However, this model is based on 2001 data—since then, the towns and counties around ZION have grown significantly, and light pollution domes of increasing size and brightness have been observed from within the park. Although this increase has not yet been quantified, unofficial observations show a deteriorating night sky condition, making this a concern for park managers. Census data shows population increases from 1990–2013: Washington County (including Springdale, Hurricane, and St. George) population increased by 204%; Iron County (including Cedar City) increased by 125%; and Clark County, NV (including the Las Vegas area and Mesquite) increased by 173%.

Resource Brief: Night Sky Resources at Zion National Park

The night sky has been a source of wonder, inspiration, and knowledge to humans for thousands of years. Additionally, naturally occurring cycles of light and dark are integral to ecosystem function (nearly half the animal species on earth are nocturnal). The quality of the nighttime environment is relevant to nearly every unit of the NPS system as the nighttime environment and the perception of it by humans (the lightscape) are both a natural and a cultural resource and are critical aspects of scenery, visitor enjoyment, and wilderness character. The naturally dark night sky at ZION is both essential for wildlife and treasured by park visitors.



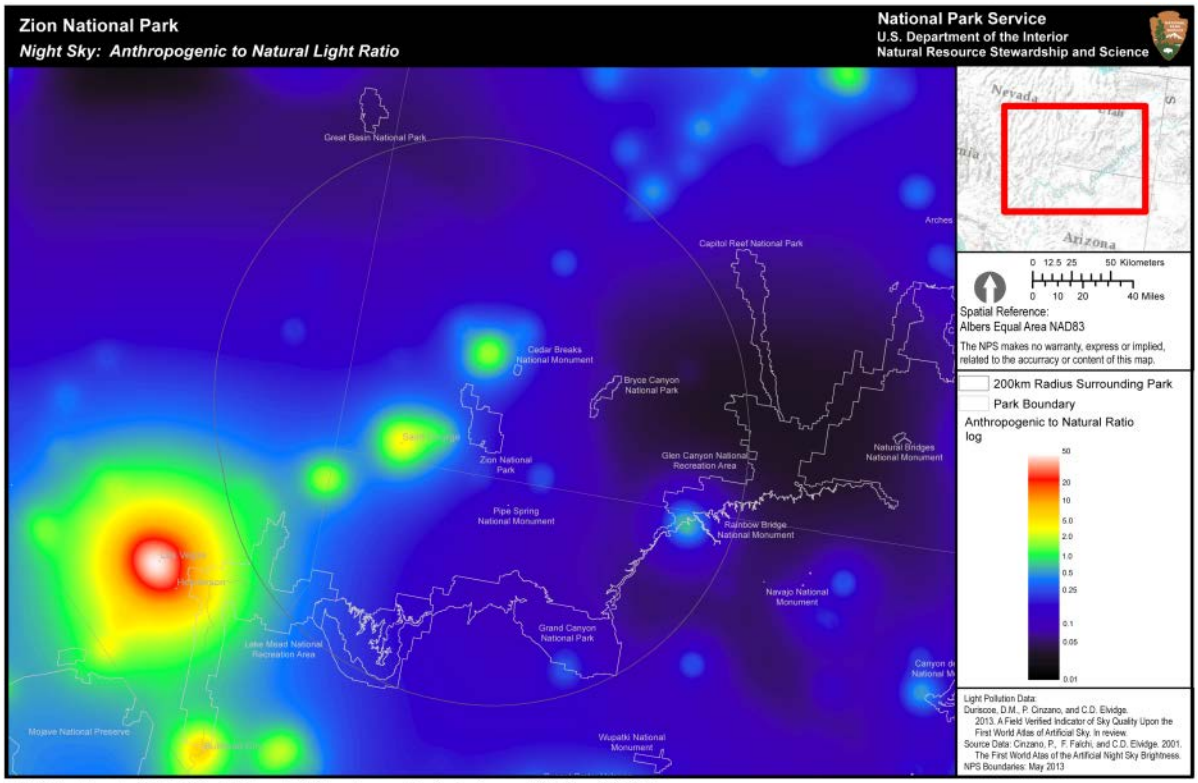
***Left*: Overhead and 360° view of night sky darkness measured from Lava Point, Zion National Park, in the early 2000s. The darkest sky, overhead, shows as magenta, punctuated by stars of the Milky Way, a light blue band. Light pollution from nearby towns are visible as yellow (Cedar City) and orange (St George) glows on the horizon. Forest trees form the irregular black figures.**

Condition

Modeling by the NPS Natural Sounds and Night Skies Division shows that the night sky quality in ZION and within designated Wilderness is in "good" condition, confirming the nighttime views seen from within the park. The map below is based on the 2001 World Atlas of Night Sky Brightness, which depicts zenith sky brightness (the brightness directly above the observer). Artificial (or anthropogenic) light up to 200 kilometers away may degrade a park's night sky quality; this impact is illustrated with a 200 km ring around the park center. Learn more in the document Recommended Indicators of Night Sky Quality, and the NPS Natural Sounds & Night Skies Division website.

Significant population growth in towns and counties surrounding Zion

National Park has occurred over the last three decades, with a corresponding increase in artificial night lighting. Washington County, which includes most of the park, had population growth of 64% between 2000 and 2013, increasing to more than 147,000 residents (up from only ≈ 26,000 residents in 1980). Although ZION still retains a largely natural dark sky with clear views of the Milky Way, unquantified observations from several locations within ZION reveal larger and brighter light domes from surrounding population centers. The gateway town of Springdale, Utah, has recently implemented a lighting ordinance to help protect dark night skies, and ZION is working to make all lighting within the park night-sky friendly.



NPS Natural Sounds & Night Skies Division and NPS Inventory and Monitoring Program MAS Group 20140811

Regional view of anthropogenic light near Zion National Park. The circle around the park represents the distance at which anthropogenic light influences the night sky quality of the park.

Acoustic Environment

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Acoustic Impact Level	Mean acoustic impact level (L_{50} dBA) – a measure of the noise contributed to the acoustic environment by man-made sources		The mean acoustic impact (L_{50} dBA) in ZION, calculated as difference between nationwide models of existing and natural ambient, is 0.7 dBA. This indicates that the acoustic resources are in good condition under non-urban park criteria. The acoustic conditions in national parks are largely driven by transportation activity, and overall, nationwide increases in ground-based (U.S. Federal Highway Administration 2013) and aircraft traffic in recent decades (Federal Aviation Administration 2010) indicate a downward trend in acoustic conditions. However, the specific measures for improving the resource described in Zion NP's Soundscape Management Plan are likely to produce a neutral trend.
Developed Areas of the Park	% of the time human-caused sounds can be heard		Acoustic monitoring took place in the park from 2009 through 2012. Data from that monitoring showed that human-caused noise can be heard 9% of the time at night. The 2010 Soundscape Management Plan (SMP) identified a management goal that human-caused noise would not be heard more than 40% during the night. The acoustic monitoring data showed that human-caused noise could be heard more than 84% of the time during the daytime. The day time management goal identified in the SMP is that human-caused noise should not be heard more than 65% of the day. Automobiles, including shuttle buses are the largest noise contributor.
Wilderness	% time audible human-caused sounds		Human-caused sounds are audible from 7% of the time at night to more than 39% of the time during the day. Aircraft are the largest noise contributor. The day time management goal identified in the SMP is that human-caused noise should not be heard more than 50% of the day nor more than 40% of the night.

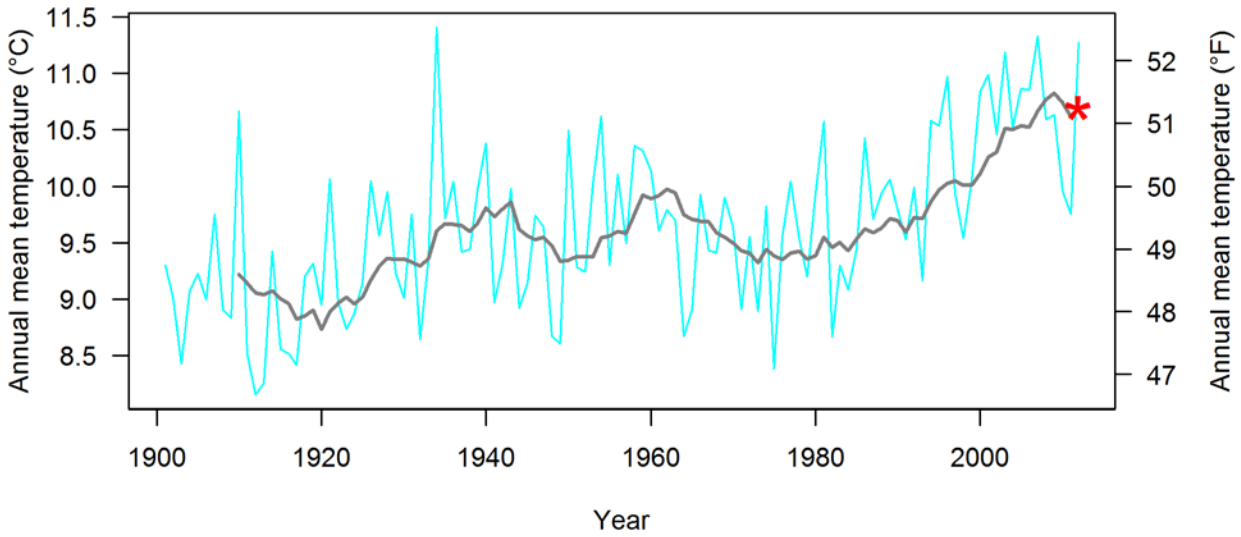
Resource Brief: Recent Climate Change in Zion National Park

Zion National Park is already experiencing a warmer climate than a century ago.

- Maximum temperatures in the warmest months are increasing. On average, the number of days above 100˚ F nearly doubled (26 more days) from 2001–2010 compared to the previous 80 years (Sharrow 2011).
- Minimum temperatures in the coldest months are also increasing. On average, there are 8 fewer days below freezing than 80 years ago (Sharrow 2011).
- In the last decade (2001–2010), record high temperatures have been set on 25 to 30 days each year, while record lows have occurred on only 5 to 10 days each year.
- Spring runoff occurs approximately 10 days earlier than it did 90 years ago (Weissinger and Sharrow, *in prep*).
- Many temperature variables are now regularly above their historic range of variability including annual average temperature (see figure below), average temperatures in the warmest and coolest seasons, maximum temperatures in the warmest month, and minimum temperatures in the coldest month (Monahan and Fisichelli 2014).

What do higher temperatures mean for Zion National Park? Some well-documented examples include:

- Higher temperatures increase water stress on plants that already live in an arid climate. In 1999–2002, the worst recorded drought in over 1,000 years caused a widespread die-off of pinyon pine throughout the Southwest, including several at Zion National Park.
- Animals intolerant of higher temperatures, like the American pika, are likely to disappear from the highest elevations of the park. This mammal has not been sighted in seven years of recent surveys (2009–2015; photo below).



***Above*: The average annual temperature (blue line) at Zion National Park has increased over the past century. The gray line shows temperature averaged over 10-year intervals, and the red asterisk shows the average temperature of the most recent 10-year interval (2003–2012).**

***Left*: The American pika's habitat is restricted to high elevation talus slopes that provide cool refuges to escape the summer heat. This species, while historically resident in the highest elevations of the park, has not been seen in the last 7 years of survey. There is no cooler, higher habitat for pika to occupy in the park if the current elevation habitat has become too warm.**

2.2. Cultural Resources

Archeological Resources

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research is conducted to understand the relationship of the park's archeological resources to the historic contexts for the park.		Approximately 16 sites (3%) have more exact dates derived from excavation data and artifact analyses. Overall, an understanding of exact dates for sites is a highly limited measure of knowledge or understanding. More important would be a focus on research to understand the relationships of past human behaviors, material culture, settlement and subsistence practices, as well as many other subjects. Funding for these research studies is difficult to acquire.
	Percentage of sites with known date ranges associated with a research theme.		As part of the standard archeological site recording process, 100% of the sites are assigned a broad cultural affiliation and/or chronological period. Determining exact dates from basic recordation data is possible but problematic due to lack of diagnostic artifacts, detailed artifact analyses, and/or chronometric dating sample analyses.
Inventory	Percentage of park intensively surveyed.		Approximately 18–19% of the total park acreage has been adequately surveyed. Considering the extreme topography, not all of the park is surveyable. No modeling has been conducted to determine what needs to be surveyed. Funding for inventory is irregular. A nominal amount of survey is conducted each year by park staff and volunteers as available.
Documentation	Percentage of known sites with adequate National Register documentation.		Based on ASMIS, 409 of 535 (76%) sites are Listed, Determined Eligible or Recommended Eligible for the National Register of Historic Places. All recorded sites are documented in the appropriate databases, but not without data errors, which compromises data quality and reliability. Data editing and maintenance is a constant task. Currently, all sites have complete ASMIS records, IMACS site forms (Inter-Mountain Antiquities Computer System – state of Utah site form), site locations in park GIS data layers, and site records entered in the ZION digital archeology database.
Certified Condition	Percentage of archeological resources certified as complete, accurate, and reliable in the Archeological Sites Management Information System (ASMIS) in good condition.		Condition assessments for all sites are current, as of FY 2011. 77 percent (410 of 535) of sites listed in ASMIS are in good condition, while101 sites are in fair condition, 8 are in poor, and 16 are either destroyed or in unknown condition. The number of sites in less than good condition indicates that more preservation work is needed. Natural and human impacts to sites are constant and on-going. Consistent monitoring of archeological sites is a problem due to lack of staffing/funding. Providing reliable data trends of impacts is also problematic.

Cultural Anthropology

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research is conducted to understand the relationship of the park's ethnographic resources to the historic context(s) for the park.		A narrowly focused ethnographic study was completed in the mid-1990s. Recent, but limited oral histories highlight the need to continue to prioritize acquiring this category of information. Overall, Native American ethnographic relationships with the resources are poorly documented. Lack of baseline documentation warrants concern given the inability to assess condition and/or adequate protection of unknown or undocumented resource(s). An ethnographic overview and assessment study is suggested to document baseline cultural anthropology data for the full spectrum of park resources and traditionally associated tribes and communities.
Inventory	Appropriate studies and consultations document resources and uses, traditionally associated people, and other affected groups, and cultural affiliations.		Only one study (referenced above) had been conducted in the park. A comprehensive approach to ethnographic research had not been undertaken and is needed to further define and determine resources and/or places of special concern to current tribal peoples and/or other non-native cultural groups. Furthermore, traditional knowledge is likely declining due to dwindling numbers of elders and practitioners of traditional lifeways. The park actively conducts required consultations for Section 106 purposes, and is increasingly reaching out to local tribes to engage in youth education opportunities.

Cultural Landscapes

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research exists to understand the relationship of the park's cultural landscapes to the historic context(s) for the park.		The upper portion of the Main Canyon is well documented with the completion of two CLIs—the Zion Canyon CLI and the Zion Lodge/Birch Creek CLI. Although a reasonable amount of documentation exists for other historic properties throughout the park (i.e., in the form of National Register nominations and/or amendments), there is no overall research oriented synthesis or analysis that specifically highlights other potential cultural landscapes to the historic contexts of the park.

	Scope of cultural landscapes in the park is understood and a determination has been made whether or not they are a fundamental or other important resource.		The CLI database identifies six potential cultural landscapes. Additional evaluations could be made on other potentially significant landscapes such as the lower main canyon, East Side (SR-9) corridor, East Fork of the Virgin (which is currently an NRHP listed archeological district), and possibly other locations. The two documented cultural landscapes have been determined to be OIRVs (other important resources and values), as opposed to FRVs (fundamental resources and values), as per the Zion Foundation Document, prepared October 2013. However, it should be noted that within the Zion Canyon CLI, which is an expansive resource encompassing most of the Main Canyon, some of the contributing resources are FRVs. These include archeological sites and are addressed in the Archeological Resources Table above.
	Percentage of cultural landscape baseline documents with current and complete information.		No cultural landscape reports (or treatment/preservation plans) have been completed for documented cultural landscapes.
Inventory	Percentage of landscapes eligible for the National Register in the Cultural Landscapes Inventory (CLI) with certified complete, accurate, and reliable data.		Two of eight (25%) cultural landscapes have been formally documented: the Zion Canyon Cultural Landscape Inventory, and the Zion Lodge/Birch Creek Cultural Landscape Inventory. Both are eligible for listing in the NRHP, with SHPO concurrence, dated 2006.
Documentation	Percentage of cultural landscapes with adequate National Register documentation.		No NRHP nominations have been completed for cultural landscapes. Of the two cultural landscapes identified and documented, cultural landscape reports (a CLR or treatment plans) have not been prepared for either property.
Certified Condition	Percentage of cultural landscapes certified as complete, accurate, and reliable in the Cultural Landscapes Inventory (CLI) in good condition.		100% (2 of 2) cultural landscapes are listed in the CLI and are considered in good condition. The continual physical impacts to landscape features from an increasing volume of visitors, and the increasing spread of exotic vegetation on these landscapes are the primary contributors to the deterioration of resource condition.

Historic Structures

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Historic Structures are identified and evaluated using historical contexts.		The LCS contains 94 structures for ZION, all of which are listed in the NRHP and have been evaluated/documented using appropriate historic contexts. Recent reconnaissance surveys reveal as many as several hundred additional historic structures need to be evaluated and documented. Other documentation includes Historic American Building Survey/Historic American Engineering Records for NRHP listed historic roads and bridges. Historic structure reports (HSR), are completed for 3 individual structures and one HSR for 22 contributing structures within the Zion Lodge/Birch Creek historic district, but the latter document is lacking some basic and necessary details.
Inventory	Percentage of historic structures eligible for the National Register in the List of Classified Structures (LCS) with accurate, complete, and reliable data.		NRHP documentation for the 94 structures currently in the LCS is adequate. Due to the potential unknown number of additional historic features (see above), no percentage is provided.
Documentation	Percentage of historic structures with adequate National Register documentation.		100% of historic structures currently in the LCS have been recorded commensurate with their significance and mandated purposes. However, during the recent fieldwork to update existing LCS records in 2014, many additional structures were identified that have yet to be evaluated for NRHP significance. An exact count for these structures is not yet possible to determine. Estimates are approximately 45 individual structures and up to 9 groups of features. Examples of a “group of features” would be the built features associated with the Zion-Mt. Carmel Highway (ZMCH), which could be more than 200 culverts, curbing, retaining walls, etc. Or landscape features associated with structures within the Oak Creek Historic District (OCHD), such as sidewalks, retaining walls, etc. (count unknown). The park is currently undertaking several new projects to begin documenting these structures. Both ZMCH and OCHD will be documented in FY 2015, in addition to other structures.
Certified Condition	Percentage of historic structures certified as complete, accurate, and reliable in the List of Classified Structures (LCS) in good condition.		According to the LCS, updated in FY 2014, 66 of 94 (70%) structures are in good condition. Maintenance and preservation of these structures is a combined effort of Zion Facilities (primarily), along with Concessions Management, Concessioners, and Zion Culture Resources. All of these structures are actively maintained and preserved within the confines of available staffing and funding. Due to the unknown number of additional historic features (see above), no percentage is available for this group of unevaluated structures.

History

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research is conducted to understand the national significance and historical contexts for the park.		Numerous references are available regarding the history and development of the southern Utah region surrounding ZION. The Sheratt Library and Special Collections at Southern Utah University, and the Dixie State University Library and Special Collections house extensive references relevant to local and regional history. The park maintains multiple resources for staff to learn about the history of the park including a library and park archives. Overall, there is an abundance of information, but it is widely scattered among many sources and facilities. The park lacks a consolidated, focused analysis of its administrative history and significance, particularly as germane to regional development. An administrative history is scheduled to begin in FY 2015, which will advance research efforts in identifying and understanding historic contexts and unit significance.
	Sufficient research is conducted to establish the reasons for park establishment and a history of the NPS management of the site.		"The Dudes are Always Right: The Utah Parks Company in Zion National Park, 1923–1972" (Markoff 1980) is a great first step toward an administrative history. As a 34 year old document, it constitutes the only attempt of historical analysis and park establishment. Park legislative history is well documented within the NEPA/Planning program files and is well presented in important park planning documents, such as the GMP completed in 2000, and the park Foundation document completed in 2014.
	Research at the appropriate level of investigation (exhaustive, thorough, or limited) precedes planning decisions involving cultural resources.		The park adequately addresses research needs for management actions and planning. However, because of limited staffing and funding, basic historical research at ZION has been concentrated on the Section 106 needs of individual projects rather than on the overall research needs of the park.
Inventory	Percentage of cultural resources listed in appropriate Service-wide inventories, including the National Register.		ASMIS: 100% of known recorded sites are listed. ICMS: approximately 98% cultural objects are cataloged. LCS: 100% of the currently documented historic structures are listed. An unknown number of additional structures have yet to be evaluated or documented. CLAIMS: 25% of identified landscapes are listed. NRIS: Total number of potentially significant resources is unknown; no percentage is provided. 40 individual cultural properties are listed in the NRHP.

Documentation	Research results are disseminated to park managers, planners, interpreters, and other NPS specialists and incorporated into appropriate park planning documents.		The park library, work group specific files and references, the historic image database, and the park museum collections and archives are important resources for understanding the cultural and natural historic of ZION and surrounding area. Data management for the large number of resource materials is inadequate; limited staffing makes it difficult to keep up with the growing body of reference materials.

Museum Collections

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The museum collections at Zion National Park (ZION) include both cultural and natural history objects as well as archives. The collection is inherently valuable for the information it provides about processes, events, and interactions among cultures, individuals, and the environment. Placing objects and specimens within a broader context, through research, analysis and documentary records, provides for greatest benefit and enjoyment by the public. Natural and cultural materials provide baseline data, serving as scientific and historical documentation of the park's resources, and of the purpose for which ZION was established.

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Percentage of museum collection baseline documents with current and complete information.		In accordance with NPS Museum management standards, the park has a current Scope of Collection Statement, Fire Protection Survey and Housekeeping Plan. A draft Collection Management Plan was created in 2011; however, major revisions were necessary and are ongoing. A Technical Assistance Request for assistance in developing a Collection Condition Survey and Storage Plan is being submitted to region for FY15. The park still lacks a security survey and needs to develop a museum specific emergency operation plan that can be added to the park's EOP.
Inventory	Percentage of existing collection that is accessioned and cataloged.		Approximately 61% of the known objects and archives have been cataloged; however, this number has steadily increased by 1% each year since 2012. The largest contributor to backlog is archives, and there are two projects currently underway that will result in a large number of them being cataloged. A survey of park records and archives likely to occur in FY15 may result in additional backlog.
	Scope of Collection is consistently implemented; items or objects are researched to determine their appropriateness for inclusion in the museum/archive collection.		The park's Scope of Collection Statement is current and accurate. There are a small number of objects being considered for deaccession due to their lack of relevance to the park.

Documentation	Accession and deaccession files are complete with all appropriate signatures.		Collection management documentation is complete.
Certified Condition	Percentage of museum collection reported in CMR and checklist report in good condition.		The collection is in very good condition. The storage area is environmentally stable and at very little risk of fire or security breach. A Collection Condition Survey and Storage Plan will identify and address any unknown deficiencies.

2.3. Visitor Experience

Visitor Numbers and Visitor Satisfaction

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Number of Visitors	Number of visitors per year		ZION experienced record-breaking visitation in 2014. The total of 3,186,696 visitors to the park in 2014 is an increase of 19.5% from 2010 (2,665,972 visitors). The 2014 total is 17% higher than the 10-year average of 2,718,666 visitors for 2004–2013.
Visitor Satisfaction	Percent of visitors who were satisfied with their visit		Based on the standard visitor satisfaction survey conducted each year, the percentage of visitors satisfied in FY14 was 99.0%, which is similar to the average for the previous five years (99.0%) and ten years (98.4%); source: 2014 Visitor Survey Card Data Report. This survey asks only general questions about the overall quality of park facilities, services, and recreational opportunities, and does not directly address issues related to park management.

Visitation Impacts to Resources

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Visitation Impacts	Quantity of social trails Encounters with other visitors on trails Quantity of human waste observed/removed Water quality (unhealthful levels of *E. coli*) Number of parking violations Number of graffiti sites removed		Visitation to the park is increasing. Concerns among park managers about overcrowding, infrastructure limitations, and resource protection have been growing. A 2014 survey of Zion Canyon and areas along the Zion-Mt. Carmel highway found 842 social trails totaling 33 miles along existing roads and trails and along the Virgin River. Visitor surveys collected during a 2014 study on the effects of the transportation system in Zion Canyon showed that trail use exceeded visitors' preferred maximum level of crowding on the Riverside Walk and Emerald Pools trails during most of the day. A random sampling of resource areas showed between 15 and 22 resources had human waste sites from 2012 to 2014; 14 to 16 of those sites were within wilderness. In 2014, 78% of the days when the shuttle system was in operation had incidents involving parking issues. Often many individual instances occurred each day. (Parking violations, an indicator of overcrowding, are greater than indicated by data.) A 2014 GIS study found 635 incidents of graffiti in the park, mainly located on or near trails and roads, and along the Virgin river. The Virgin River Comprehensive River Management Plan

			lists indicators and standards for river corridors, but very little data has been collected on these measurable items. Most observations are anecdotal, based on visitor comments and park staff experiences. Many of the specific measures listed to the left are high or increasing, resulting in an overall deteriorating condition.
Non-Wilderness Recreational Opportunities	Campsite availability Zion Lodge room availability		The occupancy rate of frontcountry campsites increased by 19% from 2010 to 2014 (204,127 camping visits). Watchman Campground regularly fills six months in advance during the reservation season (March through November). South Campground fills before noon every day during the busy season (approximately May through October) and many visitors who wish to camp are turned away. In 2014 the park kept South Campground open through November to accommodate the rise in visitation. Although data is not collected on how many people are unable to find a campsite, in 2014, the Fee operation gave out 9,000 handouts to visitors that outlined camping options outside the park. Zion Lodge is more than 98% full during the months of May through October.
Wilderness Recreational Opportunities	Wilderness campsite availability Canyoneering permit availability		The number of Wilderness Permits issued from 2008 to 2014 increased by 55%. From 2000 to 2014, there was an increase of 109%. Most Wilderness areas in the park have limits on the number of people permitted each day. The Subway route has the most demand for permits; in 2014, 3,961 visitors applied for the advanced lottery. Lottery participants had a 46% chance of obtaining one of their three lottery choices. It is common to have more than 600 people interested in the 60 available lottery spots on a summer Saturday. Many wilderness areas are at capacity for much of the season, and anecdotal evidence suggests many visitors are turned away. For example, in 2014 the Subway was at capacity 113 days and Mystery Canyon was at capacity 106 days. The Narrows overnight sites were at capacity 74 days.
Park Transportation System and Traffic Flow	Hours per day shuttles running over capacity		Shuttles are near or at capacity during most of the busy season. A survey of 82 shuttle loops (consisting of 1,293 segments between stops) conducted in 2014 showed that 17% of segments carried a number of riders that exceeded the number of seats on the shuttle. Lines at Visitor Center and Temple of Sinawava (the end points of the park loop) are common. The shuttle has seen boardings per hour of service rise steadily since inception. There were 45.53 riders per bus, per hour of service in 2000; 73.76 in 2009; and 82.52 in 2014. Shuttle service has extended from the original months of April through October; service has run fewer hours during the day to address core visitation hours. As the hours per day that the shuttles are over capacity increases, the condition of visitor experience deteriorates.

	Parking availability Number of visitor parking incidents during shuttle season		Parking lots are full most days from 9:00 am to 4:00 pm during the shuttle season. Parking lots have been expanded and re-configured to maximize private vehicle and recreational vehicle parking spaces. The pressure for more parking space has spread into Springdale and illegal parking that impedes driving lanes inside the park has increased. Parking is full or over capacity at trailheads in Zion Canyon during the non-shuttle season, and in Kolob Canyons and the East Side during the busy season. New pull-offs are routinely created by visitors looking for parking in the park and in Springdale. During the 2014 shuttle season, 170 of the 220 days (78%) saw parking issues and 211 problem days for the entire year (58%).
	Number of oversized vehicles driving in tunnel Entrance station and tunnel wait times		In 2009 oversized vehicles through the tunnel numbered 28,802. In 2014 there were 31,446, an increase of 9% from 2009. A 2012 analysis of South Entrance operations estimated that at least 136 days each year experience at least some period of time when demand exceeds capacity and significant queues develop at the entrance station. A redesign of the South Entrance and Zion Canyon Visitor Center area is in progress that should help alleviate wait times at the entrance, increase parking, and smooth the flow of traffic within the park. As the number of oversized vehicles increases and entrance station and tunnel wait times increase, the condition of visitor experience deteriorates.
Inholding Status	Ability to protect the viewshed Impact to elements of Wilderness character Acreage affected by trespass livestock Hiker access – number of trails and areas affected		Over 3,000 acres of private inholdings (2% of park) remain within the legislative boundaries of the park and only 40 acres have been acquired over the last ten years. Significant trespass issues occur on NPS lands in proximity to the inholdings. A large new home was built on an inholding near Firepit Knoll over the last few years, affecting the viewshed throughout the Lee Valley area. Developments in and around Wilderness areas not only affect the viewshed, but also night sky quality and general wilderness character in surrounding park land. Another inholding contains the only access route between the Kolob Canyons section and the Kolob Terrace section. If the private owner denies access to hikers, visitors will be greatly affected (especially with the increasing number of visitors hiking the Trans-Zion route). In 2014, 87 groups had permits to hike the Trans-Zion route. Increased property values limit the park's ability to either purchase inholdings when they come on the market or jointly attain easements to limit development. The amount of livestock trespass has decreased in recent years due to staff vigilance and fence building. However, hikers are advised not to use water due to cattle contamination, and visitors frequently comment on negative encounters with cattle. An access easement was secured for the Chamberlain's Ranch Trailhead in 2012. A similar agreement is in the works for the Orderville Canyon Trailhead.

Resource Brief: Increasing Visitation

Over the years, visitation to Zion National Park has steadily increased, leading to concern about the amount of use that can be sustained in the park while protecting natural and cultural resources and providing a quality visitor experience. Visitation to ZION first exceeded two million people in 1990 and has risen steadily through the years; in 2014 almost 3.2 million people visited the park. If the average rate of growth from 1990 to 2013 continues, the park will receive 4 million visitors per year by 2037. Washington County, where most of ZION is located, has been one of the fastest growing counties in Utah over the last two decades. The county's population is projected to grow from 168,078 in 2010 to 860,378 by 2060.

90% of the park is managed as wilderness, with carrying capacities identified by the wilderness management plan. The plan puts use limits in place based on visitor experience surveys. Standards were developed that rely on data such as group encounter rates on routes and trails in the wilderness. Many wilderness areas in the park require permits to access them, which allows the park to manage the encounter rates. From 2000 through 2014, there was a 109% increase in wilderness permits.

A typical July morning where the paved Riverside Walk delivers up to 300 people per hour to the mouth of The Narrows

Because access to much of the park's wilderness is restricted by the permit system, most of the visitors to ZION are limited to the 10% of park lands that are not in wilderness. Implementation of the shuttle system in 2000 produced noticeable positive benefits for the visitor experience, but also brought with it significant increases in visitor use because locations once limited by parking space are now exposed to the much higher capacity of the shuttle system to deliver people. Impacts from increased visitation have been observed: more social trails (which result in trampled vegetation and increased erosion), increased noise levels, and increased observations of graffiti and human waste.

The busiest day of shuttle service in 2014 recorded 41,723 passenger boardings, with an average of 120 riders per bus, per hour of service for the day. This high level of visitation also results in stress on the park's infrastructure. The scenic drive is deteriorating before the end of its projected lifespan, possibly due to the frequency and weight of shuttles driving on it.

The Virgin River Comprehensive Management Plan identifies standards and indicators that relate to crowding in both wilderness and non-wilderness sections of the park. Monitoring these items will allow the park to see if areas are too crowded. If areas are out of compliance, then the park will have to use adaptive management policies to correct the problem. However, the park lacks overall data regarding "crowding" conditions, especially in the non-wilderness areas. The park needs to gather data and monitor conditions to understand what problems there are and where they are happening.

Resource Brief: Removal of Human Waste from Scout Lookout

Human waste is a growing challenge for park management in front country and remote areas. Most notable is the removal of barrels of human waste from Scout Lookout at the start of the Angels Landing route, one of the most popular areas in the park. Two evaporative toilets located at Scout Lookout were installed and designed to see use rates of 50 people per day. The toilets are now overused with use rates closer to 400 people per day. Loading and hauling the waste away requires the use of a helicopter. The helicopter hauls between 10 and 15 barrels each day during the annual two-day operation. Each barrel weighs approximately 500 pounds when full. This is a costly and relatively risky operation due to the use of helicopters. There are trail and road closures during the operation to protect visitors and staff.

To help the park address this problem, visitors are asked to use the restrooms located at the Grotto parking and shuttle stop area before they start hiking up to Scout Lookout. With increased visitation, however, the problem will likely become more difficult to manage and will result in an increase in the costly helicopter operations or a closure of the restrooms, which would bring the problem back to the original problem of large quantities of human waste being left in the bushes and on this sandstone ridge, 1,000 feet above the canyon floor.

Interpretive and Education Programs – Talks, Tours, and Special Events

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Education Programs	Number and quality of curriculum-based programs, and number of participants		Zion Youth Programs have significantly increased in number of offerings and participants since the 2010 implementation of Zion National Park Foundation's (ZNPF) Youth Education Initiative, increased staffing, and numerous successful grants. From 2003 to 2010 about 100 school and outreach programs were conducted annually reaching about 3,000 visitors. Since 2010, about 300 programs are conducted annually, reaching 7,000 to 9,000 visitors each year through school and outreach programs. New curricula have been developed and posted on the park website. Concerns arise from the fact that this program is run primarily off grant funding and Zion National Park Foundation donations. Additionally, staffing is insufficient to meet demand for our education programs: 3rd–5th grade outreach covers Washington County, but not Iron County (≈1,800 students not covered); 5th grade Ticket to Ride program could accommodate only 5 of 20 schools that applied (≈1,800 students not reached); plus additional unmet demand for 6th–7th grade programs. Providing these additional education opportunities would require three additional seasonal positions.

Ranger Programs	Number and quality of programs and attendance Includes formal and informal interpretive programming		Zion National Park sets a high standard for quality interpretive programming. Extensive training, coaching, and mentoring are provided to each field interpreter to ensure the best experience for visitors and to increase advocates of the park and its resources. ZION offers 9 formal interpretive programs each day in the summer including very popular shuttle tours, evening programs, patio talks, and guided hikes. Park staff continue to expand efforts to "meet visitors where they are" with drop-in programs at various locations throughout the park. Over the past 3 years, interpretive program attendance has averaged 60,000 visitors annually. Limited staffing and reliance on seasonal positions does not allow for ranger programs during the spring (March into April) or fall (early Oct. through Nov.), when the park has many visitors looking to take part in these programs. Visitation in these "shoulder" seasons is increasing, and the park is currently unable to offer these visitors any traditional programs.
Junior Ranger Programs	Number of ranger-led programs and attendance Number of youth participating in the self-guided program Includes informal and formal youth programming		Visitor attendance at summer ranger-led youth programs has increased significantly since implementation of the Youth Education Initiative allowing additional hiring of youth program staff. Prior to 2010, about 2,000 summer visitors participated in two daily, ranger-led youth programs. Since 2010, between 10,000 and 24,000 visitors have participated each year, in four to five daily ranger-led programs during the summer. In addition, the self-guided Junior Ranger Program and Handbook is used by about 15,000 visitors annually, up from about 6,000 annual users prior to 2010. Concerns arise from the fact that this program is run primarily off grant funding and Zion National Park Foundation donations, with volunteers and interns doing a majority of the work.
Special Events	Variety and continuity of events Community involvement		ZION's flagship special event is the annual *Plein Air Art Invitational*, now in its 6th year. This weeklong event brings together several partners and features a variety of activities attended by 2,000 visitors. Other special events include the ZCFI lecture series, cultural heritage demonstrations by members of affiliated tribes, hosting a desert tortoise event in Springdale, Springdale's *Earth Day* event, community holiday events, National Public Lands Day, Audubon Christmas Bird Count, and ZION staff participating in events at other area parks. All of these events are funding/staffing-dependent.

Interpretive Media – Brochures, Exhibits, Signs, and Website

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Wayside Signs	Condition, accuracy, and currency of signs		The park's waysides are in good shape, but many are outdated and need to be replaced, and some are inaccurate. Work has been done to replace most of the informational panels. Interpretive panels would be the next area of concern. A comprehensive plan to address specific interpretive topics in specific areas of the park would be ideal. All waysides are documented in FMSS with a condition assessment. A project is funded to improve existing waysides.
Park Directional Signs	On site and off site Usefulness, effectiveness, quantity, and placement		Over the last five years, the park has been communicating with local businesses to streamline traffic signage through Springdale to improve visitor information and wayfinding as related to use of the park transportation system. The park and town are looking at opportunities to utilize variable messaging where possible to better inform and direct park visitors. Shuttle stop, directional, pedestrian, and parking signs will be replaced in the park and Springdale to be more visible and provide better orientation on how to use the system. Off-site directional signs are confusing or in very poor shape. There are multiple entrances and some visitors arrive and are surprised as to where they are. Signage is regularly shot and vandalized in some locations. There is a funded project that is in the design phase to replace all signs in and outside of the park to mitigate these issues.
Exhibits	Visitor Center exhibits Current, accurate, condition, comprehensive		Fourteen years ago, park planners designed a new experimental visitor center experience, where all visitor center exhibits were placed outside of the visitor center in the plaza area. Unfortunately, most visitors do not see or use these exhibits. Orientation exhibits inside the building would be preferable. There are no interpretive exhibits in Zion Canyon on the subject of geology. Since geology is the central feature and significance of the park, this should be addressed. A new exhibit plan is in place for the visitor center, with the design phase taking place in FY15.
	Museum exhibits Current, accurate, condition, comprehensive		The Zion Human History Museum was renovated in 2001 with new exhibits designed and installed. The Museum focuses on human history in four display areas. People's relationships with plants, water, animals, and sanctuary are featured. The 2014 Long-Range Interpretive Plan (LRIP) for ZION recommends updating the museum's exhibits to include both cultural and natural history topics. A small space is available for museum collection/gallery exhibits.

	Nature Center exhibits		The Zion Nature Center exhibits are currently being upgraded with assistance from the Harpers Ferry Design Team. The Nature Center is currently a multiple use building, and exhibits are set up during the summer season when the building is open to the public. Exhibits need to be designed to be portable and easily assembled and disassembled for compact storage in limited storage area.
Print Media	Accuracy and availability of primary park publications		Most of the important documents have been improved in some way in the last five years. The park's newspapers changed completely with contributions from all divisions. The Wilderness Guide needs to be rewritten and redesigned. Foreign Language newspapers are also available. Handouts could be reassessed for need. Most handouts are available on the website.
Audio-visual Media	Orientation films		The park orientation film is a great introduction and overview of the park. It was created in 2001, and is viewed by over 130,000 visitors annually. The LRIP recommends creating a new film to better meet the needs of visitors who end their visit to ZION at the museum. The projector and timer were new in 2012; other equipment is 15 years old. Wilderness, leave-no-trace, and canyoneering safety videos are available at the Zion Canyon Visitor Center.
	AV equipment TIS system		The park may have more interpretive AV systems than are necessary. From an operations standpoint, maintaining 9 different systems is time-consuming and costly. The orientation, education, and interpretive needs of visitors may be better met through traditional media. The park maintains an effective and frequently updated Travelers' Information System (TIS) that broadcasts on an AM radio frequency, providing visitors with important information about visiting ZION.
Digital Media	Currency and scope of website; number of website visitors		ZION's official website receives over 6 million visitors each year with over 10 million pages viewed, and from 2013 to 2014 visitation to the site increased by 13%. It was recently ranked as the fifth most visited NPS site in the Intermountain region for views and average view time. Significant updates have been made to the site recently, most notably to trip-planning pages. Currently, park staff is expanding the content in natural and cultural resources.
	Social media: Facebook updates and "likes," overall activity		ZION has a strong presence on social media that continues to increase each day. The park has a Facebook page with over 192,000 likes (seventh most followed NPS site), a Twitter page with over 27,000 followers (fifth most followed NPS site), and an Instagram account with over 27,000 followers (third most followed NPS site). The park also has a YouTube channel, a Flickr page, and a Flickr group where visitors can donate their photos to the park. The staff that runs the social media accounts is project-funded and seasonal. Increasingly, the park relies on social media for providing trip planning needs and important notifications such as road closures. The park should secure funding for sufficient social media staff to maintain these platforms, which visitors now expect and rely on.

	Other technology/ media		Funding has been requested for an app, and Harpers Ferry is currently working on an app for all national parks. Currently visitors are getting information from other, non-official online sources and apps. There is limited potential for other technology and media due to limited funding, staffing, and service-wide security concerns. The park recognizes the need to keep up with technology for visitors, but also recognizes the above limitations, as well as the limited cellular and wireless capabilities in ZION. Wireless access for park visitor centers for all national parks is also in the planning stages.

Scenic Resources

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Scenic Views	Scenic views quality and protection		Most scenic views in and around the park are generally high quality and in good condition. A significant number of visitors come to the park to view the scenery and it is a primary reason that visitors come to the park. The park has experienced some recent development adjacent to the park that has affected scenic views but general land use around the park should mostly retain the important qualities of the views.

Universal Access

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
ADA Compliance	Mobility		All new visitor facilities in the past 15 years have been designed to be as universally accessible as possible. There are two largely ADA-compliant trails, and the park is working to make other facilities (including trails) as compliant as possible considering the environmental constraints. Because the park recognizes that some areas of the park will never be accessible, it has started providing alternative experiences such as eHikes, Google Street View, and improved interpretive exhibits. The Zion Shuttle System is designed to be accessible and special vehicle permits allow those that the shuttle cannot accommodate to visit Zion Canyon. Wheelchairs are available for use at the VC, museum, and Zion Lodge. Accessible rooms at Zion Lodge, and sites at Watchman Campground.
	Visual accommodation		There is a 3D tangible map outside the main Visitor Center, and tactile objects are used in many interpretive programs. New exhibits underway in VC and Nature Center will be ADA-compliant, and the Human History Exhibit has some accommodation for auditory description. The primary park brochure is available in braille. The park has need for additional alternative format interpretive materials in braille and large print. The shuttle narration also provides descriptive information about features of the Main Canyon.
	Auditory accommodation		Closed captions are available for most audio/visual programs and a brochure contains the narration of the shuttle tour. The park has tried various methods of captioning the narration, but technical problems have persisted and the printed version has proven most reliable. Assistive listening devices are available for ranger-led programs, and the park schedules a sign language interpreter for visitors who provide 24-hours' notice.

	Other accommodations/ general		ZION as a comprehensive accessibility assessment planned for this year to help ensure full universal access wherever feasible to ZION's facilities and programs. Service animals are permitted throughout the park, on trails, including on shuttle buses.
Multi-lingual Resources	Audio and print materials in multiple languages Directional signs Bi-lingual staff		The Italian and Spanish map and guides have been redesigned with new translations. There are also French and German map and guides, which are in a slightly different format. We have translations for smaller handouts in over ten languages, but have not had the resources to have them designed and printed yet. These handouts serve as smaller versions of the map and guide, translating the most important information. Waysides are not translated in different languages, but the park has transitioned to using universal symbols and icons on signs, newspapers, and websites to accommodate non-English speaking visitors while maintaining the park aesthetic. Law enforcement has translation services available, and a central database is maintained of staff members who speak multiple languages for use on an as-needed basis.
Public Transportation	Access within Zion Canyon and Springdale via park-owned shuttle system		The park's alternative transportation system was instituted in 2000 and replaces private vehicles on the Zion Canyon scenic drive from spring through fall each year. The system has dramatically decreased traffic congestion within ZION and increased access to the popular area of Zion Canyon and its trails and services. Traffic flow within the park is generally smooth. The ZION transportation system recorded 4,031,441 boardings in 2014, the most recent year for which data is available. That year also saw the system perform 4,589 wheelchair lifts and carry 8,297 bicycles, which provided access to a wide range of visitors efficiently and effectively. In addition to transportation into the park, the Springdale shuttle system is also used as a free public transportation in town.
	Access to park and Springdale via public transportation		Access via public transportation from other surrounding towns and neighboring counties to the park is non-existent; however, the county is considering the feasibility of running a commuter bus service from St. George to Springdale. The East Side, Kolob Canyons, and Kolob Terrace areas are not accessible by public transportation. Two transit studies, prepared for Five County Association of Governments, demonstrate the need for a public rural transportation system linking the park and Springdale with the city of St. George.

Multi-Modal Transportation	Opportunities for multi-modal transportation		The park maintains one designated bike trail (Pa'rus) within the main canyon. Safety restrictions exist for bicycles and pedestrians in Zion-Mt. Carmel tunnel, forcing any through-cyclists to get rides from other private vehicles. While the park has no hard data on the number of bicyclists in the park, it is a very common occurrence and even supports two exclusive bike rental shops in our gateway community. The introduction of the shuttle system has opened Zion Canyon to increased bicycle use by limiting vehicular traffic during the shuttle season. The shuttles are equipped to carry 3 bicycles, and many visitors ride the shuttle to the top of the route and ride their bicycles down the canyon. With no designated bike lane on this route, there are still safety concerns with bicyclists and vehicles. The park installed signage to inform cyclists that they are required to pull over and allow vehicles to pass, but the interaction with bikes and vehicles is still constant. In addition to the bike use in the Main Canyon, 90% of the park is managed as Wilderness and is open to compatible modes of transport.

Resource Brief: Renewable Resource Sustainability

Zion National Park is recognized world-wide for sustainable efforts. Beginning with the introduction of an energy-efficient Visitor Center and propane-powered shuttle system, the park has put great emphasis on fully embracing the park service's overall goal of conservation and protection. Since that time, ZION staff has been instrumental in bringing wide-scale recycling services to Southern Utah; increasing sustainability messaging throughout the park and its programs; improving visitors' access to sustainable information on the website and in park publications; and helping park visitors think about their impact on the world around them.

In 2008, ZION began constructing water bottle refilling stations throughout the park through grant funding and partner support. Currently, there are four such stations in prominent visitor use areas in the Main Canyon: the Zion Canyon Visitor Center, Human History Museum, Zion Lodge, and Temple of Sinawava. Culinary water is available at numerous other locations, but each of these filling stations has two to three commercial-grade spigots mounted in an attractive interpretive backsplash. Visitor response to the stations has been almost exclusively positive, and the impact has been substantial. ZION's partners (ZNHA & Xanterra, who both maintain gift shops within the park that used to sell disposable bottled water) estimate the stations eliminate more than 60,000 bottles of waste annually. By removing the water cooler from the gift shop area of the VC, the total energy use of the complex (building, plaza, parking, etc.) dropped 10%. Partners also saw a 78% increase in reusable bottle sales, which means visitors are going home with a sustainable souvenir.

Park staff has also been working to provide easier access to recycling facilities within the park by improving labeling, locations, and frequency of receptacles. The interpretive programs, including the Junior Ranger program, have worked throughout the past few years to include information about resource conservation and our impact on the environment in order to provide a take-home message to visitors. Messaging on the park shuttles now includes information on the pollution-reducing effects of eliminating private vehicle miles driven, and the park newspaper was reformatted to include an entire section on environmental impact.

ZION's goals of sustainability go beyond maintaining sustainable facilities. The park tries to engage visitors in thoughtful reflection about how the things they do each day—on vacation, at work, and at home—can affect the planet as a whole. Through appropriate visitor experiences and information, we hope to have a larger-reaching effect on each of the more than 3 million visitors who spend time in ZION each year.

Resource Brief: Shuttle System

In the 1990s, visitation to ZION surpassed 2,000,000 people and park managers took steps to implement a shuttle system that would replace private vehicles on the six-mile-long Zion Canyon Scenic Drive. The system began service in May, 2000, and immediately addressed issues related to vehicle congestion, air quality, and degradation of resources in the canyon. The mandatory system operates full time between mid-March and October in Zion Canyon and on weekends during the month of November. The cost to ride the shuttle is included in the park entrance fee. The buses are powered with liquefied propane, a clean-burning alternative energy fuel.

The system operates along two loops: one through the adjacent town of Springdale and one along the Zion Canyon Scenic Drive. The park buses make nine stops and take eighty minutes to complete a full loop; the town buses make seven stops and take thirty minutes to complete a loop. The transit fleet includes 39 buses and 23 trailer units. Each bus and trailer unit is 30' in length with a combined seating capacity for 68 passengers.

Throughout its fifteen years of service, the shuttle system has continuously seen increased ridership. There were 4,031,441 multiple passenger boardings in 2014 on the whole system, which was an increase of 10% from 2013. The average number of riders per bus, per hour of service for the year was 82.5, which was the highest annual number recorded since the inception of the system. The busiest day of service in 2014 recorded 41,723 passenger boardings, with an average of 120 riders per bus, per hour of service for the day. Operation of the shuttle significantly reduces the number of private vehicles that would be in the canyon without it. Wheelchair lifts continue to increase annually as well as bicycle lifts, demonstrating a variety of users utilizing the shuttle system as part of their park experience.

Safety

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Emergency Services	Emergency incidents per FTE		The safety of visitors is a park priority. The park works to quickly identify and mitigate potential hazards. The health and well-being of visitors within the park is good with the law enforcement staff providing additional emergency services. These services include an Advanced Life Support-Cardiac transporting ambulance, a top rated search and rescue program, wildland fire support, and a robust structural fire brigade. Incident numbers in emergency medical services, search and rescue, and structural fire categories are increasing in number and complexity along with visitation numbers but staffing levels have been stagnant since 2001. The core of emergency service personnel is also the law enforcement staff, and staff is stretched thin due to the high number of incidents. Visitation has increased 44% since 2001. Emergency calls are on the increase with a 58% increase since 2006 and most calls taking multiple responders. A risk assessment study was done in 2010 and 2011, working with risk management office to analyze 5 years of data for common locations and causes of visitor injuries. In 2012, the Center for Disease Control conducted a survey of visitors injured and non-injured to see where they had obtained their park and safety information.

Visitor Safety and Law Enforcement	Law enforcement incidents per FTE		Overall safety of park visitors is good with an upward trend on law enforcement contacts. The response to incidents is quick and professional. Violent crime is uncommon and arrest numbers are on an even trend. The park's concern is due to increasing numbers and complexity of law enforcement incidents along with rising visitation numbers but stagnant staffing levels (unchanged since 2001 but with a 44% increase in visitation).
Staff Safety and Training	Percent of employees trained Employee injuries Ratio of Safety and Occupational Health Manager to number of employees		94% of ZION permanent employees are trained in Operational Leadership. CPR, First Aid, AED training, and OSHA-required trainings are offered and required for staff and volunteers. Risk assessments are conducted prior to task and project engagement. Regular risk management educational messages are shared with staff and volunteers. The Bureau of Labor Statistics and the Occupational Safety and Health Administration use "days away, restricted, and/or transfer" (DART) as a metric to gauge the severity of incident. ZION's FY10–13 DART rate average was 2.40. Comparatively, the Intermountain Region as a whole had an average DART rate of 2.03 (FY10–13), while the NPS as an agency had an average DART rate of 2.18 (FY10–13). The top cause of employee injury/illness at ZION (FY10–13) was slip, trip, and fall at 24 incidents, followed by handling materials or equipment at 18 incidents. Ratio of Safety and Health Manager to number of employees exceeds Director's Order 50B. Current ratio is 1:275 full time employees. There are safety concerns for staff working at the Zion-Mount Carmel Tunnel.

Resource Brief: Zion-Mount Carmel Tunnel

The historic Zion-Mount Carmel Tunnel, completed in 1930, is listed on the National Register of Historic Places (1987) and recognized by the American Society of Civil Engineers as a National Historic Civil Engineering Landmark (2012). The 1.1 mile long tunnel connects Zion Canyon to the east side of the park and to other NPS units in the Grand Circle. It was the longest tunnel in the United States at the time of its construction and remains the longest vehicular tunnel in a NPS unit. It has six gallery windows, originally used for daylight and debris removal, that give visitors a peek of Zion Canyon. The tunnel is a timber frame structure and 90% of the timber frame is covered with gunite, a mix of cement, sand, and water that is sprayed onto a mold.

Large vehicles (11’4” tall or taller and/or 7’10” wide or wider) cannot negotiate the curves of the historic Zion-Mount Carmel Tunnel without crossing the center line and therefore require controlled one-way traffic. Visitors requiring traffic control, formerly referred to as tunnel “escorts,” through the tunnel must obtain a special use permit. Traffic control for oversized vehicles in the tunnel has been provided by park visitor use assistants since 1989 and requires two VUAs to control vehicle traffic. In 2014, 31,446 “escorts” were performed, an increase of 17% over 2013 and 65% increase over 2010 (19,016 “escorts” in 2010). Vehicle lines can exceed one mile in length and 10 minutes while waiting for an oversized vehicle. Vehicles over 13’1” tall and 50 feet long are not permitted in the park because of the tunnel’s height restrictions and tight hairpin turns on the switchbacks.

Tunnel operations expose park personnel to hazardous conditions such as motor vehicle operations, traffic, heat and cold stress, and mental and physical fatigue. Engineering controls, administrative controls, and personal protective equipment instituted over the past 25 years have not significantly reduced the risk to the park staff.

The tunnel has no power source, which precludes any lighting or fire suppression system in the tunnel. Disabled vehicles within the tunnel and at either opening create hazards and can force the closure of the tunnel, hence the entire east park road, to all vehicular traffic for several hours. Both pedestrian and bicycle traffic is prohibited in the tunnel due to the lack of road shoulders and lighting. There have been four fatalities inside the tunnel since 1986, all involving motorcyclists colliding with a tunnel wall. In 2014 a bicyclist was critically injured when he collided with a tunnel wall after illegally entering the tunnel.

Without a permanent power source, installation of an automated traffic control system is problematic but it remains a goal.

Partnerships

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Volunteers	Number of volunteers and hours contributed		Analysis of the annual Volunteers-in-Parks (VIP) Program reports for the last five years indicates Zion's VIP Program has remained relatively steady with an annual average of 350 volunteers and 26,000 volunteer hours. In FY 2009, ZION dedicated a full time, subject-to-furlough position for a VIP Coordinator. The program is currently in good shape, but there is cause for future concern from an ever-increasing servicewide trend of fund source restrictions and proposed changes to background investigation requirements. These factors could lead to a decline in volunteer support.
Partnerships	Number of official and unofficial partnerships Cooperating Agreements Formal MOUs		Zion Natural History Association is the park's non-profit cooperating organization, and provides support to education, research, and the arts, through the Zion Canyon Field Institute and the Zion National Park Foundation. ZION is the lead park in several operational groupings: 3-unit group – ZION, CEBR, PISP; 8-unit fire management group; 5-park FMSS group, 4-park Safety program. ZION also partners with 5 regional parks and 2 universities on an Intergovernmental Internship Cooperative (IIC). We also have concession and service contractors that include: Xanterra, Parks Transportation Inc., and Bryce Zion Trail Rides. The law enforcement division has formal MOUs and works closely with other emergency service providers surrounding the park and adjoining towns and counties on law enforcement contacts, EMS, structural fire calls, and rescue work. Park law enforcement also works closely with the United States Attorney's office and the other Utah parks in the area on consistent prosecution. ZION does share a position with Cedar Breaks in a cost savings measure. The park partners with multiple natural resource conservation corps on a variety of resource projects. Additional official and unofficial partnerships for resource conservation with USFWS, USFS, BLM, UDWR, and tribal partners. The park also cooperates with local towns on special events, volunteer services, and planning efforts.

2.4. Park Infrastructure

Overall Facility Condition Index

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The National Park Service uses a facility condition index (FCI) to indicate the condition of its facilities and infrastructure. FCI is the cost of repairing an asset, such as a building, road, trail, or water system, divided by the cost of replacing it. The lower the FCI number, the better the condition of the asset. The condition of the buildings and other infrastructure assets at each park is determined by regular facility inspections, or "condition assessments," including daily informal inspections and formal yearly inspections. Deficiencies identified from these assessments are documented in the NPS Facility Management Software System and the cost for each repair determined. Repairs that cannot be completed within the year count against the condition of a structure. The total cost of these deferred repairs divided by the total cost to replace the structure results in the FCI, with values between 0 and 1 (the lower the decimal number, the better the condition). The FCI is assigned a condition category of Good, Fair, Poor, or Serious based on industry and NPS standards. Deferred maintenance projects that require additional funding are identified based on FCI. Planned preventive maintenance on critical components occurs during the year, using a park's base budget. For additional information about how park managers use information about the condition of facilities and infrastructure to make decisions about the efficient use of funding for maintenance and restoration activities at the park, Click Here.

Asset Category	Number of Assets 2008 / 2013	FCI 2008 / 2013	Condition Status/Trend	Rationale
Buildings	135 / 148	0.054 / 0.057		Buildings are being maintained using appropriated funds, reimbursable accounts, and FLREA funds. The scheduled rehabilitations are planned and successfully funded, where possible, using FLREA and Concessions Franchise Fees funds. Six newly built comfort stations in Watchman Campground, two new vault toilets, Temple of Sinawava restroom replacement, and major rehabilitations of the Grotto house, Q21, Q38, Q34, Lava Point Cabin within the last five years. Our investments are being applied to the heavily used visitor locations and housing locations. In the last 15 years park visitation has increased by ¾ million (a 31% increase) and has created a multitude of deferred maintenance. Other buildings that are not primarily used by visitors have deferred maintenance that continues to accumulate. No condition assessments have been completed in the last three years resulting in the FCI scores being understated. The park does not feel that the FCI data for this category represents the actual condition that they see locally; therefore, the park has modified this rating to reflect their professional view of the condition. This is an exception to the State of the Parks model.

Campgrounds	3 / 4	0.275 / 0.087		ZION has been in the process of rehabilitating campgrounds since 1998. Lava Point is complete, Watchman campground has had some rehabilitation but some sections are still in need of restoration soon, and South Campground upgrade is in the planning stages. The 4th campground location is the Walk-in Campground. South Campground is in serious need of rehabilitation and thus accounts for the down arrow on condition. Half of our camp sites are reflected in South Campground and it is in poor condition. Campground locations are only considered the land pad that is the actual camp site, the picnic table, the fire pit and the maintained landscape, not the bathroom facilities, roads, or utility systems. No condition assessments have been completed in the last 3 years resulting in the FCI scores being understated. The park does not feel that the FCI data for this category represents the actual condition that they see locally; therefore, the park has modified this rating to reflect their professional view of the condition. This is an exception to the State of the Parks model.
Trails	31 / 49	0.140 / 0.046		Trail maintenance crews have improved sections of trails within the park, which accounts for the lower FCI. There is still a significant amount of both documented and undocumented deferred trail maintenance to address. Natural processes constantly erode the trail systems. The trail crews are funded by FLREA projects. Reduction or loss of this funding source would significantly impact trail maintenance and improvements. The park does not feel that the FCI data for this category represents the actual condition that they see locally; therefore, the park has modified this rating to reflect their professional view of the condition. This is an exception to the State of the Parks model.

Waste Water Systems	9 / 9	0.187 / 0.075		ZION has no waste water treatment facility. The park pays the local community for waste water treatment. The community's waste water treatment capacity has been over capacity for the last 12 years. With visitation increasing the waste water amount will continue to increase resulting in a moderate level of concern and a declining capacity. The park's waste water assets (9) are used for waste water collection and movement of waste to the town of Springdale facility. Waste water lines are inspected and cleaned annually and are in good condition. ZION has been successful rehabilitating a number of small septic systems using FLREA funding. The park does not feel that the FCI data for this category represents the actual condition that they see locally; therefore, the park has modified this rating to reflect their professional view of the condition. This is an exception to the State of the Parks model.
Water Systems	6 / 10	0.223 / 0.036		The ZION water systems are relatively simple-collection, filtering, chlorination, and distribution. The systems have been in an improvement cycle since 1990. Portions of the systems—piping, valves, storage, or filtering and treatment equipment—is replaced or rehabilitated each year.
Unpaved Roads	5 / 3	0.001 / 0.000		Recent work and keeping up with recurring maintenance has kept unpaved roads in good condition.
Paved Roads, Parking Areas, Bridges, Tunnels	86 / 109	0.120 / 0.072		Conditions vary throughout the park ranging in very good to poor. Facilities require maintenance, repair, or replacement on an ever-shortening cycle due to visitation increases. Zion Canyon Scenic Drive is deteriorating at a high rate of speed due to the shuttle systems, weather conditions, floods, heavy rain, and/or snow fall. The shuttle capacity is too high and it is degrading the road faster than it should because the class of road built was for a smaller weight capacity than what is traveling on it. No condition assessments have been completed in the last 3 years resulting in the FCI scores being understated. The park does not feel that the FCI data for this category represents the actual condition that they see locally; therefore, the park has modified this rating to reflect their professional view of the condition. This is an exception to the State of the Parks model.

All Others	42 / 48	0.298 / 0.055		All other assets include fences, maintained landscapes, irrigation systems, interpretive waysides, photovoltaic systems, park phone system, radio system, fuel system, entrance and directional signs and propane systems. The low confidence in the assessment is due to the lack of data for all ZION boundary fences. Approximately 30 percent of the fences have been assessed by current staff. Fence crews have improved sections of boundary fence from a poor condition to new in the last five years accounting for the change in FCI.

Park Carbon Footprint

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Greenhouse Gas Emissions	Reduction in metric tons of CO_2 equivalent ($MTCO_2E$)		Renewable Energy Credits (RECs) have been purchased since FY 2011. RECs are purchased in the amount of kilowatt hours (kWh) that the park had used in the previous fiscal year. These RECs are used to offset our GHG emissions, helping the park remain on track or even exceed the GHG reduction goal.

Profile – Park Carbon Footprint

Carbon Footprint is measured by greenhouse gas (GHG) emissions resulting from the combustion of fossil fuels for transportation and energy (e.g., boilers, electricity generation), the decomposition of waste and other organic matter, and the volatilization or release of gases from various other sources (e.g., fertilizers and refrigerants). A decreasing carbon footprint indicates the park is striving to reduce its impact on climate change through mitigation efforts. In 2008, the baseline GHG emissions were set within ZION and totaled 9,280 metric tons of carbon dioxide equivalent ($MTCO_2E$). This includes emissions from park and concessioner operations and visitor activities, including vehicle use within the park. To put this in perspective, a typical U.S. single family home produces approximately 12 $MTCO_2$ per year (U.S. EPA 2011). Thus, the emissions from park operations are roughly equivalent to the emissions from the energy use of 773 households each year. The largest emission sector for ZION is park visitors, totaling 4,042 $MTCO_2E$ in 2008. Purchased electricity comprises 43.9 percent of emissions from energy and 13.7 percent of total park emissions.

In order to reduce our energy use, ZION has incorporated many improvements such as the installation of Energy Star refrigerators and washing machines in the housing units, and twenty housing units had programmable thermostats installed. Thermal auditing was conducted and higher R value insulation was placed in locations with high heat and cold air escape.

The reduction in water use has occurred due to several measures including the purchase of 33 water heater blankets in 2010, the removal of the humidified system at the museum, the installation of low flow shower heads in housing, and the installation of 90 low flow aerators for faucets. The new comfort stations have low flow aerators, and low flow toilets.

2.5. Wilderness Character and Stewardship

The Wilderness Act of 1964 requires the NPS to maintain Wilderness character, including the qualities of being "…untrammeled by man…undeveloped…natural," and allowing for "…solitude or primitive and unconfined recreation." The Zion National Park Foundation Document includes a wilderness character narrative on pages 54 through 57. The narrative describes what is unique and special about the Zion Wilderness organized under the framework of the five qualities of wilderness character. It is located at http://www.nps.gov/zion/parkmgmt/index.htm

Overall Wilderness Character

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Wilderness Character Qualities	Natural		Wilderness ecological systems are substantially free from the effects of modern civilization. The plant and wildlife populations that are of concern—including Mexican spotted owls, peregrine falcons, and Shivwits milkvetch—are stable or improving. The upper Zion Narrows fails state water quality standards for water-to-body contact, but the number of eroded access trails remains stable. Due to a number of areas where vegetation type conversion has occurred, the percentage of the wilderness with a fire regime ecological condition class of 1 has decreased over the last ten years.
	Undeveloped		Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation. The number of authorized days of helicopter use and hours of motorized equipment use has dropped over the last four years primarily due to low incidents of wildland fire. A modern era cabin and ¼ mile of road were removed from the wilderness in 2015. The number of structures on potential wilderness lands has remained constant over the last five years, but concern with the potential development of the inholdings is substantial.
	Untrammeled		Wilderness is essentially unhindered and free from modern human control or manipulation. The number of significant actions that manipulate the biophysical environment authorized by the NPS in the wilderness has dropped over the last four years, representing an improvement to the untrammeled condition. The number of animal days of livestock trespass has also dropped in recent years.
	Solitude or Primitive and Unconfined Recreation Opportunity		Wilderness provides outstanding opportunities for solitude or a primitive and unconfined type of recreation. The number of encounters with other groups is managed in a large part of the wilderness through a permitting system. There are several areas, such as the Middle Fork of Taylor Creek and the lower Narrows where permits are not required and encounter rates exceed standards. Monitoring is not ongoing to measure soundscape values. Campsite conditions remain constant as do the number of signs and the percentage of the park available for at-large camping. The number of visitors whose wilderness experience is confined either through the requirement that they obtain a permit or through their inability to obtain a permit continues to rise.

	Other Features of Value		Wilderness may also contain other features of scientific, educational, scenic, or historical value. Cultural resources are the other features of value that have been identified for the Zion Wilderness. The percentage of archeological sites in good condition has remained constant in recent years.

Wilderness Stewardship

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Stewardship to Preserve Wilderness Character	Key Information		The 2007 wilderness stewardship plan includes a legislative history of the Zion Wilderness. 84% of the park was designated as wilderness in 2009. 6% remains recommended wilderness. 3% is potential wilderness that can be converted to designated wilderness once non-conforming uses are removed. A legal description and GIS boundary layer have been developed and submitted to the WASO wilderness office. A wilderness character narrative was developed as a part of the park's foundation document.
	Management Operations		Wilderness character is incorporated into all management decisions affecting the Zion Wilderness including MRAs, NEPA, 106 documents, and scientific research proposals. Through the 2007 wilderness stewardship plan, commercial services were determined not to be necessary or appropriate with very limited exceptions.
	Status of Plans		The park completed a wilderness stewardship plan in 2007 that uses the visitor experience and resource protection framework to set indicators and standards. The monitoring framework was modified to incorporate the five qualities of wilderness character and baseline wilderness character monitoring was conducted in 2011. The monitoring program is ongoing due to the efforts of the wilderness permit and resource management staffs. A second round of monitoring should be conducted in 2016.
	Completed Training		A Carhart unit training was last held in the park in 2008. The park hosted a regional wilderness character workshop in 2011. The superintendent has not been to the Carhart national training. The wilderness coordinator has been to a Carhart regional training.

Chapter 3. Summary of Key Stewardship Activities and Accomplishments

Activities and Accomplishments

The list below provides examples of stewardship activities and accomplishments by park staff and partners to maintain or improve the condition of priority park resources and values for this and future generations:

Natural Resources

- Obtained Congressional Wild and Scenic River designations for 145 river miles within the park, the first designations in the state of Utah. A River Management Plan was completed to protect the free-flowing condition of rivers, water quality, and the outstanding natural and recreational values for future park visitors.
- Zion Wilderness was Congressionally designated in 2009. ZION completed a standards based wilderness management plan in 2007 that allows the park to manage use limits based on resource conditions and visitor experiences. The standards were incorporated into a baseline wilderness character monitoring program, which was completed for the Zion Wilderness in 2011. A wilderness narrative was completed as a part of the park's foundation document in 2013. Wilderness character has been integrated into all management decisions affecting the Zion Wilderness.
- Zion NP Water rights Settlement Agreement signed in 1996 provides long term protection of stream flows, while accepting a relatively low level of present and future impact. This protects overall stream flow, flood peaks (by preventing construction of new reservoirs), and periods of low flow. It carries an affirmative requirement for the park to monitor changes in water rights.
- Worked with FAA and St. George airport to minimize the effects of commercial flight paths over the park, the first time airspace over a national park unit has been considered in an airport EIS.
- Initiated soundscape monitoring and completed the first Soundscape Management Plan in the National Park Service.
- Successfully integrated Wilderness tactics into numerous fire responses, including large fires such as the Horse Fire (2,400 acres), the Subway Fire (1,000 acres), and the Herbs Fire (220 acres).
- Completed the first geologic hazard maps for the park in 2010. An energy absorbing rockfall barrier was installed at the NPS maintenance building in 2011.
- Based on habitat models, found and documented additional populations of the endangered Shivwits milkvetch.
- Initiated the Tortoise Birthday Bash, an annual local outreach event to raise awareness and stewardship of the Desert Tortoise population.
- Added an additional long-term weather station in cooperation with the Natural Resource Conservation Service.
- Collected baseline information on bat populations and established a long-term monitoring program.
- Established a long-term monitoring program for pinyon-juniper woodland, Gambel oak shrublands, and riparian areas through the NCPN Inventory & Monitoring program.

Cultural Resources

- All concessioner buildings underwent a comprehensive condition assessment in 2012 that will be repeated every five years. Maintenance needs into the future were identified, prioritized and classified and are being met by NPS and the concessioners.
- Two historic dormitories at the Lodge have been remodeled to reintroduce historic character defining features, rehabilitate structural condition, and improve employee comfort.
- Developed a diverse array of heritage educational and outreach opportunities including a lecture series, participating in state sponsored events (Utah Archaeology Week), archeology workshops, cultural demonstrations, and an archeology traveling trunk for schools.

Visitor Experience

- The shuttle system keeps hundreds of thousands of private vehicles from entering Zion Canyon, which greatly reduces traffic congestion, resource damage from parking, noise levels, etc. The system is very efficient and well-run; it does a great job of moving large numbers of people every day. The park is currently working with transportation experts to quantify visitor use of the transportation system and development alternative management strategies that move large numbers of visitors efficiently while protecting important park resources and maintain a quality visitor experience.
- Zion Youth Programs have significantly increased since 2010: approximately 300 education programs are conducted annually, reaching 7,000 to 9,000 visitors each year through school and outreach programs. The second year of the Concrete to Canyons program brought students from four urban middle schools to ZION for a multi-day camping and learning experience.
- ZION is recognized worldwide for its sustainability efforts. Highlights include: the propane-powered shuttle fleet which eliminates thousands of private automobiles from driving in the park every day, highly efficient buildings, water bottle filling stations to reduce waste (the first in the NPS), photovoltaic panels which provide ≈12% of the park's electricity needs,

electric and alternative fuel vehicles, a park composting program, and an extensive recycling program for residents and visitors.

- Wilderness permitting operations have added a last minute drawing to the reservation and lottery system. This system eliminates the need for visitors to wait in long lines over multiple days to obtain canyoneering permits, allowing them to spend more time out in the park experiencing the wilderness.
- Over the past four years, ZION has greatly increased its social media presence. The park has a Facebook page with over 228,000 likes (seventh most followed NPS site), a Twitter page with over 31,000 followers (fifth most followed NPS site), and an Instagram account with over 43,000 followers (third most followed NPS site). The park also has a YouTube channel, a Flickr page, and a Flickr group where visitors can donate their photos to the park.
- The park has implemented improved technology in the dispatch communications center, particularly via the Emergency Medical Dispatching (EMD) system. EMD allows pre-screening of incoming medical calls for proper triage and response, improving timeliness and level of response by emergency personnel. This system improves visitor safety and allocation of park resources and staff.
- Over the past three years, interpretive program attendance has averaged 60,000 visitors annually. The interpretive staff continues to expand efforts to "meet visitors where they are" with drop-in programs at various locations throughout the park.
- The ZION Junior Ranger program continues to grow, offering 4–5 ranger-led programs for children daily during the summer. Since 2010, between 10,000 and 24,000 visitors have participated each year. In addition, the self-guided Junior Ranger Handbook is used by about 15,000 visitors annually. These booklets are now available at no cost to visitors, thanks to funding provided by the Zion Natural History Association.
- Volunteers contribute an average of 26,000 hours annually at ZION, providing vital services that would not otherwise be accomplished within the park, including wilderness patrols, emergency response, visitor assistance, native plant restoration, and much more.
- The ZION Artist in Residence program has grown over the last several years, and the park now hosts four artists each year, to continue the long-standing connection between the arts and conservation. ZION hosts a very successful plein air festival in the fall that draws artists and visitors from around the world. Proceeds from the event support education programs in the park.
- The park is an active participant in planning efforts with local towns and county officials in looking at the feasibility of a commuter or fixed line transit system.

Park Infrastructure

- The sustainability and maintenance program revised and implemented an Integrated Solid Waste Alternatives Plan (ISWAP) program.
- ZION has maintained a 30–35 percent landfill diversion rate since 2010.
- 85 kW of photovoltaics have been installed at 3 different park facilities.
- There has been a switch to LED lighting in administrative buildings, and in indoor and outdoor public spaces through an American Recovery and Reinvestment Act (ARRA) grant.
- ZION conducts an annual hazardous waste pick up to remove unapproved materials from the park that have been left by visitors or residents.
- Thermal audits of park facilities were conducted to improve efficiency.
- In the last five years six restrooms and 16,800 linear feet of pumped irrigation were installed in the Watchman Campground.
- In 2011 the ZION road crew and a contracted company completely reconstructed the highway switchbacks on State Route 9. The project took 10 months to complete and cost $10,092,445.11.
- Several safety deficiencies on the Angels Landing route and Hidden Canyon trail have been corrected. Many of the hand hold chains have been replaced, and new chain has been added. The stone tread has been carved in a few locations to provide more steps and even footing surfaces.
- Telephone Canyon Trail and the West Rim Trail had major rerouting work completed. Resurfacing and retaining wall work has been initiated on the East Rim Trail.
- Lava Point Cabin has been completely rehabilitated along with 2 historic residences and the historic Grotto house.

Chapter 4. Key Issues and Challenges for Consideration in Management Planning

Challenges and Issues

Planning and management efforts over the last 20 years provide a well-established basis for park management and the identification of key issues and challenges. A General Management Plan was completed in 2001 and remains relatively current because it was followed by a Backcountry Management Plan (2007), a Soundscape Management Plan (2010), and a Comprehensive River Management Plan (2015). A Foundation Document was completed in 2013 presenting the park purpose and significance, and the fundamental resources and values of the park. This document also identified special mandates and administrative commitments pertaining specifically to ZION, and an assessment of planning and data needs.

Challenges and issues for current and future management planning fall into four major categories: increasing visitation, transportation, operational budget shortfall, and external influences.

Increasing Visitation

Due to multiple influences external to the NPS, the park is rapidly becoming a year-round destination with an ever-shrinking "slow season" in December and January. The past five year trend in visitation from 2010–2014 has shown a 19.37% increase. This type of increase impacts parking availability and traffic congestion within the park and the town of Springdale, and contributes to adverse resource impacts from social trailing, vegetation trampling, and the introduction and spread of non-native plant seed. Increased visitor density accelerates wear and diminishes facility lifecycles and requires significant staff time and effort to service restrooms, campgrounds and primary visitor contact stations, to direct traffic, and to restore areas impacted by human waste, vandalism and litter. The park now receives negative comments about the crowding on the chain route up Angels Landing, which has become a leading visitor safety concern. Aggressive wildlife behaviors toward humans by deer and squirrels have been observed at popular, crowded park destinations, presumably due to feeding animals and their acclimation.

Zion Wilderness permit issuance is often at capacity, and increased visitation in Zion Canyon now spills over into previously lesser-used areas of the park. The number of wilderness resource impacts monitored by staff such as campsite sprawl, human waste, additional canyoneering anchors, illegal campfire scars, and braided or multiple trails have greatly increased in recent years. Canyoneering is a rapidly increasing visitor use in the park, with unknown effects on wildlife. Sound monitoring in one of the canyons occupied by threatened Mexican spotted owls which rely on this habitat, documents that human noise and activity now occurs in that canyon during portions of every hour of a 24-hour day.

The park is concerned with the long-term trend of increasing visitation, overcrowding in Zion Canyon, impacts to infrastructure, and degradation of visitor experience. Maintenance projects that are temperature-dependent such as major road work or trail reconstruction can't be done in the coldest, slower visitation months. This situation either adds to deferred maintenance when projects are put off to avoid visitor conflicts, or forces road and trail closures during busy periods that affect visitor access. Controlling the number of visitors in Zion Canyon at one time could reduce the impacts to park resources and infrastructure but such actions would undoubtedly be controversial. A variety of visitor capacity management techniques such as reservations or timed entries may need to be implemented to protect the resources and the visitor experience.

Transportation Issues

The park and adjacent town of Springdale have a limited amount of parking. A shuttle bus system was established in the town and within the park in 2000 to help move people and reduce traffic congestion; however, the buses are frequently at standing-room-only capacity. The highly successful shuttle system delivers many more people to trailheads and destinations than were possible with private vehicles, increasing social crowding conditions on park trails and increasing resource damage. The repeated passes of the weight of shuttles are causing premature deterioration to the roads in the park and in the town of Springdale. Neither the park nor the town can simply build ourselves out of this situation by providing more parking lots, more buses, and heavier duty roads without sacrificing the local quality of life, the quality of park resources, and the quality of visitor experiences.

Given the temporal nature of visitor use, the park can handle large numbers of people depending on time of day, week, year, and weather conditions. The park needs more visitor management planning to 1) determine when the park actually reaches visitor, parking, safety and shuttle capacity, 2) implement management strategies that use the shuttle system to help manage visitor use, 3) slow down the pulse of visitors coming into the park during high use, and 4) distribute visitor use to other areas of the park and nearby recreation areas through information sharing and messaging.

There is strong support for public transportation to the park by local mayors and town officials. Public support has yet to be measured given that public transit is not yet available to all areas of St. George. The biggest challenge to developing public transportation is how to fund it. Federal and state sources are available for development of systems, equipment and facilities, but not for operation. A number of ideas to fund transit operations have been postulated including user fees, tax revenues, and similar ideas.

Large vehicle traffic such as buses and recreational vehicles must be controlled through the Zion-Mt. Carmel Tunnel for motorist safety due to the dimensions of the historic tunnel. This requires a significant commitment of staff time. Traffic control operations expose park personnel to hazardous conditions related to working in and near the roadway and traffic, heat and cold stress, mental and physical fatigue, and challenging radio communications. Engineering and administrative controls and personal protective equipment instituted over the past 25 years have not significantly reduced the risk to the park staff. The park would like to automate the traffic control function to improve staff and motorist safety; however, there are constraints and issues dealing with National Register historic structure preservation, no electricity at the tunnel, viewshed preservation, and the consequences of motorists, bicyclists, and pedestrians who might attempt to defeat an automated system.

Budget Shortfall

Base budget increases for park operations have not kept pace with the demands on staff associated with increased visitation. The shortage in operational budget and staff level for what is becoming a year-round park is being felt in every division. Although budget relief comes in the form of “soft money” received from sources such as Federal Lands Recreation Enhancement Act (FLREA), concession franchise fees, and competitive sources during the Servicewide Comprehensive Call, these sources carry constraints on the types of projects and the types of employees that can be hired with the project-based funds.

ZION relies heavily on seasonal staff, limited to 6-month appointments, for what has become a 10-month peak-period operation and is approaching a year-round operation. This requires the inefficient and costly practice of recruiting, hiring, and training two sets of seasonal workers each year to cover these expanded operations. This places a multiplied workload on supervisors and the Servicing Human Resources Office (SHRO) staff. This need to hire multiple sets of seasonal workers is felt throughout all aspects of park operations, including law enforcement and emergency response; maintenance of roads, trails, grounds, buildings and utilities; fee operations, and visitor information and education services. The visitor information and fee operations staff are struggling to keep up with the significant increase in visitors at the park’s contact and entrance stations because staffing levels have remained static despite a dramatic increase in visitation over the last 5 years. Current vehicle and pedestrian entrance station configurations impede the rate to process incoming visitors without exposing staff to extreme environmental and traffic hazards. Interpretive ranger programs are currently only available for visitors from late April to mid-October, due to seasonal staffing limitations. A significant portion of the education program relies on donations and grants, which creates concern over the continuity of funding and the youth education services they provide.

The park also relies heavily on term positions, although many of these positions are performing ongoing park needs that would be best remedied by raising the cap on Full-Time-Equivalent (FTE) positions, increasing base funding, and/or changing the staffing constraints associated with soft funding sources. Similarly, the park relies heavily on volunteers to provide services that would otherwise be reduced, such as staffing visitor contact stations, conducting Wilderness patrols, and operating campgrounds. Career ladders within the maintenance division are needed to retain institutional knowledge and specialized trade skills specific to park facilities and materials.

Budget and staff shortages also adversely affect the knowledge base and management of the resources for which the park was established and that visitors come to enjoy. There is inadequate base funding to maintain key staff, such as a physical scientist/hydrologist, and staff to accomplish mandated agency mission and goals, such as monitoring resource conditions, mitigating resource degradation, and maintaining cultural and natural resource data integrity. Budget cuts to the fire program—a 76% reduction in 4 years—prevent the fire program from proactively planning and implementing mandated, critical fuels management for human safety as well as ecological resilience, and limits an effective response to emergencies.

The staffing level in law enforcement patrol is currently inadequate to provide even a strictly reactive law enforcement operation. Employee illness, training, or annual leave stresses the schedule so as to require overtime, lieu day changes, and/or reduction in shift coverage hours. The increase in all risk incident responses such as emergency medical services, search and rescue, and structural fire call out, is rapidly outpacing the current staff ability to provide these emergency services and having adequate time for rest, recovery and equipment preparation for the next incident. The park needs additional staff qualified to perform these emergency services.

Appropriate backup for law enforcement officer safety is a critical concern under the current staffing level. The Kolob District and Cedar Breaks areas operate with single ranger coverage during daylight hours and rely on backup coming from surrounding communities with an average response time of 30 minutes. This is currently outside operational leadership principles for risk management and is not a safe practice.

Eighty-five year old river levees in Zion Canyon are deteriorating. The park desires to remove them and provide flood protection by armoring the scenic drive. This has been a known problem for over 15 years, yet funding is not available for this undertaking. A single large flood event could cause the river channel to shift to a location that would damage the Lodge, the main park road, and underground utilities. The Wild and Scenic Rivers plan sets a carrying capacity for Zion Canyon, as well as other areas of the park, but there is no funding for monitoring the standards created by the plan. Stream flow monitoring is not conducted on two perennial streams, and springs are abundant in ZION, but the park lacks an inventory of springs.

There is no funding for most data needs identified in the park foundation document. This includes actions such as monitoring outlined in the Soundscape Management Plan, completing the commercial air tours planning over the park, performing museum collection and facility surveys necessary to generate mandatory core museum documents or conducting scientific research to properly understand resource significance and historical contexts of park cultural resources, such as ethnographic studies, oral histories, archeological overview and assessment, and historic resource studies. Seeking project funding for these needs has proven to be a piecemeal and largely inadequate approach.

The lack of funding available through the Land and Water Conservation Fund and the park's inability to purchase private land inholdings within the authorized park boundary, coupled with current and potential land uses in and around inholdings, threaten park resources, wilderness character, and visitor access to portions of the park.

External Influences

There are processes external to the park that could adversely impact park resources or visitor experience. Park managers need to maintain or develop working relationships with external agencies or partners for the conservation of park resources and visitor experience.

Visibility is generally very good, but since local air contains very few pollutants it is vulnerable to new pollutant sources in the near vicinity and region. Ozone levels have been documented to be very close to exceeding standards. ZION retains a largely natural dark sky and provides great opportunities for stargazing, but observations from several locations within ZION reveal larger and brighter light domes encroaching from surrounding towns.

Native fish appear to be present in healthy populations, but two species are managed under conservation agreements to avoid a federal listing under the Endangered Species Act. The introduction of any problematic exotic aquatic species could present a significant threat. ZION should be vigilant to provide the best refugia for these native species. The North Fork of the Virgin is listed for not meeting water quality standards for *E. coli* and temperature; however, the park is working with multiple agencies and private land owners to rectify the source of the issue that originates outside the park.

The desert bighorn sheep in ZION represent some of the healthiest populations of bighorn in the state; however, the risk of disease exposure from domestic animals to the bighorn sheep population is increasing as the population grows and expands its distribution. A multi-agency bighorn sheep management plan is in development.

Land development within desert tortoise habitat adjacent to the park may adversely affect park populations of this threatened species. Land development east of the park poses a threat to water resources due to groundwater consumption and wastewater discharge. Additional development may cause impacts to scenic views along the park access roads.

Proliferation of invasive exotic annual grasses continues to fuel catastrophic wildfire, which threatens life, property, and continued loss of native plant and animal habitat, inside and outside the park. The potential for a major shift in fire regime in some vegetation types is considered, along with a climate change, to carry the greatest potential for major ecological transformation in the park.

Changes in stream morphology and area predator control have had a profound effect on the riparian woodlands. There is a very low level of recruitment of new cottonwood trees in Zion Canyon with two apparent causes: 1) aggressive channelization of the river in the 1930s that disconnected the river and its floodplain preventing the scour and deposition during floods that is needed to prepare a seedbed for cottonwoods, and 2) accentuated browsing by over-abundant wildlife that eat the seedlings.

There are natural or external forces that park managers will have little to no ability to influence but must keep in mind for management actions. The greatest risk to stream flow is from climate change and the loss of snowpack. The rocks of ZION have abundant fossil resources, some of which are very significant to the scientific community; however, due to the very rapid natural rate of erosion in the park, these fossils are exposed and available for study, but also prone to loss at a high rate from erosion processes. Most park structures are located in areas subject to one or more geological hazards including flooding, rock fall, landslides, and earthquake. Historic stone masonry structures are particularly prone to damage during seismic events.

Concluding Thoughts

In the face of these challenges and issues stands a highly dedicated, skilled, competent, and passionate workforce that daily goes the extra mile to provide high quality services and experiences for park visitors and that is committed to the protection and preservation of park resources. In spite of the fact that lines to enter the park, to get on a shuttle, or to reach certain destinations are getting longer each year and that campgrounds are full and trails in the main canyon are crowded, visitor responses to annual survey cards, transportation studies or talking with park staff indicate that visitors continue to have a satisfying experience while visiting the park.

Notwithstanding these encouraging observations, park professionals recognize that the current conditions and trends are not sustainable. The park and community cannot continue to build facilities to solve these issues and challenges, but will need to rely on innovative ideas, partnerships, and perhaps a change in mindset to protect the quality of experiences and park resources.

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See Also:

Collection of Natural Resource-Related References

Collection of Cultural Resource-Related References

Collection of Visitor Experience-Related References

Glossary

See the State of the Parks home page for a link to a complete glossary of terms used in State of the Park reports. Definitions of key terms used in this report are as follows:

Americans with Disabilities Act (ADA)	Law enacted by the federal government that includes provisions to remove barriers that limit a disabled person's ability to engage in normal daily activity in the physical, public environment.
Archeological Sites Management Information System (ASMIS)	The National Park Service's standardized database for the basic registration and management of park prehistoric and historical archeological resources. ASMIS site records contain data on condition, threats and disturbances, site location, date of site discovery and documentation, description, proposed treatments, and management actions for known park archeological sites. It serves as a tool to support improved archeological resources preservation, protection, planning, and decision-making by parks, centers, regional offices, and the national program offices.
Baseline Documentation	Baseline documentation records the physical condition of a structure, object, or landscape at a specific point in time. A baseline provides a starting point against which future changes can be measured.
Carbon Footprint	Carbon footprint is generally defined as the total set of greenhouse gas emissions caused by an organization, event, product, or person.
Climate Friendly Park	The NPS Climate Friendly Park designation requires meeting three milestones: completing an application; completing a comprehensive greenhouse gas (GHG) inventory; and completing a Climate Action Plan, which is the actions, policies, programs, and measures a park will put into place to reduce its GHG emissions.
Cultural Landscapes Inventory (CLI)	A Cultural Landscapes Inventory describes historically significant landscapes within a park. The inventory identifies and documents each landscape's location, size, physical development, condition, characteristics, and features, as well as other information useful to park management.
Cultural Landscape Report (CLR)	A Cultural Landscape Report is the principal treatment document for cultural landscapes and the primary tool for long-term management of those landscapes. It guides management and treatment decisions about a landscape's physical attributes, biotic systems, and use when that use contributes to historical significance.
Curation	National parks are the stewards of numerous types of objects, field notes, publications, maps, artifacts, photographs, and more. The assemblage of these materials comprises a museum collection. Curation is the process of managing, preserving, and safeguarding a collection according to professional museum and archival practices.
Facility Condition Index (FCI)	FCI is the cost of repairing an asset (e.g., a building, road, bridge, or trail) divided by the cost of replacing it. The lower the FCI number, the better the condition of the resource.
Foundation Document	A park Foundation Document summarizes a park's purpose, significance, resources and values, primary interpretive themes, and special mandates. The document identifies a park's unique characteristics and what is most important about a park. The Foundation Document is fundamental to guiding park management and is an important component of a park's General Management Plan.

Fundamental and Other Important Resources and Values	Fundamental resources and values are the particular systems, processes, experiences, scenery, sounds, and other features that are key to achieving the park's purposes and maintaining its significance. Other important resources and values are those attributes that are determined to be particularly important to park management and planning, although they are not central to the park's purpose and significance. These priority resources are identified in the Park Foundation Document and/or General Management Plan. The short-cut name that will be used for this will be Priority Resources.
General Management Plan (GMP)	A General Management Plan is a strategic planning document that outlines the future management of a National Park Service site for the next 15 to 20 years. The plan will set the basic philosophy and broad guidance for management decisions that affect the park's resources and the visitor's experience.
Historic Integrity	Historic Integrity is the assemblage of physical values of a site, building, structure, or object and is a key element in assessing historical value and significance. The assessment of integrity is required to determine the eligibility of a property for listing in the National Register.
Historic Resource Study (HRS)	The historic resource study is the primary document used to identify and manage the historic resources in a park. It is the basis for understanding their significance and interrelationships, a point of departure for development of interpretive plans, and the framework within which additional research should be initiated.
Historic Structures Report (HSR)	The historic structure report is the primary guide to treatment and use of a historic structure and may also be used in managing a prehistoric structure.
Indicator of Condition	A selected subset of components or elements of a Priority Resource that are particularly "information rich" and that represent or "indicate" the overall condition of the Priority Resource. There may be one or several Indicators of Condition for a particular Priority Resource.
Integrated Resource Management Applications (IRMA)	The NPS-wide repository for documents, publications, and data sets that are related to NPS natural and cultural resources.
Interpretation	Interpretation is the explanation of the major features and significance of a park to visitors. Interpretation can include field trips, presentations, exhibits, and publications, as well as informal conversations with park visitors. A key feature of successful interpretation is allowing a person to form his or her own personal connection with the meaning and significance inherent in a resource.
Invasive Species	Invasive species are non-indigenous (or non-native) plants or animals that can spread widely and cause harm to an area, habitat, or bioregion. Invasive species can dominate a region or habitat, out-compete native or beneficial species, and threaten biological diversity.
List of Classified Structures (LCS)	LCS is an inventory system that records and tracks the condition of the approximately 27,000 historic structures listed in the National Register of Historic Places that are the responsibility of NPS.
Museum Collection	NPS is the steward of the largest network of museums in the United States. NPS museum collections document American, tribal, and ethnic histories; park cultural and natural resources; park histories; and other aspects of human experience. Collections are managed by professionally-trained NPS staff, who ensure long-term maintenance of collections in specialized facilities.

National Register of Historic Places (NRHP)	The National Register of Historic Places is the official list of the Nation's historic properties worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Park Service's National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. Listing in the National Register of Historic Places provides formal recognition of a property's historical, architectural, or archeological significance based on national standards used by every state. The National Register is a public, searchable database about the places.
Native American Graves Protection and Repatriation Act (NAGPRA)	A federal law passed in 1990. NAGPRA provides a process for museums and federal agencies to return certain Native American cultural items (e.g., human remains, funerary objects, sacred objects, objects of cultural patrimony) to lineal descendants and culturally-affiliated Indian tribes and Native Hawaiian organizations.
Northern Colorado Plateau Network (NCPN)	One of 32 I&M networks established as part of the NPS Inventory and Monitoring Program. The Northern Colorado Plateau Network provides scientific data and expertise for natural resources in 16 parks located in Colorado, Utah, Wyoming, and Arizona.
Priority Resource or Value	This term refers to the Fundamental and Other Important Resources and Values of a park. These can include natural, cultural, and historic resources as well as opportunities for learning, discovery, and enjoyment. Priority Resources or Values include features that have been identified in park Foundation Documents, as well as other park assets or values that have been developed or recognized over the course of park operations. Priority Resources or Values warrant primary consideration during park planning and management because they are critical to a park's purpose and significance.
Project Management Information System (PMIS)	A servicewide intranet application within the National Park Service to manage information about requests for project funding. It enables parks and NPS offices to submit project proposals to be reviewed, approved, and prioritized at park units, regional directorates, and the Washington Office.
Resource Management	The term "resources" in NPS encompasses the many natural, cultural, historical, or sociological features and assets associated with parks. Resource management includes the knowledge, understanding, and long-term stewardship and preservation of these resources.
Specific Measure of Condition	One or more specific measurements used to quantify or qualitatively evaluate the condition of an Indicator at a particular place and time. There may be one or more Specific Measures of Condition for each Indicator of Condition.
Visitor and Resource Protection (VRP)	VRP includes, among other responsibilities, protecting and preserving park natural and cultural resources, enforcing laws that protect people and the parks, fire management, search and rescue, managing large-scale incidents, and on-the-ground customer service.
Volunteers In Parks Program (VIP)	The Volunteers In Parks Program was authorized by Public Law 91–357 enacted 1970. The primary purpose of the VIP program is to provide a vehicle through which the National Park Service can accept and utilize voluntary help and services from the public. The major objective of the program is to utilize this voluntary help in such a way that is mutually beneficial to the National Park Service and the volunteer. Volunteers are accepted from the public without regard to race, creed, religion, age, sex, sexual orientation, national origin, or disability.
Wilderness	A designation applied to certain federal lands set aside for preservation and protection in their natural condition, in accordance with the Wilderness Act of 1964.