



State of the Park Report

Bering Land Bridge National Preserve Alaska



2016

On the cover: Granite tor rock formations near Serpentine Hot Springs, NPS Photo/Ken Hill

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.

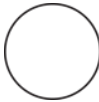
The purpose of this State of the Park report is to:

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

The purpose of Bering Land Bridge National Preserve (BELA, “the preserve”) is to protect the natural, cultural and subsistence resources of this landscape and to provide the opportunity to study and interpret the landscape, which contains an invaluable record of floral, faunal, and human migration between Asia and North America and which supports an ongoing traditional subsistence culture.

The summary table, below, and the supporting information that follows, provide an overall assessment of the condition of priority resources and values at Bering Land Bridge National Preserve based on scientific and scholarly studies and expert opinion. The internet version of this report, available at <http://www.nps.gov/stateoftheparks/bela/>, 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 goals for managing resources, and may alter how the preserve measures the trend in condition of resources. Thus, reference conditions, regulatory standards, and/or best judgment about resource status or trend may evolve as the rate of climate change accelerates and the preserve responds to novel conditions. In this context, the status and trends documented here provide a useful point-in-time baseline to inform understanding of emerging change, as well as a synthesis to share as the preserve builds 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		The preserve does not monitor air quality. Air quality at BELA is thought to be generally good. The preserve has also experienced intermittent periods of high particulate haze from local or regional summer fires.
Geological Resources		BELA has known geological resources, but lacks a formal geological resources inventory. Rates of coastal erosion in BELA have accelerated in the past decade, which threaten the preserve's unique coastal formations. External development may also impact BELA; proposed developments include: oil and gas exploration near Cape Espenberg, placer mining for gold on BELA's southern and eastern border (Chicago and Inmachuk Creeks and Taylor Creek), and a proposed road to Ear Mountain for gravel mining to support the village of Shishmaref relocation efforts. Exploration is occurring along most of the eastern and southern boundaries of the preserve.
Paleontological Resources		Very few paleontological surveys have been completed in BELA. A database of the few known paleontological resources is under development and expected to be completed in 2017. Threats associated with BELA's paleontological resources include non-permitted fossil collecting (which has been observed in Arctic parklands) and erosion.
Water Resources		Sampling for water quality is infrequent. No long-term records of water quality exist for BELA. The magnitude and seasonality of water flow is changing in many Arctic streams and rivers, but has not been documented.
Terrestrial Vegetation		BELA has the highest amount of lichen cover in the Arctic parks, with 28% cover within lichen-rich plant communities. Terrestrial lichen cover is likely to have declined slightly due to shrub increase in tundra habitats and this trend is expected to continue. Vascular plant cover has been increasing across the Arctic in recent decades, as shrubs and other plants increase in height and density, and this trend is expected to continue to replace low-shrub tundra.
Birds		BELA falls within nationally and internationally recognized bird conservation regions; however, population status information for landbird and breeding shorebird species in the preserve is incomplete. Habitat for high-latitude breeding landbirds and shorebirds is vulnerable to the effects of human activities and climate change.
Fish		BELA does not currently monitor fish in lakes and rivers. Fish are an important subsistence resource. As a group, they represent the most accessible subsistence resource in the area. Generally, fish diversity and populations are presumed to be good based on the remote location and low levels of anthropogenic impact; however, the lack of available rigorous fish data warrants moderate concern.

Priority Resource or Value	Condition Status/Trend	Rationale
Terrestrial Mammals		Terrestrial mammals in the preserve include, but are not limited to, moose, brown bear, caribou, reindeer, muskox, wolves, wolverines, and beaver. After a decline in the 1990s, the moose population on the Seward Peninsula is stable, but distribution may have shifted inland. Concerns exist related to the condition of food and available habitat for this low density population. The Western Arctic Caribou herd is currently at the low end of its population cycle, and uses the Seward Peninsula for winter range. Reindeer populations are co-mingling with the Western Arctic herd and reindeer herding has been extremely limited for many years. Muskoxen were extirpated from Alaska in the late 1800s. Following many years of growth after reintroduction, the population of muskox declined by 10–30% on the Seward Peninsula between 2010 and 2012. The population of muskoxen now appears stable on the Seward Peninsula as a whole, though some evidence points to lower local populations within BELA. Muskoxen on the Seward Peninsula—including those in BELA—have been surveyed since 1983. The wolf population in BELA has not been monitored. The few historical estimates of the wolf population size in northwest Alaska are varied and unreliable. Some local residents report an increase in wolf observations and a concern for the caribou.
Marine Nearshore		Notable marine nearshore animals include ice seals, walrus, beluga whales, migratory fishes, and polar bears. Marine resources are estimated to account for 67% or more of people’s subsistence diet in villages around the preserve. Changing sea ice conditions are expected to negatively influence these populations. Abundance data for polar bear is lacking and reliable population estimates for ice seals (ringed and bearded seal) are not available. Beluga whales are present in waters off the BELA coast, and distributed throughout seasonally ice-covered water. Marine incidents are relatively common in the Chukchi Sea and Kotzebue Basin Area. With significant increases in Arctic marine operations through the Bering Strait, associated Arctic marine incident risks are also increasing. Marine debris including microplastics and other pollutants are a growing concern, especially in areas where rural communities are dependent on marine mammal harvest for subsistence. Volunteer marine debris removal efforts on BELA’s coast make a small dent in a growing problem. Permafrost thaw on coasts and in the saltmarshes reduces elevation, inundating and drowning land and vegetation resources and causing thermal erosion. Late shorefast ice development increases erosion likelihood during late fall storm events.

Priority Resource or Value	Condition Status/Trend	Rationale
Unique Communities and Landscape Features		Unique communities and landscape features at BELA include Serpentine Hot Springs, Arctic Hot Springs, extensive lava flows, maar lakes, and barrier island complexes. Serpentine Hot Springs consists of two distinct thermal areas; Serpentine Hot Springs and Arctic Hot Springs, both of which host unique aquatic ecosystems. The coastline of BELA includes a span of approximately 172 km of open and closed barrier and lagoon complexes with over 500 km of inner- and outer-coastal features. These soft-sediment shorelines include vast, shallow lagoons with fractal-patterned interiors, large estuaries teeming with waterbirds, barrier islands, sandy capes, salt marshes, mudflats, brackish wetlands, small freshwater lakes and ponds, dunes, ridge systems covered with dwarf shrub-lichen vegetation, and the world's northernmost eelgrass beds. Like those of eastern North America before European contact, the northwest Arctic shorelines are wild, dynamic, productive, and extensive. The barrier islands host a tremendous diversity of wildlife. Impacts to the barrier islands include increased erosion due to storm events and loss of sea ice and marine debris.
Landscape and Ecosystem Processes		Located on the coast, active geologic erosion is heavily influenced by sea ice. Rates of coastal erosion have been increasing, and heavy erosion caused by storm surges has created visible damage. Most of BELA is underlain by frozen soil called permafrost. Permafrost average temperatures have warmed since 1950, and the thickness of the seasonally-thawed upper layer has increased as a result of climate warming since 1950. While the extent of permafrost has changed little so far, BELA represents the southern extent of the continuous permafrost zone, and continued warming is expected to impact the permafrost and tundra ecosystem. Large permafrost thaw slumps are now commonly seen along the coast, exacerbated by coastal erosion. The number of fires is variable in the preserve, with no change over the past 65 years. Overall greenness of lowland tundra landscapes as measured by satellite has increased since records began in the 1980s. Changes in greenness from vegetation cover shifts will have diverse impacts to the tundra ecosystem.
Dark Night Sky		A photic environment is described as the physical amount and character of light at a particular location, irrespective of human perception. The NPS Night Sky Program characterizes a park's photic environment by measuring both anthropogenic and natural light. While no ground-based or modeled data are available for BELA, 2012 visible infrared imaging radiometer (VIIRS) satellite data indicate that there is no visible upward radiance within the preserve boundary. The largest sources of upward radiance are near the preserve's northeast boundary from the town Kotzebue. Additional upward radiance is visible from Nome, about 100 km from the preserve's southern boundary.
Acoustic Environment		There is no regular acoustic monitoring in BELA. The mean acoustic impact level (L_{50} dBA), a measure of noise contributed to the existing acoustic environment by man-made sources, is 0.1 dBA in BELA, meaning that the acoustic environment is in good condition.

Priority Resource or Value	Condition Status/Trend	Rationale
Cultural Resources web ▶		
Archeological Resources		The major themes/historic contexts for BELA are well developed, particularly for the late-Holocene cultures, but many questions remain about the origins of coastal adaptations, trans-Bering strait connections, and the role of Beringia in the peopling of the Americas. Most areas of the interior portion of the preserve have not yet been surveyed.
Cultural Anthropology		Although some anthropological research has been conducted in the region by scholars, local residents, and federal/state agencies, the preserve lacks formal baseline documentation to assess condition and/or adequate protection of unknown or undocumented ethnographic resources. Each passing year marks the loss of knowledge bearers and Elders who can contribute to the documentation process.
Cultural Landscapes		Six cultural landscapes have been identified in the preserve; only two have been formally documented, inventoried, or evaluated using the preserve's established historical contexts.
Historic Structures		BELA has several Historic Resource Studies. Identification and evaluation of additional structures (e.g., shelter cabins) should take place using additional historical context. Documentation of structure attributes is lacking.
History		The main BELA Historic Resource Study was completed in 1986, with an addendum in 2009. The preserve lacks an Administrative History.
Museum Collections		BELA currently has an adequate amount of research and reports to demonstrate the significance and context of the items in the museum collection; however, the preserve has the potential for both continued and expanded archeological, ethnological, historical, and natural history studies that would expand understanding. BELA benefits from substantial support from the Alaska Regional Curatorial Center located in Anchorage, AK.
Visitor Experience web ▶		
Number of Visitors		Calculating a precise number of visitors to the preserve is difficult as, unlike most NPS parks, the preserve has no main entry point and no visitor stations in the preserve. Visitors arrive to BELA by small airplane, boat, snowmobile, bicycle, and foot. Visitors have been counted in certain locations, and visitation at Serpentine Hot Springs and Nuluk cabin was 3,891 in 2015. Between 2011 and 2015, BELA averaged more than 10,000 visits. Visits to the Bering Land Bridge Visitor Center in Nome have increased from 2,107 to 3,366 (37%). Total visitor contacts in 2015 were 21,916. This number does not include backcountry preserve visits, as backcountry visits are very difficult to track. The majority of people accessing preserve land are local residents using the area for subsistence harvest or recreation, which is not technically counted as a visit; however accounts for approximately 4,000 entries annually as BELA is a land base for four main communities: Shishmaref, Wales, Deering, and Nome. Coastal areas and rivers are widely used by locals. In winter, the preserve sees subsistence use and increased travel from snowmobile as people travel from village to village.

Priority Resource or Value	Condition Status/Trend	Rationale
Visitor Satisfaction		BELA does not conduct formal visitor satisfaction surveys. Information on visitor satisfaction can be estimated from a visitor log at Serpentine Hot Springs, community meetings, and social media. These sources generally indicate that visitor satisfaction is high.
Scenic Resources		The preserve has no sources of scenic disturbance. Scenic views of hot springs, lava flows, maar lakes, coastal formations, and barrier island complexes exist throughout the preserve.
Interpretive and Education Programs – Talks, Tours, and Special Events		A small but robust interpretive team conducts many interpretive programs for community children and adults, and virtual visitors. The preserve's education program reached 2,258 students through 172 programs in 2015.
Interpretive Media – Brochures, Exhibits, Signs, and Website		The administrative offices and Visitor Center for BELA are located in Nome, Alaska. New exhibits were installed at the Visitor Center in 2015. A new map was recently developed and the preserve recently published a new visitor guide and brochure about Serpentine Hot Springs.
Accessibility		BELA is located in remote Alaska, with no road access or trails and with only limited facilities. Accessibility is challenging for all visitors; however the Nome Visitor Center offers a window into the preserve through various accessible exhibits and films.
Safety		The safety of visitors and employees is a priority for the preserve. The number of reported accidents in the preserve is very low.
Partnerships		Many long-term community partnerships exist to enhance interpretive efforts for the public. Volunteer efforts are critical to operation of BELA and the preserve has worked to recruit more volunteers for many different types of projects.
Recreational Opportunities		Wilderness covers a wide area of the preserve, so there are many opportunities for solitude and hiking. Although there are no formal trails, winter tripods exist for safe travel in the preserve to some locations, such as Serpentine Hot Springs. Limited flightseeing tours are available for visitors to view lava beds, maar lakes and the tundra ecosystem. Visitors are allowed to fish with an Alaska fishing license.
Park Infrastructure web ▶		
Overall Facility Condition Index		Located in remote Alaska, BELA has little park infrastructure. The Visitor Center in Nome is in good condition, but more remote buildings such as ranger cabins and the outbuildings at Serpentine Hot Springs are in fair to poor condition. The Arctic environment is hard on structures, and harsh weather compounds the challenge of maintenance and upkeep.

Priority Resource or Value	Condition Status/Trend	Rationale
Wilderness Character and Stewardship web ►		
Overall Wilderness Character		BELA represents a remote landscape with intact natural ecosystems, and as such, there are few threats to the natural condition of the wilderness. The most prominent threat to the natural quality of BELA's Wilderness is climate change. BELA has already begun to experience localized permafrost thaw, increased severity of coastal storms, habitat change and shrub increase. Within the BELA Wilderness, there is no development and only sparse motorized use (snowmobile and small plane) authorized by ANILCA. In general, the BELA Wilderness offers ample opportunity for solitude and primitive recreation, and shows little sign of human presence on the landscape. In the future, the BELA Wilderness may be affected by the proposed relocation of the Village of Shishmaref to a nearby new location on the mainland; relocation may require development of a 6-mile road across the preserve, in order to provide access to obtain rock materials (for building foundations and roads) from Ear Mountain.
Wilderness Stewardship		BELA has a draft Wilderness Character Narrative, which provides a detailed description of the condition of its wilderness resources. Although there is no current wilderness character monitoring in BELA, wilderness character is considered in all planning and management actions with potential impacts to resources. BELA scopes all potential projects for impacts to Wilderness character and utilizes the Wilderness Minimum Requirements Analysis (MRA) for projects thought to have a moderate or greater impact. During evaluations of research projects, the preserve uses the Science in Wilderness evaluation framework. BELA maintains an active compliance team headed by a NEPA coordinator who presides over evaluation of each project for impacts to natural resources, cultural resources, subsistence, and Wilderness.
Subsistence web ►		
Overall Condition, Opportunity and Continuity for Subsistence Activities		BELA has three primary communities that are affiliated with the preserve and are heavily dependent on subsistence resources from the preserve: Deering, Shishmaref, and Wales. Additionally, some residents of Kotzebue, Buckland, Teller, Brevig Mission, Koyuk, Elim, White Mountain, and Nome occasionally pursue subsistence activities within the preserve. Sharing of subsistence foods with relatives and friends is an important cultural practice extending beyond the region. Opportunity to pursue key subsistence activities is decreasing. This is due to four primary reasons: (1) declines in the biological status of several important wildlife species (caribou, muskox, and moose); (2) reduction in access to resources due to climate change (lack of snow cover for winter travel and increased safety hazards from thinning marine ice); (3) a regulatory system that often conflicts with traditional harvest practices; and (4) increasingly higher costs of pursuing subsistence activities.

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 National Park Service staff and partners to maintain or improve the condition of priority resources and values for this and future generations:

Natural Resources

- NPS Arctic Network Inventory and Monitoring Program conducted monitoring in BELA on vital signs including: muskoxen, brown bears, terrestrial vegetation, lichen communities, permafrost, caribou, yellow-billed loons, large lakes, shallow lakes, streams, lagoons, weather and climate, and fire.
- Over the past 5 years, BELA obtained over \$2 million of project funding for 17 projects to gather baseline data on coastal resources and to develop scientific and logistical preparedness for an oil spill. Projects include multiple agency and non-governmental partners.
- NPS partnered with the Alaska Department of Fish and Game to complete the Seward Peninsula muskox survey. This is the largest interagency wildlife survey in the state.
- A team of youth volunteers, staff, and residents from the villages of Shishmaref and Wales held a marine debris cleanup near Cape Espenberg and Wales for a week in July 2015. A total of 30 km of beach was cleaned of fishing gear (ropes, nets), plastic garbage, foam, and other materials. Story maps and youth videos have been produced on the cleanup and research, which occurred in all five coastal parks in the Alaska Region.

Cultural Resources

- All archival processing has been brought up-to-date. Forty-seven linear feet of archives with a finding aid were produced for the Arctic Parks (Bering Land Bridge, Cape Krusenstern, Kobuk Valley, and Noatak).
- NPS financially supported several Iñupiat place name documentation projects in the region during the 1970s and 1990s. For a number of recent years, NPS staff has been working to identify existing Iñupiat place names data sets that may be suited for digitization into a Geographic Information System (GIS). The preserve will benefit from this important indigenous knowledge.
- Since 2012, the National Park Service has administered a vulnerability assessment program to identify the most significant and at-risk cultural and paleontological resources on the BELA and Cape Krusenstern National Monument coasts. These sites are in danger of being washed away by increasingly frequent storm surges as the climate changes impact Arctic waters.

Visitor Experience

- In 2015, BELA had a grand re-opening of the Nome Visitor Center. New interpretive signs were installed for a variety of distinct Ice Age mammals, and new display cases were installed to share unique features, including mammoth tusks. New dynamic maps on 44-inch touch screen kiosks present interactive content.
- Story map content was created to provide visitors with a virtual visit to the preserve and assist visitors with trip planning on the remote and logistically challenging Seward Peninsula. These story maps are presented on the 44-inch touch screen Nome Visitor Center kiosks and the BELA website.

Park Infrastructure

- The preserve continues to participate in a partnered winter trail-staking project with native village of Shishmaref and Kawerak (trail from Shishmaref to Cape Espenberg).
- The preserve developed a robust recycling program in cooperation with Kawarak, Inc. and the City of Nome.

Wilderness

- BELA introduced Wilderness scoping for every internal and external project in 2008, and a Minimum Requirements Analysis where appropriate, resulting in significant Wilderness impact mitigations and interdisciplinary input on projects.
- BELA tested the Science in Wilderness Evaluation Framework on grazing exclosures in 2012, resulting in a large amount of interdisciplinary input into the project and potential Wilderness impact mitigations.

Subsistence Use

- NPS is completing work on proposed regulation changes allowing customary and traditional uses of horns, antlers, and plant materials collected from parklands.
- NPS continues to work within a regulatory framework to balance subsistence uses with conservation of wildlife populations. The NPS continues to manage four muskox hunts within and adjacent to BELA and coordinate with the State of Alaska. The NPS also continues to manage one moose hunt on federal public lands in Game Management Unit 22E, including Bering Land Bridge National Preserve.
- BELA continues its support of the Western Arctic Caribou Herd Working Group, which was established to “ensure conservation of the Western Arctic caribou herd, safeguard the spiritual and cultural well-being of Alaska Natives and the interests of all users of the herd, and to integrate indigenous knowledge with Western Science.”

Key Issues and Challenges for Consideration in Management Planning

Natural Resources

Declines in Game Species: There are recent declines in several game species important to the ecology of the preserve and for subsistence and sport hunting: muskoxen, caribou, and moose. In addition, there are perceptions that there is an overabundance of wolf and bear populations and increased human/wildlife conflicts. This mix of lower numbers of game species for harvest, and perceived increases in predator species could increase intensive management practices by the State of Alaska adjacent to the preserve. The preserve has no quantitative information regarding the status of wolf and bear populations.

Lack of Fisheries Resource Information: The preserve is lacking fisheries information. There is no baseline data for fish species, and there is concern that climate change could be shifting fish species distributions. Little is known about fish in the preserve's montane lakes that may contain clues to the evolutionary history of fish in Beringia. Fisheries are a major concern for communities who rely on fish for their food harvest: an average of 95% of households in the villages of Shishmaref, Wales, and Deering harvest fish (ADF&G Food Harvest Data 1995).

Terrestrial Ecosystem Changes: Many changes to terrestrial ecosystems are already occurring and others are likely to occur over the coming decades due to climate changes. These include: increase in tall shrubs, loss of ungulate lichen winter range and open tundra currently hosting abundant lichen cover types, increase in fire frequency, increase in winter icing events leading to wildlife winter forage difficulties, and a mismatch of migration, forage, and pollination timing because of earlier green-up and longer snow-free season.

Increased Coastal and River Erosion: Rates of coastline erosion in BELA averaged 0.9 m/yr for the period 2003 to 2014, compared to the long-term average of 0.4 m/yr (1950 to 2014). Sand bars adjacent to the closed lagoon systems and upland bluffs are eroding most rapidly. The later onset of shore-fast ice (accompanied by reduced ice thickness and quicker spring melt) has exposed the coastline to powerful storm surges. For over 25 years, the community of Shishmaref has been threatened by coastal erosion. Coastal erosion threatens private native allotments, where allottees lose land (and occasionally structures) that people depend for subsistence hunting, gathering, and recreation. Coastal erosion directly affects beaches, nearshore ecosystems, fragile archeological sites, and terrestrial habitat. Release of sediment and organic carbon alters nutrient fluxes in nearshore marine and lagoon ecosystems (Jorgenson and Brown 2005). It is important that the preserve work with local communities—like Shishmaref—that are bordered by preserve lands, in order to create mutually beneficial strategies that could include land exchanges, transportation infrastructure, and exploration of new technology to continue to responsibly utilize resources.

Ear Mountain Road and Shishmaref Village Relocation: The village of Shishmaref is subject to major coastal erosion; relocation of the village to a nearby new location on the mainland is proposed. Constructing a new village will require large amounts of rock materials for building foundations and roads. Ear Mountain is the closest source of rock materials—13 miles from Shishmaref Inlet. A new road would need to be constructed to access Ear Mountain, and about 6 miles of the road would cross BELA. If it is found to be necessary to develop access from Shishmaref Lagoon to obtain rock from Ear Mountain (rather than from other sources), a right-of-way could be granted under the authority of section 1110(b) of ANILCA. No site for relocation of the village has yet been decided upon. Funding for the proposed village relocation and a road to Ear Mountain has not been secured.

Increased Development and Shipping in the Bering and Chukchi Seas: There is an increase in shipping, oil and gas development, tourism, and commercial fisheries in the Bering and Chukchi Seas. Many of these changes have been facilitated by the opening of the Northern Sea Route, due to retreating sea ice. There is great potential for resource damage and problems with subsistence harvest due to contamination, resource overharvest, and increased vessel traffic. Oil spills are a major concern. Increased ship traffic could cause collisions with marine mammals, and disturbance of communication and migration routes for marine mammals and fish (due to undersea vessel noise pollution). Coastal and lagoon resources have limited baseline information; BELA has very limited ability to protect coastal areas or to conduct emergency response if offshore spill or vessel accident occurs.

Cultural Resources

Archeological and Paleontological Resource Loss: Coastal zones and watersheds are being impacted by increased erosion due to the lack of sea ice, faster sea ice melt, permafrost thaw, and increased and stronger storm events. The preserve is home to thousands of archeological sites that date back an estimated 13,000 years or more. The preserve has not been surveyed for paleontological resources. While recent survey work has uncovered some new sites, an equal or greater number have been lost to erosion. The preserve needs to continue to create an inventory and monitoring protocol for these sites and develop a method to assess which sites are at most risk so that plans can be made to mitigate site damage or conduct excavation. In addition, exposed resources are at a higher risk for looting, which has become one of the preserve's most pressing resource protection concerns. The preserve lacks adequate resources and plans for reducing archeological and paleontological looting.

Lack of Baseline Documentation: BELA needs to increase baseline documentation of its ethnographic resources, cultural landscapes, and historic structures. Complete baseline documentation will enable the preserve to better care for these resources. Several baseline documents need to be completed, including an ethnographic overview and assessment, several cultural landscape inventories and cultural landscape reports, and several historic resource studies. It is also important that BELA complete National Register documentation for key cultural resources.

Park Infrastructure

Lack of Facilities Maintenance: BELA has over \$900,000 in deferred maintenance costs. Most of this cost is associated with the estimated cost of repair of two old NPS houses, planned for removal. New housing will be needed to replace the removed homes. Backcountry facilities that are critical to visitor safety (including four public emergency shelter cabins and facilities at Serpentine Hot Springs) receive limited funding for maintenance. The emergency shelter cabins are in serious condition; the cost to rehabilitate these facilities has not been calculated. Winter snowmobile tripod trail markers need maintenance along the approximately 120 miles of winter trail marked in the preserve. A Park Asset Management Plan is needed to create a strategy to work on facilities and maintenance issues so that facilities are maintained on a preventative basis, with fewer emergency issues.

Visitor Experience

Increased Cruise Ship Visitation: The recent advent of Arctic cruise ship tourism and the opening of the Northwest Passage have brought increased cruise ship tourism to Nome. This has increased the number of interpretive programs that the preserve offers; however, there has not been an increase in support for staffing or supplies. The preserve needs to complete the Serpentine Hot Springs Strategic Plan and update its Interpretive Prospectus to address increased visitation, changes to visitation and new multi-media and educational programs.

Subsistence

Food Security Concerns: Subsistence foods are the main dietary source in the communities around the Bering Land Bridge area. Climate change has changed freeze-up timing, snowfall, and ice thickness, which has impeded local people's ability to travel into the preserve by snowmobile to hunt and fish for species like caribou, moose, white fish, and muskoxen. Climate change affects the duration and thickness of sea ice that marine mammals require to migrate into Arctic waters. Due to this, hunters who depend on marine mammals must travel many more miles to hunt for walrus and seal and once-stable sea ice is now much more treacherous. The need to travel far from villages to find these animals has also created unsafe situations for hunters.

It is estimated that more than 67% of households surrounding the preserve harvest marine mammals ([ADF&G 2016](#)). Communities are reporting subsistence food shortages and as the climate changes, the demand for and competition for subsistence food resources will continue. It is important that the preserve work with local people to identify flexible harvest strategies and embrace adaptive management techniques to help ensure that subsistence food sources are managed for continued harvest. In addition, the preserve should work to document and utilize indigenous knowledge to make informed decisions with local peoples who have gained extensive ecological knowledge from their experiences with the land and other sources (e.g., formal schooling and contact with biologists).

Chapter 1. Introduction

The purpose of this State of the Park report for Bering Land Bridge National Preserve (BELA, “the preserve”) is to assess the overall condition of the preserve’s priority resources and values, to communicate complex 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 National Park Service staff to maintain or improve the condition of priority 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 preserve, based on BELA’s purpose and significance, as described in the preserve’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 BELA’s priority resources and values.
- Summarizes and communicates complex scientific, scholarly, and operations factual information and expert opinion using non-technical language and a visual format.
- Highlights stewardship activities and accomplishments to maintain or improve the state of the preserve.
- Identifies key issues and challenges facing the preserve to inform park management planning.

The process of identifying priority resources by BELA staff and partners, tracking their condition, organizing and synthesizing data and information, and communicating the results will be closely coordinated with BELA planning processes, 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 BELA, based on the preserve’s purpose and significance within the National Park System, as documented in the preserve’s foundation document and other planning documents. This report summarizes and communicates the overall condition of priority resources and values based on the available scientific and scholarly information and expert opinion, irrespective of the ability of the superintendent or the National Park Service to influence it.

Climate impacts many aspects of park management, from ecological systems to park infrastructure. The climate is changing and human influence is now detectable in nearly all major components of the climate system, including the atmosphere and oceans, snow and ice, and various aspects of the water cycle ([IPCC 2013](#)). Trends in global climate change are even more pronounced in high latitudes and polar regions ([Larsen et al. 2014](#)). As a region, Alaska has warmed more than twice as rapidly as the rest of the United States over the past 60 years, with average annual air temperature increasing by 3 °F and average winter temperature by 6 °F ([Chapin et al. 2014](#)). The observed impacts of a warming climate in Alaska include shrinking sea ice, shrinking glaciers, thawing permafrost, changing ocean temperatures and chemistry, increased coastal erosion, and more extensive insect outbreaks and wildfire (e.g., [Larsen et al. 2014](#), [Chapin et al. 2014](#), [Markon et al. 2012](#)).

Even with multiple lines of evidence that Alaska is warming, interpreting temperature trends and other climatic indicators is complicated. Climate in Alaska is dynamic and nonlinear, with strong linkages to atmospheric and oceanic processes, such as the position of the polar jet stream or the frequency of El Niño events (Papineau 2001). An important climate pattern, evident in the relatively few long-term climate stations located in parks, is the Pacific Decadal Oscillation (PDO). Much of the warming that has occurred since the middle of the 20th century occurred in 1976 as a stepwise shift, attributed to a climatic transition from a cool to a warm phase in the PDO ([Chapin et al. 2014](#), [Bieniek et al. 2014](#)). In the early 2000s the PDO shifted back to a cooler phase resulting in statewide temperatures that were cooler than the previous decades ([Bieniek et al. 2014](#)). The most recent years have seen yet another shift back to a warm phase that may or may not persist, but has resulted in two of the warmest years on record for Alaska in 2014 and 2015 ([NOAA 2016](#)). The north slope of Alaska has continued to warm despite changes in the PDO. Nonlinear responses and regional variations are expected to continue to occur as the planet adjusts to global scale change ([IPCC 2013](#), [Larsen et al. 2014](#)). Recent studies suggest that warming Arctic temperatures weaken the temperature gradient between the poles and lower latitudes leading to a wavier jet stream, which results in more persistent weather patterns and extreme conditions such as cold spells, heat waves, droughts, and flooding ([Francis and Vavrus 2015](#)). The data and information gathered from national parks provide an important piece of the puzzle in understanding both the drivers and effects of climate change.

With climate change progressing steadily in the Arctic, sea ice has retreated by an average of 1.3% per year since the 1950s ([NSIDC 2015](#), [Perovich 2015](#)). Through 2015, the September Arctic sea ice extent has decreased by 13.4% per decade, relative to the 1981 to 2010 average. The nine lowest September sea ice extents have occurred in the last nine years. In the summer months, the Arctic ice pack is now sufficiently far north to allow for passage of vessels via both the Northern Sea Route (above Siberia) and the Northwest Passage (through the Canadian Archipelago to Greenland). As a result, this park unit is now more vulnerable to marine incidents (e.g., oil spills) and coastal erosion. The thinning sea ice has made subsistence hunting for marine mammals much more dangerous and has limited hunting opportunity drastically ([Arctic Council 2009a](#)). BELA will incorporate climate considerations into decision processes and management planning as adaptation options that may deviate from traditional practices are considered.

In 1971, Native claims were resolved by passage of the Alaska Native Claims Settlement Act (ANCSA). In addition to providing Native land claims, this act also provided for withdrawal of 80 million acres for possible designation as national parks, fish and wildlife refuges, national forests, and wild and scenic rivers. BELA is among those park areas first established in 1978 by Presidential Proclamation by President Carter. Most of the national park units in Alaska, including BELA, were established or expanded under the Alaska National Interest Lands Conservation Act (ANILCA), adopted on December 2, 1980. ANILCA's passage culminated more than 20 years of deliberation on federal land claims after Alaska statehood.

Guided by legislation and the knowledge acquired through management, research, and civic engagement, statements of significance define what is most important about the preserve's natural and cultural resources and values. The significance statements are used to guide planning and management decisions to ensure that priority resources and values are preserved. Significance statements for BELA are:

1. Bering Land Bridge National Preserve protects and provides opportunities for the study of paleontological, archeological, and biological resources that reveal a record of migration across the land bridge between Asia and North America.
2. Bering Land Bridge National Preserve protects and interprets, in collaboration with Alaska Natives, thousands of years of use and occupation by the Iñupiat people and their continuing subsistence way of life.
3. Bering Land Bridge National Preserve protects natural resources and native habitats that provide the opportunity for local rural Alaska residents to engage in customary and traditional subsistence uses.
4. Bering Land Bridge National Preserve protects the integrity of the Serpentine Hot Springs, its natural setting, and its cultural and spiritual significance.
5. Bering Land Bridge National Preserve protects and provides opportunities to study and interpret a variety of high latitude volcanic features unique to North America.
6. Bering Land Bridge National Preserve protects reindeer herding habitat to ensure the continued opportunity for reindeer herding by Alaska Natives.

Located on the Seward Peninsula, north of the city of Nome and just below the Arctic Circle, the preserve is comprised of 2.7 million acres of tundra and coastal ecosystems. The preserve protects a remnant of the 1,000 mile wide Pleistocene land bridge (also known as the subcontinent of "Beringia") that once connected Asia and North America, providing a migration route for animals, plants, and the first people to North America. The preserve is not connected to the state road system; the preserve's administrative office and visitor center are located in Nome. Commercial airline service is available to Nome and Kotzebue, and access to parklands is typically by small charter aircraft from Nome or Kotzebue. Local visitors utilize four main forms of access: small aircraft, small boat, snowmobile, and hiking. The village of Shishmaref and Shishmaref Inlet are just outside of the northwest boundary of the preserve. Serpentine Hot Springs, a natural geothermal feature located within a scenic valley, is the most visited destination in the preserve; a bunkhouse and bathhouse at Serpentine Hot Springs are open to visitors year-round.



Map of Bering Land Bridge National Preserve

Chapter 2. State of the Park

The State of the Park is summarized below for six categories—Natural Resources, Cultural Resources, Visitor Experience, Park Infrastructure, Wilderness Character, and Subsistence—based on a synthesis of the National Park Service’s monitoring, evaluation, management, and information programs, as well as expert opinion. Brief resource summaries are provided below for a selection of the priority resources and values of the preserve. Clicking on the [web](#) ► symbol found in the tables and resource briefs below will take the reader 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 National Park Service staff and subject matter experts involved in developing the report. This expert opinion and professional judgment are derived from the in-depth knowledge and expertise of BELA and regional staff involved in the day-to-day practice of all aspects of stewardship and from the professional experience of 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). Note that climate change adaptation requires park managers to continue to learn from the past, but attempting to manage for conditions based on an understanding of the historical “natural” range of variation will be increasingly futile in many locations. Thus, these reference conditions, and/or judgment about resource condition or trend may evolve as the rate of climate change accelerates and park managers respond to novel conditions. Management must be even more “forward looking,” to anticipate plausible but unprecedented conditions, also recognizing there will be surprises. In this context, the preserve will incorporate climate considerations into decision processes and management planning as it considers adaptation options that may deviate from traditional practices.

2.1. Natural Resources

Air Quality			
			web ►
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Ozone	Ozone Annual 4th-Highest 8-Hour Concentration		No condition data are available for ozone concentration. However, given the scarcity of regional ozone sources, it is likely that levels fall well below advisory thresholds.
Visibility	Haze Index		Based on data from the Bettles monitoring site (approximately 350 miles distant), visibility is in good condition. While haze is generally low, the preserve experiences intermittent periods of high particulate haze from local or regional summer fires.

Air Quality (continued)

[web](#) ▶

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Deposition	Nitrogen Wet Deposition, Sulfur Wet Deposition, Dry Deposition		Air quality is not monitored in BELA. The closest air monitoring station is in Bettles, which is 350 miles away. Regional pollution is likely to increase due to increased shipping traffic through the Chukchi Sea and oil development in the National Petroleum Reserve – Alaska. No trend has been assigned due to insufficient monitoring timespan. Data from the Bettles National Atmospheric Deposition Program (NADP) monitor (350 miles distant) and adjacent areas suggest that wet nitrogen deposition (ammonium, nitrates) is likely to be in the range of 0.2–0.5 kg/ha/yr level (NADP Monitor ID: AK06, NPS-ARD 2015, Brumbaugh et al. 2016). National and Arctic nitrogen critical loads assessments rated Arctic tundra as extremely sensitive with a critical load of 1–3 kg/ha/yr of nitrogen deposition (Pardo et al. 2011, Linder et al. 2013). Ecosystems such as the preserve’s lakes, headwater streams, and lichen-rich tundra are sensitive to the effects of acidification from atmospheric nitrogen and sulfur deposition. Acidification effects can include changes in water and soil chemistry that impact ecosystem health, lichens, fish, invertebrates, and phytoplankton (Sullivan et al. 2011a, Sullivan et al. 2011b). Heavy metals are at or near Arctic baseline levels based on moss monitoring (Neitlich et al. 2016, Hasselbach et al. 2005).
Contaminants	Mercury and Persistent Organic Pollutants		Mercury and organic pollutants are not monitored in BELA. Persistent organic pollutants were low in water, air, snow, lake sediment, and vegetation of Noatak National Preserve, about 200 miles distant (Landers et al. 2008). However, concentrations of historically-used pesticides were generally mid-range along the spectrum of western U.S. National Parks. The banned pesticide Dieldrin in long-lived fish such as lake trout exceeded the health advisory threshold for subsistence users while Chlordanes approached the advisory threshold for fish-eating birds. The 2011–2013 average wet mercury deposition is very low at the adjacent monitoring station in Bettles at 2.1 micrograms per square meter (NADP MDN Monitor ID: AK06) and predicted methylmercury concentrations in surface waters are very low, estimated to be 0.02 nanogram / liter (USGS 2015). While much lower than NPS Air Resource Division benchmarks, mercury concentrations in some fish in both parks exceeded thresholds for both subsistence users and wildlife health (Landers et al. 2008, NPS-ARD 2015).

Resource Brief: Historical and Projected Changes in Climate

Climate, by determining the temperature and precipitation regimes for any ecosystem, is widely recognized as one of the most fundamental drivers of ecological condition. The climate patterns of Alaska are primarily influenced by latitude, continentality, and elevation. The high latitude drives the seasonal pendulum of available solar radiation; areas farther north have limited incoming solar warmth in the winter and an abundance of available light in the summer. Major mountain ranges act as barriers to the moisture from surrounding ocean waters. Large scale atmospheric and oceanic circulation patterns influence seasonal and annual weather patterns in the parks, like the repositioning of the polar jet stream and the Aleutian low pressure system or the frequency of La Niñas and El Niños (Papineau 2001). Each of these can affect the regional patterns of storm tracks, prevailing winds, snowfall amounts, and the extent of sea ice (ACIA 2004).

BELA is within the West Coast climate division as defined by Bieniek et al. (2012). There are two long-term climate stations that anchor the West Coast climate zone near the preserve; Nome on the southern coast of the Seward Peninsula and Kotzebue to the northwest. Average seasonal and annual temperatures from these sites are shown in the graphs below. For consistency, observations are from 1949, the time period for which the most reliable meteorological data are available. Temperature and precipitation projections over the next century have been calculated on a monthly time scale for both locations. The projections are based on the PRISM model historical baseline projected at a 2 km resolution using the mid-range emissions scenario (representative concentration pathway RCP 6.0). These graphs are useful in looking at overall trends in temperature increases versus specific values due to the uncertainty in models and natural climate variability ([SNAP 2016](#)).

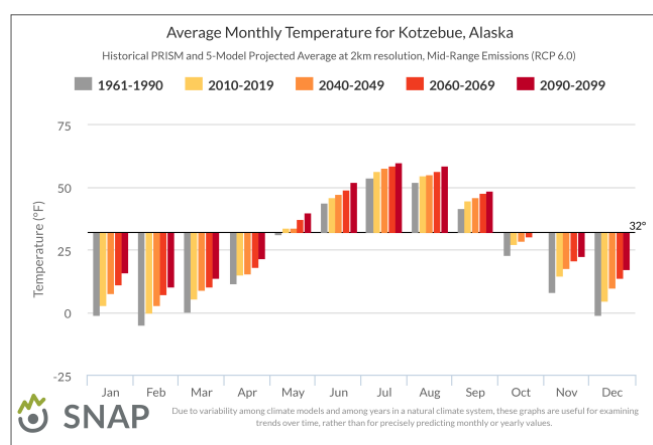
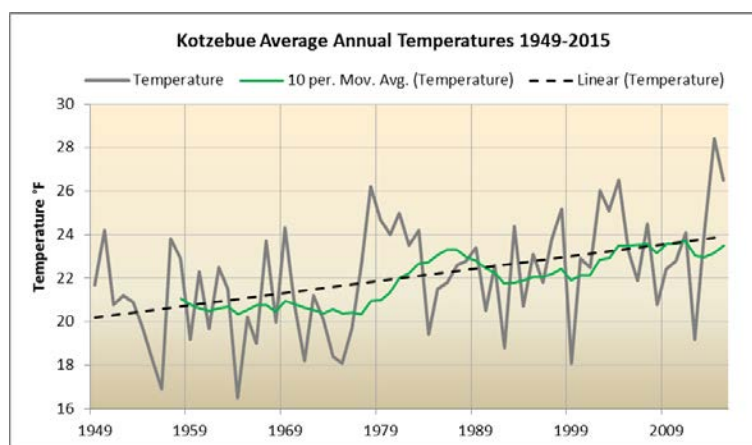
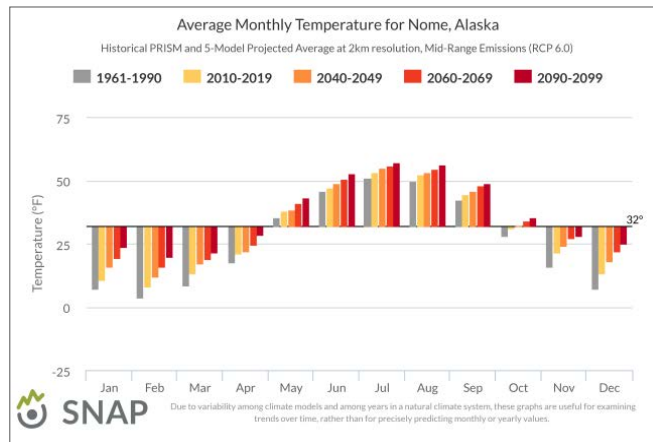
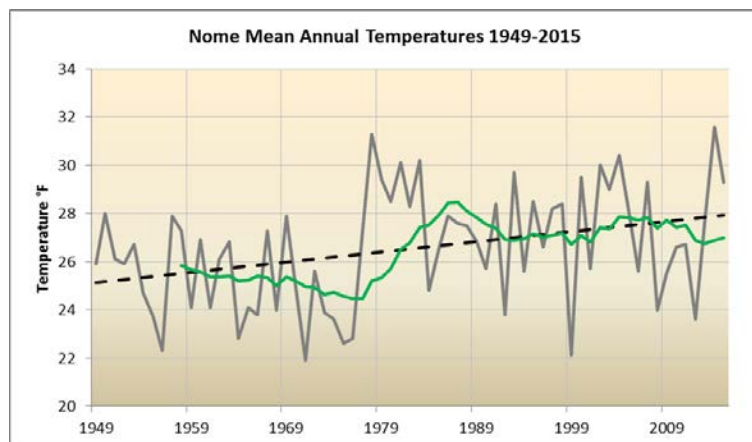
Historical trends and future projection for temperature

The observed temperature trend is non-linear, with multi-decadal variations (graphs below left). The increase in the mean annual temperature is significant with temperatures warming ≈ 2.8 °F when a simple linear regression is applied to the 67-year record at Nome and ≈ 3.8 °F at Kotzebue. Considering just a linear trend masks important variability in the time series; the record spans the phase shift of the Pacific Decadal Oscillation (PDO) in 1976 where annual temperatures at these locations, and at most locations around the state, abruptly shifted up by ≈ 2.5 °F in a single year and then persisted in a warmer phase for the next several decades. The trend in annual temperatures since 1977 has been relatively stable. However, over the past several years the PDO index has had the highest, most persistent positive values since the 1980s, coinciding with a strong El Niño pattern, resulting in two of the warmest years on record for the state of Alaska in 2014 and 2015.

Seasonally, winter temperatures show the most significant increase at both locations. Summer temperatures have also increased significantly over the period of record. Temperatures are projected to increase for all seasons by mid-century, with the greatest increases likely in winter (graphs below right). There is general agreement among individual climate models in the direction and magnitude of warming over the coming decades.

Persistent warm periods and temperatures that reach above freezing in winter can pose problems to an ecosystem that is dominated by snowcover for a good portion of the year: snow turns to rain, which leads to icing, which makes foraging difficult; plants are subject to desiccation because of low or no snow cover; and subnivean fauna are left unprotected. Extremes in spring temperatures, especially in late spring can have repercussions related to the timing of many phenological events that are triggered by the return of warmer temperatures in May. An increase in summer temperatures can lead to many scenarios that fall out of the “normal” range of expectations including impacts to the fire season, insect outbreaks, wildlife migrations, aquatic ecosystems, and active layer thawing. Changes in early fall season temperatures can once again impact the timing of many phenological events that are triggered by cooler temperatures and decreasing daylight. Warmer fall temperatures may also delay the onset of shorefast ice, leaving coasts vulnerable to erosion during fall storms.

Resource Brief: Historical and Projected Changes in Climate (continued)



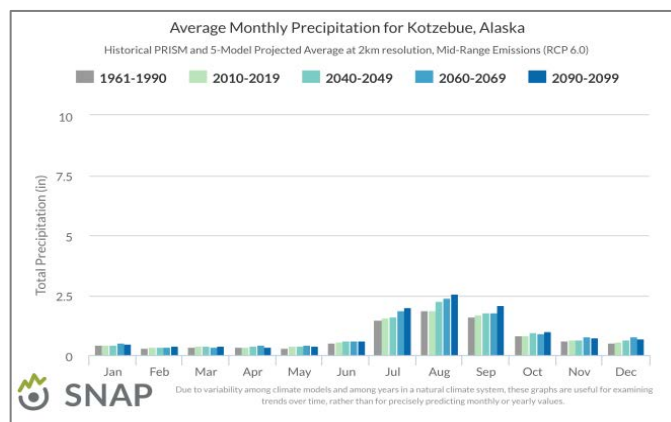
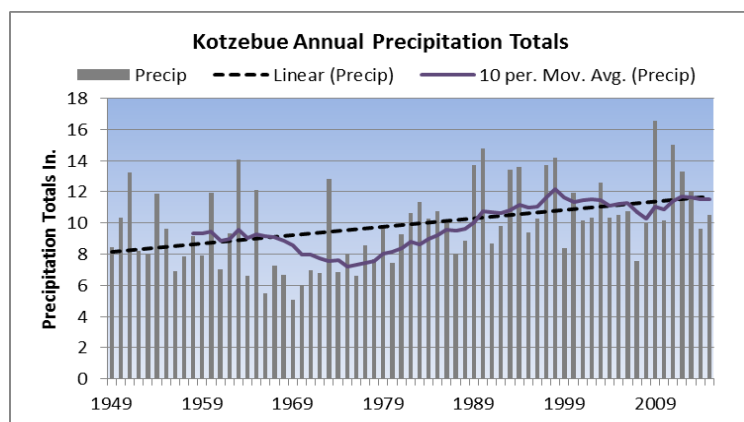
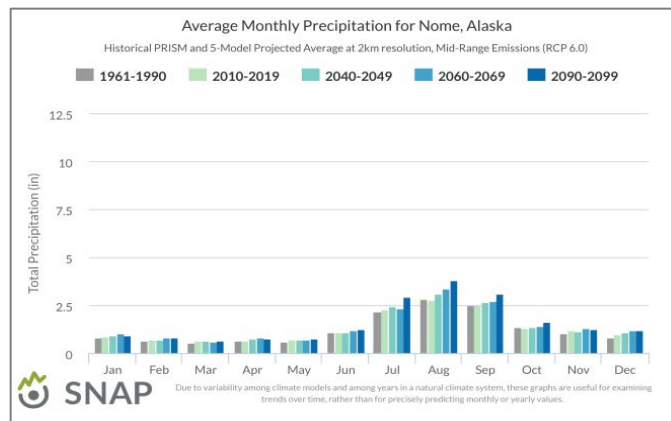
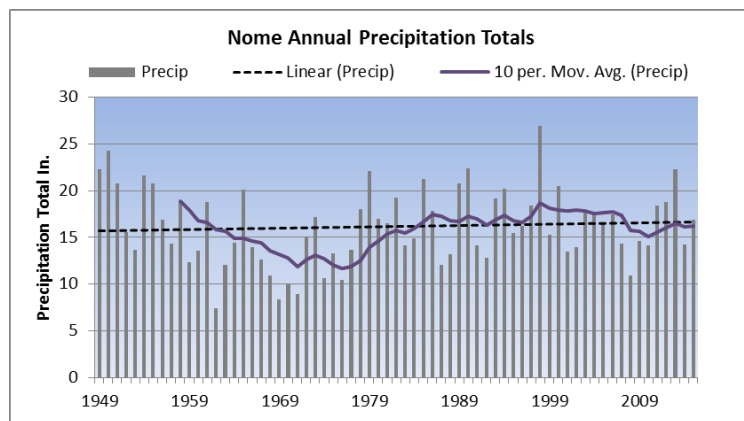
Average annual temperatures at Nome (top left) and Kotzebue (bottom left). The green lines show the **10-year moving averages**. The dotted lines show a simple linear regression trend. The Scenarios Network for Alaska and Arctic Planning (SNAP) monthly temperature projections for the next century are shown for Nome (top right) and Kotzebue (bottom right) (SNAP 2016).

Historical trends and future projection for precipitation

Observed annual precipitation totals have increased significantly at Kotzebue, with most of the increase apparent in the winter and spring seasons. In Nome, the precipitation totals have increased over the period of record, but not significantly, with the largest increases occurring during the winter season. Snowfall records show a significant increasing trend for annual and winter snowfall totals at both locations. Total annual precipitation is projected to increase throughout the next century, particularly in the summer season (graphs below right) (SNAP 2016). Precipitation variability is likely to remain large over the coming decades (larger uncertainty in precipitation than in temperature projections; Stewart et al. 2013). Seasonal trends show the extreme variability in precipitation between seasons and among seasons, and can also be used to highlight extreme events that have large ecological implications for humans (i.e., floods, droughts) and wildlife (i.e., high or low snowfall).

Increasing winter temperatures can lead to an increase in the number or intensity of rain-on-snow events that could potentially disrupt the path to the food supply for wildlife. The precipitation projections indicate that late spring may see an increase in precipitation amounts. Late spring snowfall events can interfere with timing of bird migrations, wildlife health, green-up, and other ecological processes that begin once the snow has melted. Projections show that precipitation will increase the most during the summer months in Kotzebue and Nome; more rain and more intense rain events can lead to flooding, erosion, and permafrost instability.

Resource Brief: Historical and Projected Changes in Climate (continued)



Total [annual precipitation](#) at Nome (upper left) and Kotzebue (lower left). The purple lines show the [10-year moving average](#). The dotted lines show a simple linear regression trend. The Scenarios Network for Alaska and Arctic Planning (SNAP) monthly precipitation projections for the next century are shown for Nome (top left) and Kotzebue (bottom right) ([SNAP 2016](#)).

Other projections

In addition to warmer mean temperatures and changes in annual precipitation, climate change will exhibit itself in many other ways. Permafrost, which is present throughout the preserve, is projected to thaw across large portions of Alaska by 2100 under both low and high emissions scenarios, altering local hydrology and potentially impacting infrastructure ([Stewart et al. 2013](#)). The growing season is projected to increase 15–25 days by mid-century, and warmer spring temperatures are already linked to increased wildfire activity in Alaska ([Stewart et al. 2013](#)). Global climate change will interact with regional phenomena, such as the Pacific Decadal Oscillation. The phase of the PDO (negative or positive) may modify observed climate trends, with the negative phase dampening and the positive phase exacerbating overall climate change trends. Significantly warmer temperatures and a more variable precipitation regime may lead to both more frequent droughts and more severe flooding and erosion.

Geological Resources


[web](#) ▶

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Coastal Formations	Coastline Stability		Preservation of BELA's striking and diverse coastal formations, geomorphology, and habitat are described in the preserve's enabling legislation. Rates of coastal erosion in BELA averaged 0.9 m/yr for the period 2003 to 2014, compared to the long-term average of 0.4 m/yr (1950 to 2014). Erosion rates are highest along the north-facing coastline where barrier island complexes adjacent to Shishmaref Inlet and Cowpack Lagoon are eroding at an average rate of 1.2 m/yr for the period 2003 to 2014, (versus the long term average of 0.8 m/yr for that location). The rate of change is slower along ice-rich permafrost bluffs (average rate of change 0.4 m/yr). Aggradation (material deposition) is predominantly found along the shoreline of Cape Espenberg, with a maximum rate of 3.0 m/yr and mean of 0.9 m/yr for the period of 2003 to 2014. Coastal erosion is threatening the village of Shishmaref, which, as a result, may require a road through BELA to access gravel for a new townsite. Degradation of large ice-rich <i>yedoma</i> features (ancient ice deposits in soil) has been observed along the coast and locally on lakeshores. In some locations, the beaches shielding <i>yedoma</i> from the waves have been lost and the <i>yedoma</i>-rich bluffs are being undercut by the ocean and slumping into the water. Thaw erosion of bluffs is expected to increase with sea level rise and the increase in wave action associated with loss of sea ice and the later onset of shorefast ice in the fall.
Tors	Percentage of Known Sites in Good Condition		The Granite Tors are volcanic remnants that date back to the Cretaceous period, formed underground, and exposed by erosion. These spectacular rock outcrops are a landmark in the area, and have cultural significance. The tors also provide habitat to wildlife. The dry uplands around Serpentine Hot Springs offer easy walking in a striking landscape of granitic tors and sweeping views. These uplands are easily accessed from the Serpentine airstrip and bunkhouse area and are very appealing to hikers. Lichen communities on and around the tors are diverse and fragile. They have been somewhat damaged on the tors closest to Serpentine's facilities. Some trail formation has occurred in these areas over the years; however trail formation does not appear to be increasing. Visitor education is important in keeping trail formation minimal.

Geological Resources (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Caves	Percentage of Cave Resources Undisturbed		BELA has two types of caves: (1) karst caves formed by dissolution of limestone, and (2) lava tubes. The Trail Creek Caves are overhangs and horizontal shafts formed by dissolution and erosion along fracture planes in limestone. Many of the caves contain faunal remains (e.g., bison, horse, caribou, bear, and mammoth) that date back 16,000 years. Other areas with limestone contain alcoves and overhangs that may also contain archeological and paleontological resources, but have yet to be studied. Lava flows of the Lost Jim Lava field contain lava tubes. Little has been documented about these caves, but a reconnaissance of the caves is scheduled for 2016. The archeological and paleontological resources of some of the Trail Creek Caves have been studied, but more work could help understand the paleodiversity of BELA and history of human habitation. The Trail Creek Cave has been impacted from ongoing human use.
External Development	Abandoned Mine Lands		Small-scale mining occurred in what is now BELA for nearly a century. Several abandoned placer gold mines and mining features still exist and are considered cultural resources. Placer gold claims at Humbolt Creek were active until the late 2000s. There are fourteen sites in the preserve related to historic placer gold mining. At Cape Espenberg, an oil and gas well was drilled and then plugged in 1974. The Fairhaven Ditch historic canal is 38 miles (61 km) long. The ditch was dug in 1906 and 1907 without the benefit of heavy equipment, and was used to transport water from Imuruk Lake to placer mining areas. It is one of a number of canals dug on the peninsula. Cabins built to house workers and monitor water flow still exist. The ditch is listed on the National Register of Historic Places.

Geological Resources (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
External Development (continued)	New External Developments		Potential external developments that may impact BELA include: oil and gas exploration near Cape Espenberg, placer mining for gold on BELA's southern and eastern border (Chicago and Inmachuk Creeks and Taylor Creek), and a proposed road to Ear Mountain for gravel mining to support the village of Shishmaref relocation efforts. Exploration is occurring along most of the eastern and southern boundaries of the preserve. A deepwater port has been proposed for Nome, and continued study of port development is occurring in three locations (Cape Blossom, Nome, and Port Clarence). Vessel traffic has increased dramatically and has increased the risk of marine incidents that have the potential to damage sensitive coastal ecosystems. Cruise ship traffic is now present in the region for the first time and may focus travel along nearshore locations where wildlife is abundant.
	Hazardous Materials Removal at Abandoned Mines and Formerly Used Defense Sites (FUDS)		A 2007 environmental site assessment at the former Humbolt Creek Mine noted a small amount of petroleum released into the ground from one of the barrels left on site. Mercury in a quantity near the Alaska Department of Environmental Conservation clean-up limit was also present in the soils beneath the blacksmith shop. It is recommended that the barrels be removed to prevent further release of petroleum into the environment. Lava Lake Military Weather Station was operated in the 1940s. During World War II, the U.S. Army developed the site as a weather station, and abandoned it shortly after the war ended. In 1993, the U.S. Army Corps of Engineers hired contractors to remediate and remove material from Formerly Used Defense Sites (FUDS) located throughout the Seward Peninsula. Many 55-gallon drums of gasoline were removed from Lava Lake. Residual soil contamination consisted mainly of diesel, bunker oil, and their chemical constituents, and low levels of chlorinated solvents, pesticides, and metals. Three hundred square feet of disturbed soil was revegetated and seed and fertilizer were applied in former drum storage areas. This vegetation should minimize wind and sheet runoff erosion while the contaminants naturally degrade over time.

Paleontological Resources


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Fossils	Percentage of Park-wide Inventory Complete		Fossils are non-renewable resources that are irreplaceable windows into the past. Once a fossil is gone, it is gone forever. Very few paleontological surveys have been completed in the preserve. A cursory paleontological inventory was completed by Elder et al. (2009). A database of the few known paleontological resources is under development and expected to be completed in 2017. BELA contains fossils in four contexts: (1) Ordovician through Proterozoic (440 to >540 million years ago) marine invertebrate fossils in the limestone of Ear Mountain; (2) Paleozoic (250–540 million years ago) marine invertebrate fossils in the metamorphic rocks of the Nome Group located in the central mountains of the preserve; (3) Pleistocene and Holocene (2.6 million years ago to present) vertebrate and plant fossils within caves formed in marble units of the Nome Group and in lava caves of the Lost Jim Lava flows; and; (4) Pleistocene and Holocene vertebrate and plant fossils within unconsolidated deposits along river gravel bars and along the coast. The marine invertebrate fossils of the preserve are generally common marine invertebrate fossils. Pleistocene and Holocene vertebrate and plant fossils are present in a handful of discrete outcrops in caves, along river bluffs, and along beaches; and found in abundance, but out-of-context, along river gravel bars. BELA hosts a buried layer of soils and plant remains from approximately 17,000 years ago that was covered by volcanic ash. This layer contains remnants of the drier grasslands present late during the last ice age in much of Beringia (Hopkins 1967).
	Percentage of Known Sites in Good Condition		A paleontological resources inventory and field-based site assessment to establish baseline resource monitoring needs has not been done. Non-permitted collecting in Arctic parks has been observed, but has not been officially documented. Fossils in sea bluff exposures and river cut banks are at high risk of being eroded.

Water Resources

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Lake Communities and Ecosystems	Surface Area and Number of Lakes		Recent analyses of lake area change by remote sensing indicate that in recent decades the area of lakes and ponds has been stable or decreasing in BELA (Jones et al. 2011, Swanson 2013).
	Water Quality (chemistry, temperature, concentration of organics, turbidity)		Sampling for water quality is infrequent. No long-term records exist of lake chemistry in BELA. Lake chemistry in the Arctic is sensitive to the effects of climate change and disturbance (e.g., permafrost thaw and erosion; Vonk et al. 2015). In BELA, lake chemistry varies across sites as a function of landscape unit and origin. There are several large maar lakes (Devil Mountain Lakes, Killeak Lakes) and other lakes influenced by volcanic processes (Imuruk Lake) that are pristine with nutrient concentrations at or near analytical detection limits (O'Donnell et al. 2015). There are also a broad range of small thermokarst lakes that have developed in response to past thawing of ice-rich permafrost and subsequent subsidence of the ground surface. Active thermokarst processes can increase particulate nitrogen and phosphorus concentrations, which in turn can affect light penetration and productivity (Larsen et al. <i>in prep</i>). Increased dissolved organic carbon loading has caused “browning” of surface waters in many high-latitude basins, altering lake structure and function (Roulet and Moore 2006). Shallow lakes are generally warmer and more responsive to warmer air temperatures than deeper lakes in BELA, yet all lakes are projected to warm considerably over the next century (Arp and Jones 2016).
Lagoon Communities and Ecosystems	Water Quality (dissolved oxygen, salinity, conductivity, pH, surface area)		There have been only two sampling pulses for water quality in the lagoons, so formal trend analysis is not possible; however, general water quality conditions appear to be stable within natural variability. Sampling for water quality is infrequent. All water quality parameters measured within the lagoons are within state standards. Water quality changes relatively rapidly with significant causes being freshwater inflows, oceanic connectivity, and wind-driven mixing throughout the shallow (<2m) lagoons leading to a lack of vertical stratification in water quality parameters. Individual localized lagoon histories drive water quality and caution should be taken when evaluating water quality results.

Water Resources (continued)

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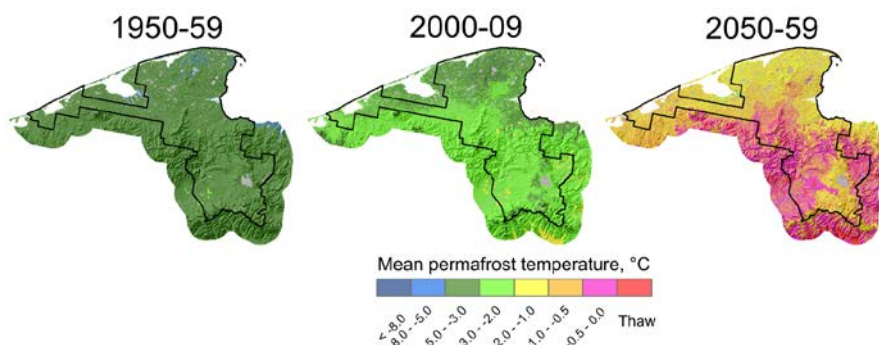
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Stream Communities and Ecosystems	Water Quality (chemistry, temperature)		No long-term records exist for stream chemistry in BELA. Arctic stream chemistry is sensitive to the effects of climate change and disturbance (e.g., permafrost thaw; Vonk et al. 2015). A 2014 survey of 10 streams in BELA indicated that water quality was unimpaired with respect to nutrient concentrations (O'Donnell et al. 2015). Inorganic nitrogen and phosphorous concentrations were typically at or near the analytical detection limit, suggesting that primary productivity in these systems is strongly limited by nutrient availability. Thick deposits of ice-rich, Pleistocene loess (i.e., <i>yedoma</i>), which stores large quantities of organic carbon and nitrogen (Ewing et al. 2015), underlie many BELA watersheds. Warming and thawing of permafrost may mobilize and transport this carbon and nitrogen from soils to the river, altering stream chemistry and ecosystem processes. Thawing of ice-rich permafrost in BELA may also impact subsurface hydrology and groundwater discharge to streams, which can modify stream chemistry (O'Donnell et al. 2015).
	Flow (magnitude and timing)		There are no stream gauges or long-term discharge measurements in BELA. The magnitude and seasonality of discharge is changing in many Arctic streams and rivers, and is likely changing within preserve boundaries. Annual river discharge is generally increasing across the Arctic (e.g., Peterson et al. 2002), primarily due to increased net precipitation. In many watersheds, spring snowmelt is occurring earlier. Groundwater discharge to stream flow is increasing in the discontinuous permafrost zone of Alaska (Walvoord and Striegl 2007), but little is known about continuous permafrost regions, such as BELA.

Resource Brief: Permafrost Temperature

Permafrost underlies most of BELA and affects nearly everything in the ecosystem, from soils and vegetation to water and wildlife.

Permafrost is ground that does not thaw in the summer due to a cold climate. Permafrost perches water near the surface, making soils wet. The striking polygonal patterned ground so characteristic of the Arctic is due to permafrost. Ice can build up in the ground and then thaw, producing pits, ponds, lakes, and landslides. Permafrost thaw in a warming

climate could have far-reaching effects on Arctic ecosystems. Ground temperature measurements and computer modeling by University of Alaska scientists and NPS show that warming since the 1950s has caused the permafrost in BELA to warm, but most is still safely frozen and has temperatures below -2 °C (Swanson 2016a, Panda et al. 2016). Permafrost temperatures need to reach 0 °C to initiate widespread thaw. Permafrost in BELA is expected to continue to warm; by 2050, most will be near the thaw point and vulnerable to major changes (Panda et al. 2016).



Terrestrial Vegetation


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Native Plants	Terrestrial Lichen Cover/Caribou Lichen Winter Range		BELA has the highest amount of lichen cover in the Arctic parks, with 28% cover within lichen-rich plant communities (Holt and Neitlich 2010). Terrestrial lichen cover is likely to have declined slightly due to shrub increase in tundra habitats (Swanson 2015), and this trend is expected to continue. Fire frequency is likely to increase with continued warming, as has occurred already in parts of Alaska. Nearly 20% of the Western Arctic Caribou Herd (WACH) core winter range has burned during the past 58 years (Joly et al. 2010). A greater presence of fire on the landscape is likely to place more of the landscape into earlier successional states with less lichen abundance (Joly et al. 2009, Racine et al. 2006). Thus far, only one preserve-wide lichen measurement has occurred.
	Lichen Species Diversity		The diversity of macrolichens in BELA is the lowest of all the Arctic parks in spite of its relatively high cover (Holt and Neitlich 2010). This low diversity relative to other units is due to the absence of forest habitat. A total of 149 macrolichens are known to exist in BELA; the species richness is 22 species per acre. Shrub increase is likely to diminish tundra lichen habitat but eventual colonization by forest would be likely to bring forest-associated species, as evidenced in the other Arctic parks (Swanson 2015). There has been only one monitoring sample for lichen diversity in BELA, thus no trend analysis is possible.

Resource Brief: Lichen

Lichens are a conspicuous and abundant component of the flora in Arctic parklands. Lichens are fragile, slow-growing, and sensitive to air pollutants. Forage lichens—i.e., the dominant lichens of the low shrub and alpine tundras—form the bulk of the winter diet for caribou and domesticated reindeer, and are also consumed by muskox. Over the past decade, NPS studies have documented 491 species of macrolichens in the Arctic parklands ([Holt and Neitlich 2010](#)). Scientists have estimated the presence of a similarly large number of crustose lichens. NPS cooperators recently described 3 new lichen species of *Hypogymnia* (or Tube Lichens) from Beringia, based in part on specimens gathered on the Seward Peninsula, including BELA ([McCune 2008](#)).

One expected impact of climate change is increased shrub dominance and spread of forest into tundra habitats (Swanson 2015). In the long term, this may turn lichen-rich dwarf and low shrub tundra into denser shrub thickets and woodlands. These communities tend to smother terrestrial lichens with litter fall and therefore have lower biomass of the forage lichens needed to sustain large ungulate herds ([Joly et al. 2010](#)). Such a pattern has been demonstrated on the Seward Peninsula, just south of BELA, with black spruce encroachment (Lloyd et al. 2003). The future state of northern Alaska lichen communities may more closely resemble the lower lichen biomass mixed forest-alpine communities of southern or interior Alaska. These climate driven changes, in combination with a decreased fire-return interval, may result in substantial declines in lichen biomass. NPS has constructed grazing exclosures in BELA to study the effects of ungulate grazing and climate change on lichen biomass. While lichen biomass may eventually decline, lichen diversity may actually increase with greater tree and shrub cover.



Reindeer lichens can frequently form a co-dominant land cover in the Arctic parks and are preferred caribou winter forage. Source: Peter Neitlich, NPS.

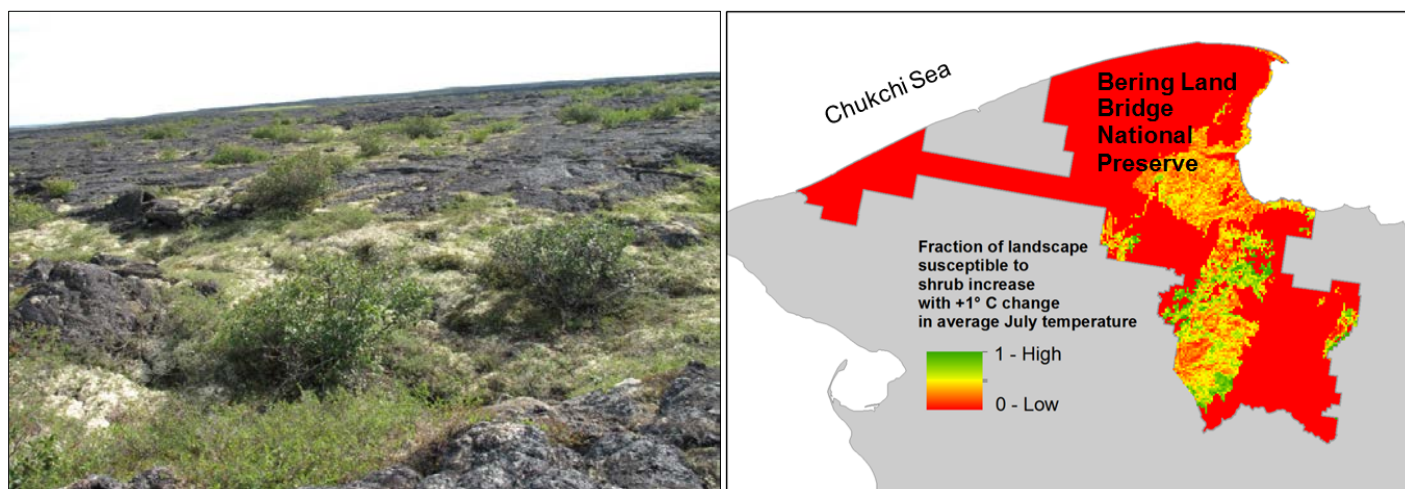
Terrestrial Vegetation (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Native Plants (continued)	Vascular Plant Diversity		BELA has relatively high vascular plant diversity, with 459 species identified to date, including 17 that are classified as rare or imperiled in the State of Alaska by the Alaska Natural Heritage Program (Parker 2006). At present, these plants are naturally rare and are not threatened with extinction by human actions. While climate change and associated changes in ecological disturbance regimes such as fire and flooding are expected to alter the abundance of many plant species, significant changes in overall diversity of vascular plants are not expected to occur in the next few decades.
	Area of Open Tundra		Vascular plant cover has been increasing across the Arctic in recent decades, as shrubs and other plants increase in height and density, and this trend is expected to continue to replace low-shrub tundra (Tape et al. 2006, Verbyla 2008). Local declines in plant cover due to fires are short-lived, as vascular vegetation cover is quickly re-established. The cover, density, and height of shrubs have increased in tundra areas of BELA. Comparison of aerial photographs from about 1980 and 2010 across 5 NPS units in northern Alaska showed that about 14% of the area of tall shrub thickets in 2010 was new since 1980; however tall shrub thickets still cover only about 6% of the total area (Swanson 2013). Most of the increase in shrubs is occurring in the relatively warm and well-vegetated portions of the tundra lowlands or near current treeline. This shrub increase is expected to continue with climate warming. While shrub increase will benefit certain species such as moose and willow ptarmigan, it will alter the iconic open Arctic tundra landscape and harm some of the species that depend on it (Marcot et al. 2015). Expansion of trees onto Arctic tundra has also been documented nearby, though not yet in BELA (Suarez et al. 1999, Swanson 2013). Tree expansion has been slower and less widespread than shrub expansion. In coming decades, white spruce (<i>Picea glauca</i>) may expand very gradually from existing stands into southeastern BELA along the Koyuk River.

Resource Brief: Shrub Extent and Expansion into the Tundra

Shrubs have grown taller and expanded into new areas of the Arctic tundra in recent decades (Tape et al. 2006). This shrub expansion is due mainly to climate warming, and it has far-reaching consequences. Shrubs provide forage for browsing species (moose, hares, and ptarmigan); they also can: reduce erosion by vegetating bare areas along streams, increase snow depth by capturing windblown snow, and shade out plants of lower stature (such as lichens). Shrubs react quickly to climate warming because they are relatively fast-growing and already present across the Arctic tundra and adjacent boreal forests—though often stunted by wind and cold. Shrub expansion can be detected by comparing aerial photographs from the 1950s or 1980s with more recent photos or satellite images. These comparisons have shown that, while shrub expansion is clearly visible, it has covered modest total areas as yet and has occurred mainly in the tundra areas with the warmest summers—July average temperatures above 10 °C (50 °F). Multiple tall shrub species can grow on well-drained soils with neutral pH, while only a few tolerate the cold-wet, acid soils common in the Arctic. Thus in the future shrub expansion is expected to be most apparent on well-drained soils in places with tundra vegetation where—as a result of warming—the July average temperatures have risen above 10 °C. The uplands of southern BELA contain the land in the preserve that is most susceptible to future shrub expansion with climate warming.



Left: Alder shrubs (*Alnus viridis*) appear to be increasing on well-drained soils on the lava beds of southern BELA. NPS Photo by Peter Neitlich; **Right:** Red areas have a lower likelihood of shrub expansion. These are generally areas of flatland tundra.

Terrestrial Vegetation (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Invasive Plants	Presence/Absence		There are no known occurrences of non-native plant species in the preserve; however, limited surveys are conducted in the preserve. Terrestrial invasive plant species have been recorded at airports in Nome, Quartz Creek, Kotzebue, Dahl Creek, Bettles, and other airports that are frequently used by BELA personnel to access the preserve. There is a concern that invasive plants could be inadvertently transported from these locations into the preserve. The main aquatic plant of concern is <i>Elodea</i>, an aquatic plant that has become established in southern and interior Alaska. Freshwater lakes accessed by floatplane are vulnerable.

Birds

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Landbirds	Species Presence and Populations		BELA falls into nationally and internationally recognized bird conservation regions (Conservation Region 2, BPIF 1999 and the Arctic Avifaunal Biome, Rich et al. 2004); however, the preserve lacks current population status information for all landbird species. 53 species of montane-nesting birds were detected during a 2001–2003 inventory of Arctic parklands. Approximately 150 species breed in Alaska. Most undergo some migration during the winter; 57% of them have some portion of their population that winters south of the U.S.-Mexico border while others winter as far away as South America and Africa. Many overwintering areas for high-latitude breeding landbirds are vulnerable to the effects of human activities and climate change. Species associated with tundra or open shrub habitat may be vulnerable to climate-induced expansion of woody vegetation into open landscapes. Only 34 species of landbirds are year-round residents in Alaska. The following are species of high conservation concern because most, if not all, of their Western Hemisphere populations breed in Alaska: short-eared owl, McKay's bunting, Smith's longspur, snowy owl, snow bunting, hoary redpoll, and Lapland longspur.
Shorebirds	Species Presence and Populations		Information about the population status of breeding shorebirds in BELA is lacking. Loss of wetlands—particularly migratory stopover areas outside of Alaska that are important to those species breeding in Alaska—represents the greatest threat to shorebird populations worldwide. Coastal wetland habitats are threatened by climate change impacts including rising sea level, drying interior wetlands and shallow lakes, saltwater inundation and/or spray, and increased storm frequency and intensity (Thorne et al. 2015). Species of high conservation concern that are thought to breed or migrate through BELA include: American golden-plover, whimbrel, bristle-thighed curlew, Hudsonian godwit, bar-tailed godwit, marbled godwit, black turnstone, surfbird, western sandpiper, dunlin, red knot, and red-necked and red Phalaropes (ASG 2008, Andres et al. 2012). All of these species are experiencing apparent population declines, with the exception of bristle-thighed curlew, which is considered a species of concern because of its restricted breeding range (Western Alaska). During the post breeding period in 2013, surveys at Arctic and Ikpek Lagoons documented 20 shorebirds species. Overall shorebird density peaked at 8.1 shorebirds per acre on July 31. During aerial survey work in 2014, over 26,000 shorebirds were counted between July 28 and August 13. Arctic and Ikpek lagoons had some of the highest densities of shorebirds in BELA during fall migration.

Birds (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Yellow-billed Loons	Population		Yellow-billed loons in Alaska were recently considered for listing under the Endangered Species Act, and though not listed, are still considered an international species of concern. More years of data are needed to assess the status of the population trend so no condition arrow has been assigned. Preliminary results of contaminants analyses in Yellow-billed loon eggs and prey fish from BELA and Cape Krusenstern National Monument are being analyzed but suggest that mercury may be approaching levels that could impede reproduction in the species (Schmidt et al. 2014).
	Distribution		Aerial surveys for yellow-billed loons in BELA and Cape Krusenstern National Monument were conducted in 2005, 2007 (Mallek et al. 2006, Bollinger et al. 2008), 2009, 2011 and 2013 (Flamme unpublished data, Schmidt et al. 2014). About 95% of yellow-billed loon observations occurred in BELA. Most yellow-billed loons were spotted on large, Arctic tundra lakes (> 7ha). Yellow-billed loons have very specific habitat requirements for nesting (Earnst et al. 2006) that are strongly associated with fish distribution. Current studies of fish distributions and environmental DNA seek better understanding of habitat requirements for loons selecting nesting lakes.
Threatened & Endangered Birds	Population of Spectacled Eider		Spectacled eider (threatened under Endangered Species Act) broods were observed on the Arctic Lagoon barrier island complex in BELA in 2013. BELA does not currently monitor the spectacled eider, primarily because its population is very small and ephemeral in the preserve. Larger populations are found off of the Yukon-Kuskokwim (Y-K) Delta (south of BELA) and the Arctic Coastal Plain (north of BELA). During the winter, the world population of spectacled eiders gathers at a single site south of St. Lawrence Island in the northern Bering Sea. During the summer, the species is divided into three breeding populations: western Alaska, northern Alaska, and northern Russia. A majority (> 90%) of adults nest in Russia. Between the 1970s and 1990s, a 96% population decline was observed on the Y-K Delta in western Alaska, from 48,000 pairs to about 2,500 pairs in 1992 (Stehn et al. 1993). The breeding population in Alaska appears to have stabilized in recent years (Stehn et al. 1993, Fischer et al. 2012). Threats to eiders at breeding areas include ingestion of contaminants, particularly lead through expended shot, and predators.

Birds (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Threatened & Endangered Birds (continued)	Population of Eskimo Curlew		BELA does not actively monitor for the Eskimo Curlew. The Eskimo Curlew was listed as endangered worldwide in 1967 (Federal Register, March 11, 1967), and is believed to be extinct. In Alaska, the Eskimo Curlew once ranged from the Yukon Delta north to Point Barrow. Eskimo Curlew populations began a marked decline around 1870, and began decreasing rapidly in 1880s (Gill et al. 1998). The bird was considered rare by 1900 and thought to be extinct in 1905.

Resource Brief: Yellow-billed Loon



Yellow-billed Loons are being monitored in 2 Arctic parks: BELA and Cape Krusenstern National Monument. NPS Photo.

The yellow-billed loon (*Gavia adamsii*) is an international species of concern with the global population estimated at 16,650–21,000. The species was considered for listing under the Endangered Species Act in 2014, but was not listed. These birds occur in a circumpolar distribution and breed on Arctic tundra habitats, including areas of BELA. Little is known about the species' status outside of the U.S. and Canada. The loons winter from Russia and Alaska along the coastlines of the Bering Sea and Aleutian Islands to the Yellow Sea in China. Approximately 20–25% of the global population occurs seasonally in Alaska, where the total summer breeding population is estimated at 3,700–4,900 birds. The species is considered one of the 10 rarest birds that regularly breed on the mainland U.S. In Alaska, yellow-billed loons are restricted to tundra landscapes on the Arctic Coastal Plain and northwestern Alaska with large, deep, clear, freshwater, fish-bearing lakes.

Based on aerial surveys conducted in June of 2011 and 2013 in BELA and Cape Krusenstern National Monument, the

population of yellow-billed loons occurring in northwestern Alaska is about 2.5 times larger than indicated by earlier estimates of 418 birds and 85 nests. This larger estimate may indicate that habitats on the northwestern Seward Peninsula and Cape Krusenstern National Monument may be more important for overall yellow-billed loon conservation in Alaska than previously realized. Yellow-billed loons used 207 of 1,291 lakes in the study area and nested at an additional 205 lakes. Between 2011 and 2013, the probability of reuse of an individual lake by a yellow-billed loon was greater than 70%, suggesting the birds were attracted to these lakes by either high site fidelity or high lake suitability.

Preliminary results of genetic data of yellow-billed and Pacific loons from the North Slope of Alaska and Canada suggest that population genetic diversity was low, particularly for yellow-billed loons (Talbot et al. 2014). Assessments of genetic variability in species can provide insight into how well a species may adapt to or recover from environmental change or impacts. The NPS is directed to assess genetic variation of wildlife populations and “strive to protect the full range of genotypes of native plant and animal populations in the parks...The need to maintain appropriate levels of genetic diversity will guide decisions on what actions to take to manage isolated populations” (NPS Missions 2006). The genetic comparisons between the North Slope and Canada populations suggest this low level of genetic diversity is not restricted to just these populations but may be inherent in yellow-billed loons. More research is needed, but unpublished data suggest that these populations also may be demonstrating tendencies for nest site fidelity, annually returning to the same breeding sites. Further analyses are necessary to determine the likely cause of comparatively lower levels of genetic diversity in yellow-billed loons.

Fish


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Whitefish	Abundance		BELA does not currently monitor whitefish in lakes and rivers. In 2015, the fish communities of Cowpack and Ikpek Lagoons in BELA were sampled. None of the eight species caught were whitefish, although residents of Shishmaref have reported whitefish in Cowpack (Kupik) Lagoon. Further investigation is needed to determine whitefish use of the BELA lagoons and rivers.
Dolly Varden and Arctic Char	Abundance		The preserve does not monitor Dolly Varden or Arctic char abundance. In general, very little data are available on Dolly Varden and Arctic char escapement, spawning, or abundance (Scanlon 2015). Dolly Varden (known locally as “trout”) are members of the salmon family that feed in the ocean and spawn in rivers and streams (Scanlon 2015). They inhabit most coastal streams and large rivers in the Kotzebue Sound area. Dolly Varden is an important subsistence fish in many villages, after Chum salmon, Sheefish, and other whitefish (Whiting 2006); though in some villages Dolly Varden outrank the other fish (Menard et al. 2015).
Lagoon Fish Assemblages	Species Diversity and Abundance		Coastal lagoons are a dominant landscape feature of the Arctic coastline. In 2013 and 2015 the fish communities of Cowpack and Ikpek Lagoons in BELA were sampled as part of a study to inventory and develop monitoring protocols for the lagoons (Robards 2014 , Haynes et al. <i>in prep</i>). Fish observed included Pacific Herring, Capelin, and Alaska Plaice. No salmon, whitefish or Dolly Varden (trout) were observed, although residents of Shishmaref have reported that whitefish use Cowpack Lagoon. These lagoons remain open to the sea year-round, which, along with seasonal changes in freshwater input, greatly influences the types of fish living in the lagoons. Preliminary observations of fish diets suggest that mysid shrimp, midges and ninespine stickleback are the primary source of food in the lagoons and likely play a critical role in the lagoon food web (Haynes et al. <i>in prep</i>).

Terrestrial Mammals


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Moose	Distribution		Distribution of moose in the Arctic is limited by winter range and winter access to shrubs over 1m tall (Tape et al. 2016a). Available moose habitat has changed over time concurrently with climate and fire regimes that favor the succession of woody browse over lichens (Joly et al. 2012). Moose have been found in the archeological record in Arctic Alaska, but were absent from this region prior to recolonization in the 20th century (Westing 2012). By the late 1960s, much of the suitable habitat in Game Management Unit (GMU) 22 contained moose.
	Abundance		The moose population on the Seward Peninsula peaked in the 1980s, and has not recovered since a decline in the 1990s (Persons 2004). Surveys conducted in and adjacent to BELA between 2006 and 2014 have indicated overall stability, but there remain concerns regarding distribution of moose in a portion of inland BELA, condition of browse in available habitat, and maintaining a population at low density. BELA comprises 25% of GMU 22D, where the population was estimated in 2014 to harbor 1,106 moose (0.38 moose/mi²), but the Kuzitrin portion of GMU 22D that includes BELA has experienced a 12% decline between 2011 and 2014 (Gorn 2010). BELA also comprises 70% of GMU 22E with an estimated 701 moose (0.18 moose/mi²). A management goal for composition (specified by a ratio of at least 30 bulls per 100 cows) established by the Alaska Department of Fish and Game was determined to be exceeded by a survey in 2014 (40 bulls per 100 cows).
Caribou	Migration Patterns		The Seward Peninsula is winter range for the Western Arctic Caribou Herd and has been designated by the State of Alaska as critical winter habitat. In recent years, there have been observations that a few thousand caribou have been staying on the Seward Peninsula and calving (in GMU 22) around Serpentine Hot Springs year round. Residents believe that the caribou may be migrating westward toward the coast.
	Population Trend		The Western Arctic Caribou Herd is currently at the low end of its population cycle. In general, the health and success of the various herds in this region is stable, with some natural fluctuation. The Western Arctic Caribou Herd reached a high of 490,000 animals in 2003, but as of 2016 the herd reached a low 201,000 (Dau 2013, Parrett 2016). In the mid-1970s, the population reached a low of 75,000 caribou and steadily increased until 2003 (Dau 2011). As the Western Arctic Caribou Herd continues to move west, the Ongtowsruk reindeer herd may be assimilated into the caribou herd, which may cause genetic dilution in native Western Arctic caribou.

Resource Brief: Caribou



Caribou sitting in the grass in BELA. NPS Photo.

migration plays a critical role in the harvest of caribou by rural villages. Changes to these patterns may affect these subsistence users, the vitality of the herd, and the ecosystem as a whole.

NPS monitoring of the Western Arctic Caribou Herd began in 2009. Since then, over 95 GPS collars have been deployed, which have collected well over 250,000 caribou locations. Collared caribou have utilized all 5 Arctic park units (Bering Land Bridge, Cape Krusenstern, Gates of the Arctic, Kobuk Valley, and Noatak). Monitoring showed that during September and October, Kobuk Valley National Park was heavily utilized by caribou from the Western Arctic Herd, while BELA was also heavily used as winter range. The herd calved north of the Noatak National Preserve in early June. The herd walked about 3,100 km (1,900 miles) each year during its annual migration cycle—one of the longest terrestrial movements on the planet. Caribou used the historic Onion Portage crossing of the Kobuk River both in fall and spring. The fall migration has tended to be concentrated towards the eastern end of the Noatak River, away from many large subsistence communities including Kotzebue, Noatak, Kiana, Selawik, and Noorvik. Caribou migrating west encounter an industrial road, which has been recently shown to delay migration of some caribou by a month ([Wilson et al. 2016](#)). It is too soon to identify trends in the timing and distribution of Western Arctic Caribou Herd movements. New analyses confirmed the importance of lichens as winter forage for Western Arctic Caribou Herd ([Joly 2012](#)).

Many residents of northwest Alaska are Natives that identify themselves as “caribou people.” The caribou is ingrained in the history, traditions, and psyche of this region. Approximately 15,000 caribou are harvested annually from the Western Arctic Caribou Herd by local rural residents; most rural residents still live a subsistence lifestyle. The herd has been one of the largest herds in the world, nearing 500,000 animals in 2003, though it has declined to 201,000 by 2016 ([Parrett 2016](#)). This decline has resulted in restrictions in sport and subsistence harvests. The herd’s ecological impact on Arctic parklands is not fully appreciated; a herd of this size can substantially impact its habitat, which covers all of northwest Alaska (over 360,000 km²), its primary predators (wolves and grizzly bears), as well as suite of other animals through cascading trophic effects.

NPS goals are to monitor the movements, distribution, and health of these caribou. The caribou use different park units at different times of year.

Further, the timing and spatial pattern of the herd’s

Terrestrial Mammals (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Brown Bear	Abundance and Harvest		In May 2015, the NPS and the Alaska Department of Fish and Game (ADF&G) conducted a brown bear survey over a 19,998 km² area of the central Seward Peninsula, including BELA. Based on the density found in this study (21 independent bears/1,000km² and 35.6 total bears/1,000km²), biologists estimate there are approximately 420 independent bears and 713 total bears (including cubs) in the survey area. These density and population estimates are not markedly different from those of a 1991 study done on the Seward Peninsula (Miller et al. 1997). The 1991 study, however, was performed in a smaller study area. The 2015 estimates are similar to previous studies of bear populations in northwestern Alaska (Miller and Nelson 1993, Miller et al. 1997). Comparison of the 2015 survey results and harvest and population information in the most recent ADF&G report (Hughes 2013) indicate that harvest from this population is at or above the 5.7% maximum sustainable harvest rate for brown bears published by Miller (1990). Those estimates of mortality do not include mortalities due to Defense of Life and Property (DLP), unreported mortalities and wounding losses. Many local residents believe that there are numerous bears in Game Management Unit 22 (of which BELA is a part). No trend is assigned to this metric because only two population estimates are available and those two survey areas were not directly comparable to determine trend.
	Distribution		There is little information regarding brown bear distribution in BELA. In the last 25 years, bear distribution may have changed in response to changes in habitat prompted by changing climate and by changes in prey distribution.
Wolves	Abundance and Distribution		The NPS does not monitor wolf populations in BELA. The few historical estimates of the wolf population size in northwest Alaska are varied and unreliable, but the concern of their influence upon the Western Arctic Caribou Herd spurred predator control by means of poison and aerial shooting as early as the 1940s (Kelly 1954) and liberal harvest quotas since. The wolf population in BELA has not been estimated, but in 1980 they were believed to have been distributed among all drainages in Game Management Unit 22, albeit in small numbers with small pack sizes of 2–3 animals (Harper 2012).

Terrestrial Mammals (continued)

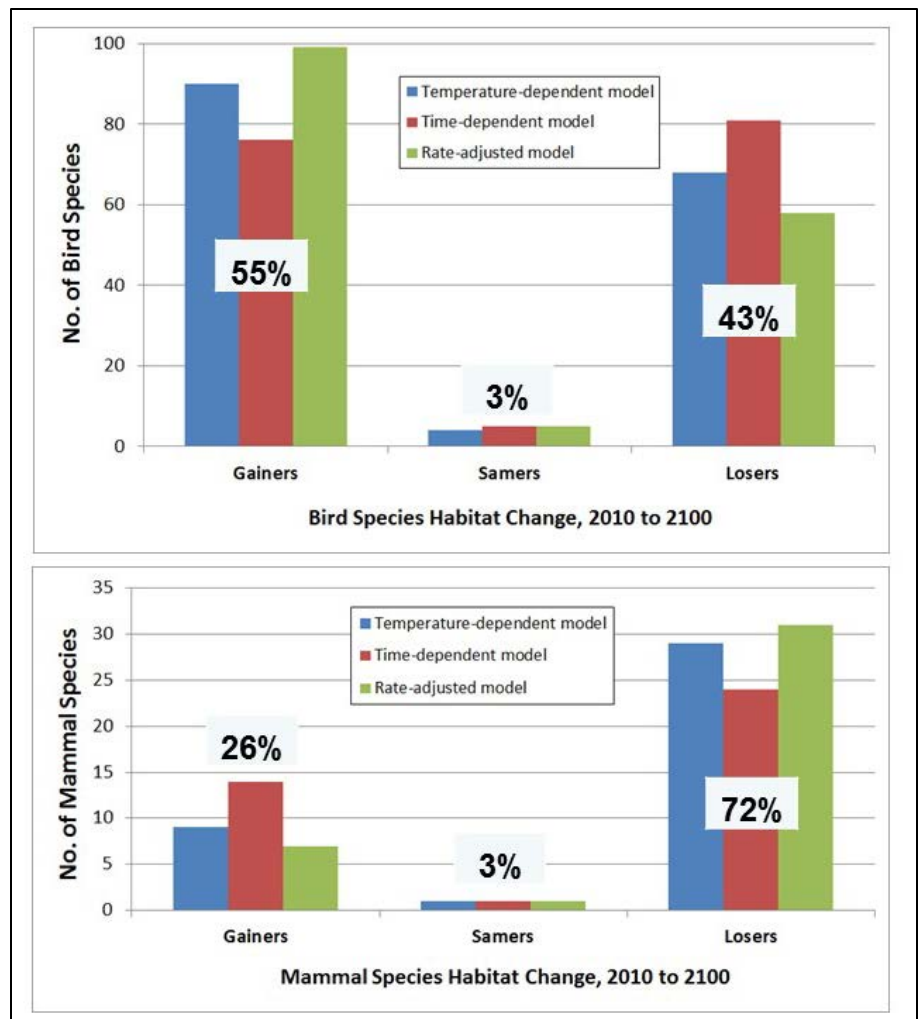
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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Reindeer	Population and Distribution		From 1892 to 1901, 1,280 reindeer were purchased by the U.S. and transported to the Seward Peninsula by Sheldon Jackson, Secretary of Education, to increase the availability of a food source and to assimilate the Iñupiat to western culture (Olson 1969). The Western Arctic Caribou Herd moved onto the Seward Peninsula in the late 1990s and severely impacted the reindeer industry. The archeological record shows that caribou have moved on and off the peninsula for hundreds of years. In the 1990s, the winter range of the Western Arctic Caribou Herd shifted onto the traditional reindeer ranges of the Seward Peninsula. Thousands of reindeer have commingled with migratory caribou groups and left the Peninsula. As a result, many herders have lost their herds. At its peak around 1930, it is believed that there were approximately 640,000 reindeer herded in western Alaska, mostly on the Seward Peninsula (Olson 1969). Before the Western Arctic Caribou Herd moved onto the peninsula in the 1990s, there were about 22,000 reindeer. From 1987 to 2003, reindeer products sold from herders generated \$10.3 million while reindeer meat sales generated \$9.6 million. There are four permitted reindeer herders in the preserve: Ongtowsruk, Weyioanna, Goodhope, and Karmun. The Ongtowsruk Herd, near Wales, AK, is the only herd currently with reindeer (600 reindeer, they are permitted 2,000 reindeer). As the Western Arctic Caribou Herd continues to move west, the Ongtowsruk reindeer herd, like other herds, may be assimilated into the Western Arctic Caribou Herd.
Beavers	Abundance and Distribution		The NPS does not monitor beaver populations in BELA and surveys have not been conducted to generate a population estimate in BELA. Beavers were extirpated from this region in the late 19th century, but anecdotal reports and increased conflicts with humans lend evidence to a successful recolonization, if not expansion of their range. Beavers are known as a keystone species and ecosystem engineers, creating wetlands that are used by insects, amphibians, waterfowl, passerines, and moose. Because most beaver dams in BELA are found in smaller order streams, high runoff and storms damage and wash out dams seasonally; however, fish species found in BELA are capable of passing through the dam structure (Brown and Fleener 2001). A documented increase in shrub cover on the tundra (Swanson 2015, Tape et al. 2016b) is expected to expand beaver habitat over time.

Resource Brief: *Wildcast*

The NPS Wildcast project modeled the likely effects of climate warming in northwest Alaska on the extent of 60 habitat types for 162 bird and 39 mammal species known (or expected to occur regularly) in the region. The project was a partnership with cooperators including U.S. Forest Service, U.S. Fish and Wildlife Service and several universities. The project developed three models based on studies of historic changes in vegetation, mean annual air temperature, and influences of 23 biophysical drivers (such as permafrost melt and tundra fire). Researchers project that shrub, woodland, and forest habitats of 53% of the 201 wildlife species will increase, habitats of 3% will have no change, and lowland shrub, meadow, grassland tundra and other habitats of 44% will decrease (Marcot et al. 2015). In addition, habitat for 86 species of birds (43% of total bird species) and 28 species of mammals (72% of total mammal species) is likely to decline (Marcot et al. 2015). Changes in wildlife habitats will likely affect the composition and function of the ecosystem; of particular significance are the predicted declines in habitats of most small mammals, as these form the prey base for mid-sized carnivores and raptors and serve ecosystem engineering functions of burrowing and soil and nutrient turnover. Habitat is also likely to decline for 25 of the 50 bird and mammal species harvested for subsistence (including greater white-fronted goose, tundra swan, rock and willow ptarmigan, caribou, muskoxen, Arctic fox, muskrat, American beaver, and northern river otter), with habitat increases for grouse, some waterfowl, cranes, moose, black bear, and American marten.

The Wildcast project will help NPS managers design better adaptation strategies by predicting the future composition of the ecosystem. Tomorrow's ecosystem will more closely resemble that of the subarctic coast and the boreal forest, with tundra restricted to the alpine. Caribou, in particular, are expected to lose a significant portion of their lichen winter range to shrub and forest communities. This will have profound influences on the ecosystem and subsistence hunting opportunity.



Above: Winners and losers with changing habitat.
Adapted from Marcot et al. 2015.



Projected Habitat Losers. Adapted from Marcot et al. 2015.

Terrestrial Mammals (continued)

[web](#) ▶

Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Wolverines	Abundance and Distribution		NPS does not currently monitor wolverines in BELA. Wolverines are distributed throughout northwestern Alaska. In general, most of what is known about both wolverine distribution and abundance is based on trapping records and anecdotal observations from local hunters and trappers. Wolverines naturally occur at low population densities and have low reproductive rates. Within Game Management Unit (GMU) 22, the GMU that includes BELA, ADF&G reports that wolverine are thought to be common and have stable populations (Hughes 2013). In BELA, wolverines are available for harvest under hunting regulation from September 1 through March 31. Trapping season goes from November 1 through April 15. Although it does not capture all of the harvest, sealing records from 1988–2011 data from GMU 22 indicate an average wolverine take of 34 per year. In GMU subunit 22E, the subunit that covers most of BELA, data from 2010 and 2011 showed 7% of the annual harvest for those 2 years came from that unit. Wolverine abundance and distribution are of moderate concern in BELA because the wolverine population size is unknown (but naturally low) and harvest rates have been relatively high.
	Abundance		Muskoxen were extirpated from Alaska in the late 1800s. In 1970 and 1981, 36 and 35 muskoxen, respectively, were reintroduced to the southern portion of the Seward Peninsula. The NPS and Alaska Department of Fish and Game collaborate on muskox population estimation and composition surveys of muskoxen on the Seward Peninsula, which includes animals that inhabit BELA. Abundance estimates of the population have been conducted at regular intervals between 1983 and 2015 (Schmidt and Gorn 2013). The muskox population increased from the time of introduction until plateauing in 2010 and then decreasing at 14% per year through 2012. One hypothesis for the decline is that harvest of mature males from the population may have changed the defensive behavior of groups, thereby leaving them more vulnerable to predation (Schmidt and Gorn 2013).
Muskoxen	Distribution		Muskoxen are now found in suitable habitat throughout the Seward Peninsula; however, they appear to be migrating to areas outside of BELA. Muskoxen are expanding their range into the Nulato Hills, east of BELA.

Resource Brief: Muskoxen



Muskox (*Ovibos moschatus*) on the tundra
NPS Photo.

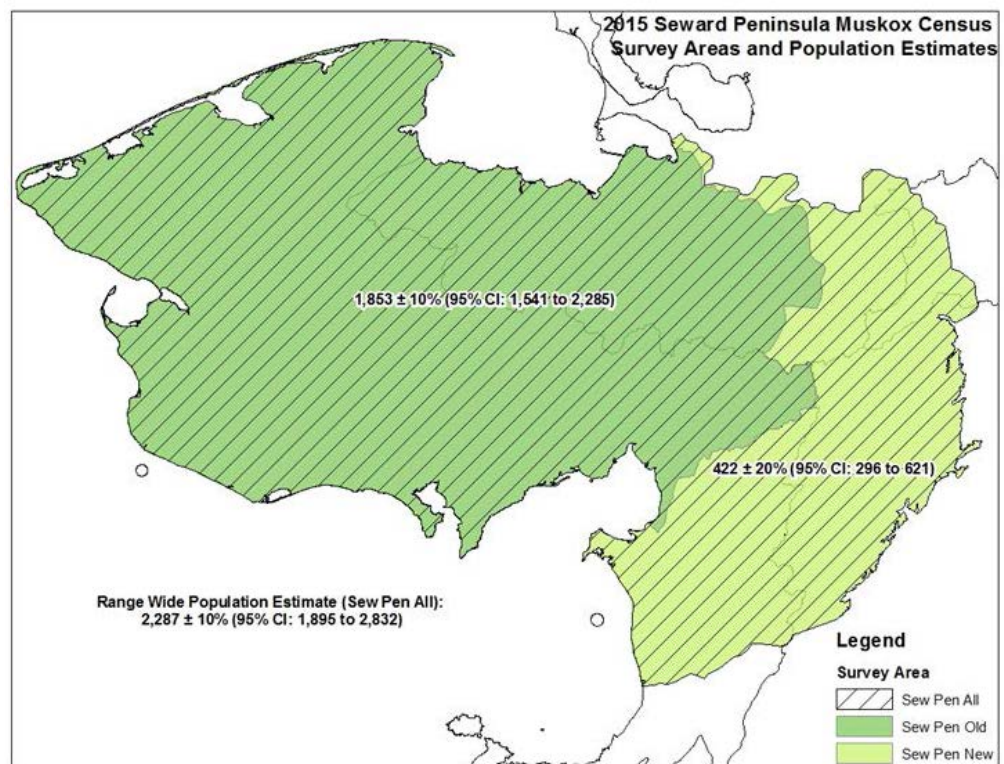
Muskoxen are found in northern Canada, Greenland, and Alaska. Inupiaq speakers call them *itomingmak*, meaning “the animal with skin like a beard” for their distinct fur that hangs down nearly to the ground. In the late 19th century, muskoxen became extirpated (locally extinct) in Alaska. The depletion of these animals was due to a combination of factors that included unfavorable climatic conditions that affected access to food, as well as mortalities from predators and hunters. People were effective hunters of muskoxen. During Arctic explorations, whalers commercially hunted this species on a large scale. The disappearance of muskoxen became a concern to the U.S. Government and from the 1930s to the 1980s populations were re-established through re-introductions. In the decades that followed, muskox numbers rose rapidly on the Seward Peninsula, and stayed high until a decline starting in 2010.

In spring 2015, the NPS, ADF&G, BLM and USFWS collaborated to complete muskox population and composition surveys for the Seward Peninsula. To conduct a population survey, pilots fly planes in long straight lines (transect lines) and pilots and biologists observe and count muskox. To conduct a composition survey, a helicopter is used to drop biologists close enough to observe muskox groups, but far enough away not to disturb the groups. Biologists then walk to an area where they can observe the animals and determine the number of males, females, and calves in a group.

The most recent population survey was conducted in 2015. The 2015 population survey estimated that there were 2,287 muskoxen on the Seward Peninsula (striped area labeled “Sew Pen All” on the figure to the right) and suggested that the overall population stabilized between 2012 and 2015. In 2015, a new survey area was added to include the eastern portion of the Nulato Hills; biologists estimated 422 muskoxen in that area (labeled “Sew Pen New” on figure to the right). Although the overall population stabilized between 2012 and 2015, the number of muskoxen in BELA and ADF&G Game Management Units 22E, 22D, and 23 southwest adjacent to BELA decreased between 32%, 10%, and 14%, respectively. This localized decline poses management challenges about harvest decisions in these areas.

A 2012 survey on the Seward Peninsula estimated 29 mature bulls present for every 100 cows. In 2015, there were an estimated 39 mature bulls present for every 100 cows. The increase in mature bulls (bulls ≥ 4 years old) may be the result of 3 consecutive years (regulatory years 2012–2014) of reduced harvest limits intended to increase the number of mature bulls in the population (Dunker 2015). The annual harvest rate was $<2\%$ during this time. In 2015, the number of young animals born into the population that survived to an age between 1–2 years old was found to be low (8% of the population).

For more information, see the [BELA muskox page](#).



Population survey of the Seward Peninsula muskoxen population. Source: Gorn 2015.

Marine Nearshore


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Ice Seals	Abundance and Distribution		The legislation establishing BELA describes protection of marine mammals. Ice seals are occasionally sighted in BELA lagoons and estuaries. In December 2012, the U.S. National Marine Fisheries Service determined two of the four ice seal species found in the preserve warranted listing as threatened species (bearded and ringed seals). The bearded seal listing was vacated by a court in 2014 and the ringed seal determination was vacated in 2016. Population estimates of seals are difficult because of logistical challenges in conducting population studies. The average age of harvest for ringed seals is decreasing, suggesting either the population age as a whole or the age at reproductive maturity is decreasing, thereby leading to a younger population age profile, and raising concern over the population as a whole (Quakenbush 2011a). Ringed and bearded seal gut analysis indicates that there has been a shift in food preferences towards fishes and away from invertebrates. In the last 50 years, growth studies indicate that bearded and ringed seals are growing at a faster rate (Quakenbush 2011a, b). Ice seals are dependent on ice for birthing and rearing their young. The reduction of sea ice is anticipated to have a negative impact on ice seal populations worldwide.
Beluga Whales	Abundance and Distribution		Two stocks of beluga whales use the coastal and marine areas of BELA: (1) the Beaufort Sea stock and (2) the Eastern Chukchi Sea stock. Both winter in the Bering and southern Chukchi Seas and have stock-specific migrations to the north and northeast in the spring and summer. During the return migration in September and October, beluga from stocks overlap in the western Beaufort Sea (Hauser et al. 2014). The most recent population estimate for the Beaufort Sea stock is 32,453 whales. Trend data indicate the stock is at least stable or increasing (Allen and Angliss 2015a). The most recent stock estimate for the eastern Chukchi beluga stock is 3,710 (Allen and Angliss 2015b). The current population trend for the eastern Chukchi sea Beluga stock is unknown.
Polar Bears	Abundance and Distribution		Polar bear were listed as a globally-threatened species under the U.S. Endangered Species Act in 2008. This listing was based on the threat to future populations in light of rapidly declining sea ice habitat (Atwood et al. 2015). Polar bear populations in the north are divided into 19 subpopulations. The subpopulations that reside in winter along the coast of BELA are Chukchi and Bering Sea subpopulations. The U.S. Fish and Wildlife Service established critical habitat for polar bear along BELA's entire Chukchi coast and the large Nugnugaluktuk estuary. Polar bears in the Chukchi and Bering Sea have large body size, good body condition, and high survival rates in comparison to other subpopulations.

Marine Nearshore (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Sea Ice	Extent		With climate change progressing steadily in the Arctic, sea ice has retreated by an average of 1.3% per year since the 1950s (NSIDC 2015 , Perovich 2015). Through 2015, the September Arctic sea ice extent has decreased by 13.4% per decade, relative to the 1981 to 2010 average. The nine lowest September sea ice extents have occurred in the last nine years. In the summer months, the Arctic ice pack is now sufficiently far north to allow for passage of vessels via both the Northern Sea Route (above Siberia) and the Northwest Passage (through the Canadian Archipelago to Greenland). As a result, this park unit is now more vulnerable to marine incidents (e.g., oil spills) and coastal erosion. While in past decades the formation of shorefast ice in early fall protected the coastline from erosion during powerful fall storms, the current onset of shorefast ice in late fall has removed this protection.
	Age and Thickness		The oldest sea ice (> 4 years old) continues to make up a small fraction of the Arctic ice pack in March at its typical annual maximum. Sea ice age is a reliable proxy for ice thickness because older ice is generally thicker (Tschudi et al. 2016). In 1985, old ice made up 20% of the ice pack, but in March 2015 old ice only constituted 3% of the ice pack. First-year ice now dominates the ice cover, comprising ≈ 70% of the March 2015 ice pack, compared to about half that in the 1980s (Perovich 2015). Sea ice in the Beaufort and Chukchi Seas is more seasonal in nature and is a mix of multiyear (≈ 25%) and first-year ice (≈ 75%). The inter-annual variability of ice thickness over the last seven years has been more variable with mean and modal ice thickness around 2.1 m and 1.8 m, respectively (Richter-Menge and Farrell 2013). The thinning sea ice has made subsistence hunting for marine mammals much more dangerous and has limited hunting opportunity drastically (Arctic Council 2009b). Traditional knowledge has indicated that sea ice is much thinner, more mobile, more broken, and hazardous than in past generations (NOAA 2012).

Marine Nearshore (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Marine Incident Preparedness	Level of Preparation (data availability, logistical readiness)		Marine incidents are relatively common in the Chukchi Sea and Kotzebue Basin Area, with historical incident rates (1995–2012) as high as 0.556 incidents/year (Reich et al. 2014). With significant increases in Arctic marine operations, marine incident risks are also increasing (NOAA 2012). Marine incidents in this remote region are extremely difficult to mitigate, even with effective response operations; recommendations from an ecological risk assessment of the Northwest Arctic (Aurand and Essex 2012) include assessing the geographic response strategies. Geographic response strategies (GRSs) in the area were developed primarily from site overflights, satellite imagery, and/or aerial imagery. However, most of the GRSs have not been assessed and updated with onsite information to verify their validity. Bathymetric and flow velocity measurements are being conducted at existing GRS locations within BELA. Potential challenges to the GRSs include shallow lagoon bottoms and boat routes (< 1ft or < 0.3m) for many proposed tactics and high water flow areas that may compromise oil boom success. Several of the strategies require updating, and ongoing assessments are being conducted to understand seasonality of the depth and currents at GRS locations. Training has occurred in Kotzebue and Nome, with test deployments. Ongoing training by the U.S. Coast Guard is occurring.
Marine Invasive Species	Presence/Absence		Attempts have been made to monitor for invasive tunicates; however, results of that monitoring are not yet available. To date, no marine invasive species have been identified in the Southern Chukchi; however, very little monitoring is being conducted in the region by any Government agency or private entity. Marine invasive species warrant moderate concern because these species have the potential to seriously impact coastal biological and subsistence resources in BELA (Larsen et al. 2014). Increased vessel traffic associated with reduced sea ice extent and duration (Azzara et al. 2015), including the advent of Arctic marine tourism in the area, is elevating the risk of marine invasions. The risks of invasion may also be exacerbated by the environmental stress of increased water temperatures on existing fauna and increased marine debris (Ruiz and Hewitt 2009). Models of the ecological parameters of marine invasives of the Pacific coast of North America indicate high latitude environmental conditions suitable for survival under current climate predictions in the 21st century (de Rivera et al. 2011).

Marine Nearshore (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Marine Debris	Marine Debris Abatement (beach cleanliness)		In 2015, a small group of volunteers removed approximately 225 kg of marine debris from 8 km of beach during 2 days in BELA (Polasek et al. 2016). Community partners from Wales and Shishmaref cleaned up several stretches of coastline closer to their communities. Debris consisted of plastic, ropes and nets, foam and other trash. Debris was heavier in proximity to private allotments but averaged 15 kg/km in the small zone sampled. New debris appears each year from local and international sources. The logistical challenges of accessing remote coastlines make effective cleanup unrealistic. Sampling in the Chukchi Sea confirms levels of microplastics (from degraded plastic debris and other sources) higher than those of the Great Garbage Patch in the North Pacific Gyre (Obbard et al. 2014, Lusher et al. 2015). Microplastic particles have accumulated persistent organic pollutants and have entered the food web in the Pacific Ocean (Rochman et al. 2013). For rural communities dependent on marine mammal harvest for subsistence, the bioaccumulation of toxic substances (small, yet increasing with the increase of microplastics) is a concern.

Resource Brief: Marine Debris, an Ongoing Challenge

The remote coastlines of northwest Alaska have increasing accumulations of marine debris. Marine debris includes fishing gear, trash, plastic materials, buoys, tarps, rope, drums, building materials, and any other non-natural, solid material that washes ashore. Debris can affect marine mammals and birds directly through entanglement, drowning, strangulation, and digestive blockage ([Derraik 2002](#), [EPA 2011](#), [Ryan et al. 2009](#)). Marine debris can transport invasive marine organisms, which have the potential to cause ecological and economic impacts. Over time, plastics break down into microplastic particles. Research has shown that bioaccumulative toxic substances borne by microplastics have entered the food web in the Pacific Ocean (Rochman et al. 2013); for rural Alaskan communities dependent on marine mammal subsistence harvest, the potential for bioaccumulation of toxic substances is a health concern. Of equal concern, it has recently been discovered that Arctic Sea ice from remote locations contains concentrations of microplastics several orders of magnitude higher than those previously reported in high concentration zones such as those of the North Pacific Gyre (Obbard et al. 2014).

In the Arctic parklands, debris sources include: (1) local garbage from poorly contained landfills, camps, and communities; (2) pan-Asian garbage from Russia, Korea, Japan and elsewhere; and (3) fishing and shipping vessels. In 2015, BELA and Cape Krusenstern National Monument partnered with other Alaska coastal parks for a marine debris cleanup and quantification study in 5 parks that removed a total of 11 tons of debris. NPS will continue to engage with communities to present school programs on marine debris, sponsor community cleanups, and facilitate dialog on ways to reduce trash escapement.



Youth volunteer cleans up fishing net in Bering Land Bridge National Preserve. NPS Photo by DevDharm Khalsa.

Unique Communities and Landscape Features


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Maar Lakes	Water Quality		BELA does not monitor, nor have an established monitoring protocol, for water quality or other unique resources at the maar lakes. Maar lakes are lakes formed in broad volcanic craters. The Devil Mountain Lakes on the northern portion of the peninsula are the largest maar lakes in the world (Begét et al. 1996). The lakes formed over 21,000 years ago as the result of an underground steam explosion. The Killeak Lakes and White Fish Lake are also volcanic maar lakes of notable size. The maar lakes are generally unimpaired with respect to water chemistry and physical properties. Nutrient concentrations (nitrogen and phosphorus) are very low at Devil Mountain and Killeak Lakes, and slightly higher at Whitefish Lake. Water clarity is excellent at Devil Mountain Lake. Mean lake temperatures during the open water period have remained relatively constant in recent decades (averaging 6–10 °C) (Arp and Jones 2016).
Serpentine and Arctic Hot Springs	Water Quality		Unique aquatic ecosystems exist at Serpentine and Arctic Hot Springs. The Serpentine Hot Springs area consists of two distinct thermal areas: Serpentine Hot Springs and Arctic Hot Springs, located approximately 600 m downstream. While the environment seems to be in good condition, these ecosystems are vulnerable to human impacts; Serpentine is one of the most visited locations in the preserve. BELA does actively monitor water quality at the hot springs. Two primary water quality issues exist: (1) drinking water quality for human consumption, and (2) potential anthropogenic inputs including gray water, shampoos, and streamside fuel management that have the potential to affect the aquatic ecosystem. BELA recently upgraded its heating fuel storage tanks to exceed Alaska Department of Environmental Conservation standards. Water quality for human consumption was examined at Serpentine Hot Springs in 2010 and 2011 in waters upstream, downstream, and immediately adjacent to the bunkhouse. Testing results indicated the presence of fecal coliform bacteria (with a range of 0–4 colonies/100 ml H₂O). Because Serpentine Hot Springs is located in a natural stream with resident beaver, moose, and bear, some level of natural fecal coliform (a subset of total coliform bacteria) contamination in the water is to be expected (the NPS has installed warning signs for visitors). The presence of any fecal coliform—regardless of the source—means the water must be properly boiled or treated prior to consuming to comply with State and U.S. Environmental Protection Agency drinking water regulations.

Unique Communities and Landscape Features (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Serpentine and Arctic Hot Springs (continued)	Unique Hot Springs Aquatic Microbial Communities		The preserve does not monitor, nor have an established monitoring protocol for, aquatic microbial communities at the hot springs. Aquatic, heat-loving microbial communities are well developed in both Serpentine and Arctic Hot Springs, and are likely adapted to specific water quality, chemistry, and hydrothermal conditions. Given the latitude and isolation of the site, there is a high likelihood of rare and/or endemic aquatic flora and/or fauna. According to Nordstrom et al. (2015) the Eimeriidae family of Apicomplexa eukaryotes are not known to tolerate elevated temperature elsewhere, and DNA of this family detected at Serpentine could potentially represent a new genus of thermophilic protozoa. In addition, the abundance of <i>Philodinida</i> rotifers at Serpentine provides evidence for the prevalence of another set of poorly understood organisms in these hot spring ecosystems. The DNA sequence signature of numerous fly, water mite, protozoa, and rotifer species at Arctic Hot Springs represents a novel contribution to understanding of the diversity and prevalence of eukaryotes in geothermal hot spring systems, suggesting that the contribution of eukaryotic life to hot spring ecosystems is perhaps more important than previously thought (Nordstrom et al. 2015). Thermal communities are more intact and robust at Arctic Hot Springs (compared to Serpentine) due to the absence of human activity in that area.
Lava Beds	Natural Quality		A succession of lava flows starting 17,000 years ago and ending 1,600 years ago have created a 150-square mile series of lava beds (Hopkins 1967). Mostly smooth <i>pahoehoe</i> lava, the flows feature craters, tubes, concentric rings, caves, and basalt flats. Until recently, the lava beds also hosted a remarkable cover of terrestrial lichens that reached thicknesses of several feet (Holt et al. 2007, Holt and Neitlich 2010). Caribou have eaten much of this lush cover in recent years, but large quantities still exist in sheltered locations among boulders, pits, and crevices. One of the warmest spots on the landscape, the lava beds are now being colonized by alders (<i>Alnus crispa</i>).

Unique Communities and Landscape Features (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Barrier Island Complexes	Natural Quality		BELA's soft-sediment shorelines include vast, shallow lagoons with fractal-patterned interiors, large estuaries teeming with waterbirds, barrier islands, sandy capes, salt marshes, mudflats, brackish wetlands, small freshwater lakes and ponds, dunes, ridge systems covered with dwarf shrub-lichen vegetation, and the world's northernmost eelgrass beds. Like those of eastern North America before European contact, the northwest Arctic shorelines are wild, dynamic, productive, and extensive. Barrier islands and spits protect lagoons and estuaries from the open ocean. Some barriers are breached permanently by narrow tidal channels, and intermittently by overwash events during storms. The coastline of BELA includes about 172 linear km of barrier and lagoon complexes, with over 500 km of outer coast and inner coastal features (interior shorelines of lagoons, estuaries, and barrier islands). The barrier islands host a tremendous diversity of wildlife including waterfowl, muskoxen, brown bears, and caribou. Valuable cultural sites, some thousands of years old, are scattered along the coastline, and the barrier complexes remain the most frequently visited part of the preserve. The main impacts to the barrier islands currently include an increase in erosion rates and storm overwash events associated with the loss of sea ice and marine debris. Coastal erosion may ultimately affect subsistence users through loss of allotments and structures. These impacts are expected to continue and increase in the future as sea ice declines, sea level rises, and permafrost thaws. Increased shipping activity in the region also brings with it the possibility of serious oil or industrial spill.

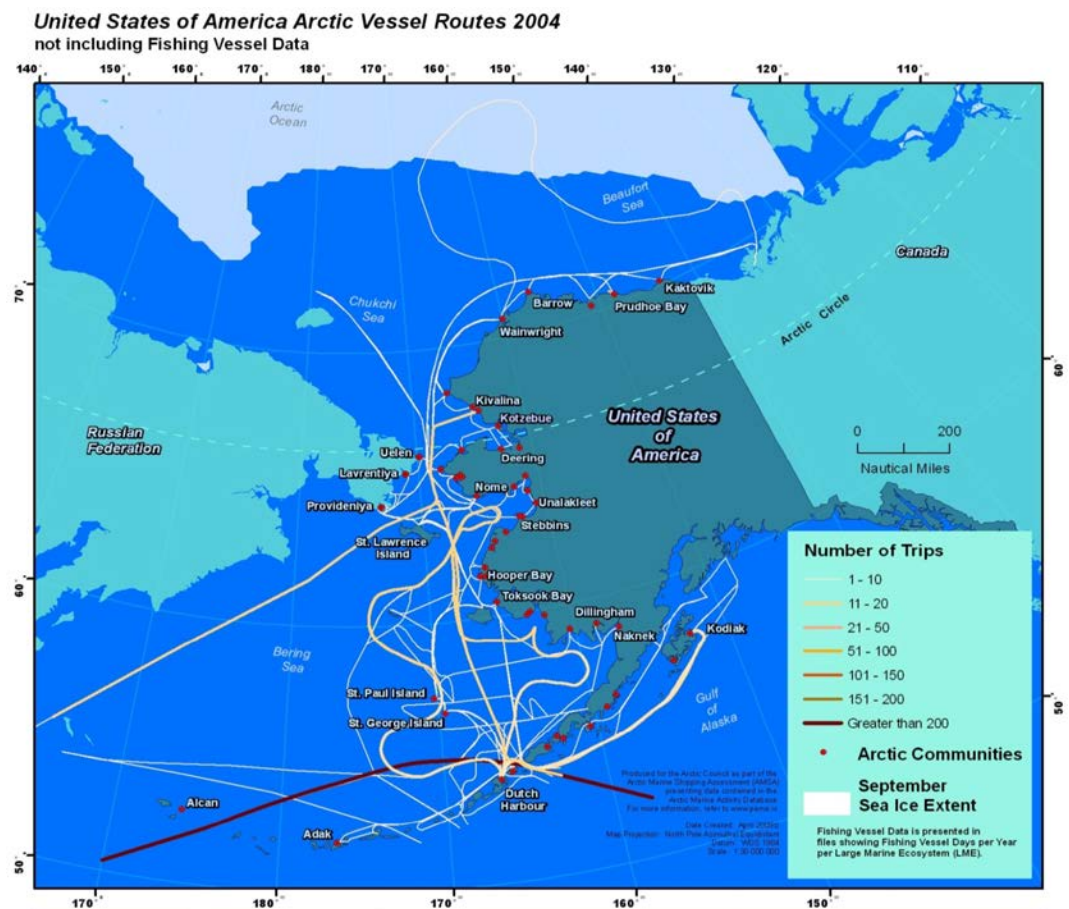
Resource Brief: Ship Traffic in Arctic Waters

With climate change progressing steadily in the Arctic, sea ice has retreated by an average of 1.3% per year since the 1950s ([NSIDC 2015](#)). Through 2015, the September Arctic sea ice extent has decreased by 13.4% per decade, relative to the 1981 to 2010 average. The nine lowest September sea ice extents have occurred in the last nine years. In the summer months, the Arctic ice pack is now sufficiently far north to allow for passage of vessels via both the Northern Sea Route (above Siberia) and the Northwest Passage (through the Canadian Archipelago to Greenland). As a result, vessel traffic has increased dramatically through the Bering Strait ([Arctic Council 2009a](#)).

The Bering Strait is poised to become a crucial and highly used waterway for commercial traffic. Connecting the Bering Sea to the Chukchi Sea, the Bering Strait is the only connection from the Pacific Ocean into Arctic waters; all Pacific marine traffic to or from the Arctic Ocean must pass through the Bering Strait. The Northern Sea Route shipping lanes to Europe and North America from Asia are now in use by cargo ships and fuel tankers, and there is projected to be as much as a 500% increase in traffic by 2025, from 2015 transit estimates ([Azzara et al. 2015](#)). Arctic shipping transits through the Bering Strait are immediately adjacent to the Western Arctic Parklands of BELA and Cape Krusenstern National Monument. Arctic large cruise ship tourism is also emerging as a new enterprise, and a 1,100-passenger ship completed its voyage through the Northwest Passage in 2016. The popular, month-long trip had a 1,000-passenger waiting list.

As shipping traffic increases, so does the risk of spills and vessel incidents. For example, fuel is being transported via fuel barges that navigate and anchor in the shallow waters near shore, occasionally in close proximity to Arctic parklands. Given the rise in demand for infrastructure to support burgeoning demand, the Army Corps of Engineers has been conducting site assessments for a new deep-water port in Nome to support trans-Arctic vessel traffic. Given the proximity of emerging shipping to these formerly remote conservation units, preparing for a coastal incident has become one of the top management priorities for BELA and Cape Krusenstern National Monument. These two units have an ambitious coastal data gathering plan including: (1) collection of baseline data on coastal and marine resources; (2) ground-truthing of incident response plans; (3) arranging for community incident preparedness trainings; and (4) modeling of future vessel traffic routes and densities.

Other key issues associated with shipping traffic increase include: dumping and vessel-related pollution in the Chukchi and Bering Seas, collisions with marine mammals, disturbance of communication and migration routes for marine mammals and fish due to undersea vessel noise pollution, potential decrease in subsistence marine mammal resources, collisions with other vessels, and increased demand for search and rescue.



Vessel traffic routes through the Bering Strait.
Map from the Arctic Marine Shipping Assessment, 2009.

Landscape and Ecosystem Processes


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Fire	Frequency		Fire is a natural part of BELA, and fire occurrence is very episodic. Fire is likely to have occurred in BELA for hundreds of years (Hu et al. 2010). The average number of fires per year is less than 1 fire per year (0.72), based on data from 1950–2015 (BLM Wildland Fire Management Information data). The greatest number of fires occurred in 1985 (10 fires). Only three fires have affected the preserve between 2010 and 2015. There appears to be no change in the trend of fires occurring in BELA over the past 60 years. The number of fires is variable in the preserve, and although no change has been detected over the past 65 years, with increased temperatures there is potential for increased fire occurrence in BELA.
	Total Area Burned		An average of 4,819 acres in BELA burn per year. The majority of acres burned within the preserve occurred during 1977, at which time several large fires burned within and around the preserve.
Landcover	Match of Seasons to Historic Norms (snow-free season, greenup, peak greenness, senescence)		The overall greenness of lowland tundra landscapes as measured by satellite has increased since records began in the 1980s. This change may be due to the climate warming that occurred in the late 1990s, which involved both longer and warmer summers. More detailed satellite records since 2000 provide specific information on the timing of snow cover loss, spring green-up, and fall. This shorter time period is dominated by year-to-year fluctuations. Higher greenness indicates higher shrub cover, which implies a decrease in caribou winter range lichen habitat; the earlier dates of snow melt has the potential to bring mismatches in the timing of wildlife migration and foraging.
Permafrost	Extent, Temperature, Thickness of Active Layer		Most of BELA is underlain by permafrost and the southern boundary of the continuous permafrost zone (>90% permafrost) is roughly contiguous with the southern boundary of BELA (Jorgenson et al. 2008). Modeling by University of Alaska scientists and ground temperature observations by NPS show that permafrost has warmed and the thickness of the seasonally-thawed upper (or “active”) layer has increased as a result of climate warming since 1950, but the extent of permafrost has changed little so far (Panda et al. 2016, Swanson 2016). Recent warming has increased permafrost temperatures above -3 °C across much of BELA. This has reduced the margin of safety protecting permafrost from thaw in the future, and widespread thaw of permafrost is expected in these areas in the latter half of the current century if warming continues.

Landscape and Ecosystem Processes (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Permafrost (continued)	Stability of Permafrost Terrain		Climate warming since 1950 has locally caused ground ice near the surface to melt, causing permafrost thaw subsidence features (thaw slumps and slides). Some degradation of ice wedges has been observed within BELA and documented throughout the northwest Arctic (Swanson 2016b). The loss of lake area in recent decades in parts of BELA is probably linked to increased breaching of lake shores due to permafrost thaw (Jones et al. 2011, Swanson 2013). A few permafrost thaw slides occurred in the mountainous terrain of southern BELA during the unusually warm summer of 2004. These have since revegetated. Degradation of large ice-rich <i>yedoma</i> features (ancient ice deposits in soil) has been observed along the coast and locally on lakeshores. In some locations, the beaches shielding <i>yedoma</i> from the waves have been lost and the <i>yedoma</i>-rich bluffs are being undercut by the ocean and slumping into the water. Thaw erosion of bluffs is expected to increase with sea level rise and the increase in wave action associated with loss of sea ice.
Sea Ice			See Marine Nearshore table above

Dark Night Sky


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Anthropogenic Light	Anthropogenic Light Ratio (ALR) – Average Anthropogenic Sky Glow: Average Natural Sky Luminance		A photic environment is described as the physical amount and character of light at a particular location, irrespective of human perception. The NPS Night Sky Program characterizes a park's photic environment by measuring both anthropogenic and natural light. While no ground-based or modeled data are available for BELA, 2012 visible infrared imaging radiometer (VIIRS) satellite data, which uses a broadband imaging detector with high sensitivity, indicates that there is no visible upward radiance within the preserve boundary, and small amounts of upward radiance within a 200-km radius surrounding the preserve. The largest sources of upward radiance emanate from the town Kotzebue just over 60 km from the preserve's northeast boundary and from Nome about 100 km from the preserve's southern boundary.

Resource Brief: Night Sky Resources

The night sky has been a source of wonder, inspiration, and knowledge for thousands of years. Unfettered night skies with naturally occurring cycles of light and dark are integral to ecosystem function as evident by the fact that nearly half the species on earth are nocturnal. The quality of the nighttime environment is relevant to nearly every unit of the NPS system as the nighttime photic environment and its 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.

Condition and Functional Consequences

Night sky quality at BELA is in good condition. 2012 visible infrared imaging radiometer (VIIRS) satellite data, which uses a broadband imaging detector with high sensitivity, suitable for detecting anthropogenic sources of light on the earth's surface, reveals no upward light within the preserve. Further, very little anthropogenic light is detected in an area within a 200-km radius surrounding the preserve except for a small amount of upward radiance from the Red Dog Mine, about 170 km to the preserve's northeast boundary, and from the town Kotzebue, AK, just over 60 km from the preserve's northeast boundary. Additional upward radiance is visible from Nome, AK about 100 km from the preserve's southern boundary. Given the absence of anthropogenic light originating within the preserve boundaries, and low to moderate upward radiance within 200 km of the preserve, the photic environment of BELA is subject to the natural regime of dark/light patterns allowing visitors to the preserve to experience pristine night sky resources. At these light levels, most observers feel they are in a natural environment. The Milky Way is visible from horizon to horizon and may show great detail, with fine details such as the Prancing Horse. Zodiacal light (or "false dawn" which is faint glow at the horizon just before dawn or just after dusk) can be seen under favorable conditions, and there is negligible impact to dark adaptation looking in any direction.

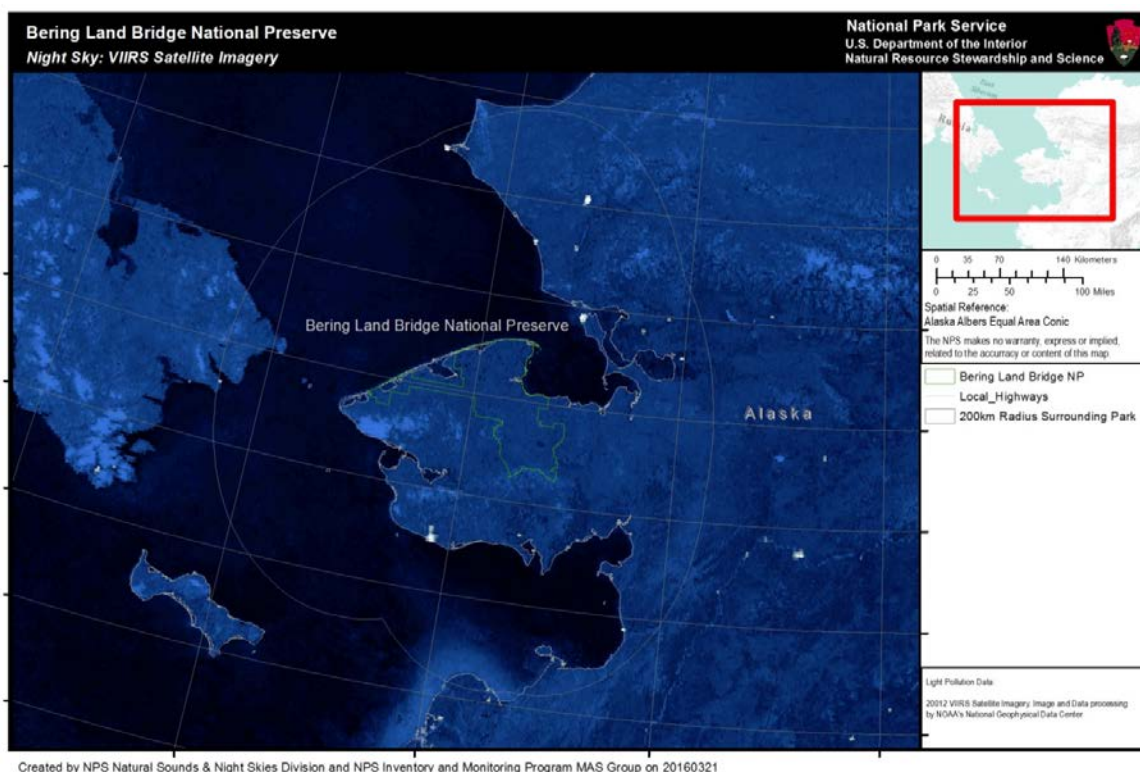
Assessment

No ground-based or modeled data are available for BELA. However 2012 visible infrared imaging radiometer (VIIRS) satellite data, which uses a broadband imaging detector with high sensitivity is suitable for detecting direct or reflected sources of upward radiance of anthropogenic sources of light on the earth's surface. These data are qualitative and are not calibrated to known thresholds or reference conditions.

Criteria for Impact

Two impact criteria were established to address the issue of urban and non-urban night sky resources. Parks within urban areas, as designated by the U.S. Census Bureau, are considered less sensitive to the impact of anthropogenic light and are assessed using higher thresholds of impact. Parks outside of designated urban areas are considered more sensitive to the impact of anthropogenic light and are assessed using lower thresholds of impact. According to the U.S. Census Bureau, BELA is categorized as non-urban, or more sensitive ([U.S. Census Bureau 2010](#)). Learn more in the document [Recommended indicators and thresholds of night sky quality for NPS State of the Park reports](#), and the NPS Natural Sounds & Night Skies Division [website](#).

Regional view of anthropogenic light near BELA. White and red represents more environmental influence from artificial lights while blues and black represent natural conditions. This scale shows regional context and how far reaching the impacts of artificial lighting can be. With no visible upward radiance originating within the preserve boundary and low to moderate upward radiance within 200 km, BELA serves as a harbor of dark skies.



Acoustic Environment

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Indicators of Condition	Specific Measures	Condition Status/Trend	Indicators of Condition
Acoustic Impact Level	A modeled measure of the noise (in dBA) contributed to the acoustic environment by man-made sources		The mean acoustic impact level (L_{50} dBA) in BELA, calculated as the difference between nationwide models of existing and natural ambient, is 0.1 dBA. This indicates that the acoustic environment is in good condition.

Resource Brief: Acoustic Environment

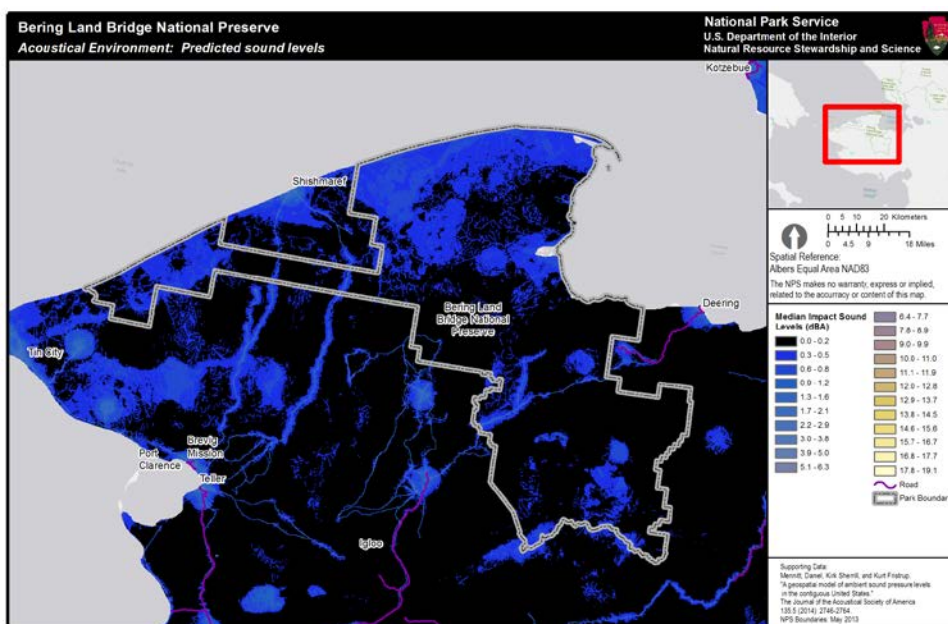
To characterize the acoustic environment, the National Park Service has developed a national model of noise pollution (Mennitt et al. 2014). This model predicts the increase in sound level due to human activity on an average summer day. The model is based on measured sound levels from hundreds of national park sites and approximately 100 additional variables such as location, climate, vegetation, hydrology, wind speed, and proximity to noise sources such as roads, railroads, and airports. The model reveals how much quieter parks would be in the absence of human activities. The quality of the acoustic environment affects visitor experience and ecological health. Acoustic resource condition, both natural and cultural, should be evaluated in relation to visitor enjoyment, wilderness character, ecosystem health, and wildlife interactions. Learn more at the NPS Natural Sounds & Night Skies Division [website](#).

Indicator	Threshold (dBA)
Acoustic Impact Level	Threshold ≤ 1.5 <i>Listening area reduced by $\leq 30\%$</i>
A modeled measure of the noise (in dBA) contributed to the acoustic environment by man-made sources.	$1.5 < \text{Threshold} \leq 3.0$ <i>Listening area reduced by 30 – 50%</i>
	$3.0 < \text{Threshold}$ <i>Listening area reduced by $> 50\%$</i>

Condition thresholds for the acoustic environment in non-urban parks

Criteria for Condition Status/Trend

For State of the Park Reports, NPS has established acoustic standards (green, amber, red) and two sets of impact criteria for urban parks and non-urban parks. A park's status (urban or non-urban) is based on data from the U.S. Census Bureau ([U.S. Census 2010](#)). Parks outside designated urban areas typically possess lower sound levels, and exhibit less divergence between existing sound levels and predicted natural sound levels. These quiet areas are susceptible to even subtle noise intrusions, so care should be taken to maintain low impact conditions in these places. Park units inside designated urban areas typically experience more interference from noise sources. Based on these assumptions, all Alaska parks will be assessed using the non-urban criteria. Condition thresholds are listed in the table below. Just as smog limits one's ability to survey a landscape, noise reduces the area in which important sound cues can be heard. Therefore, thresholds in the table are also explained in terms of listening area.



Map of predicted acoustic impact levels in the park for an average summer day. The color scale indicates how much man-made noise increases the sound level (in A-weighted decibels, or dBA), with 250 meter resolution. Black or dark blue colors indicate low impacts while yellow or white colors indicate greater impacts. Note that this graphic may not reflect recent localized changes such as new access roads or development. Distribution of impacts (blue) is influenced by many factors including, but not limited to man-made noise, wind, and topography.

2.2. Cultural Resources

Archeological Resources  web			
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research is conducted to understand the relationship of the preserve's archeological resources to the historic contexts for the preserve.		The major themes/historic contexts in BELA are well developed, especially for the last 4,000 years, but it is very likely that a significant number of archeological sites have not yet been identified or professionally documented. 47 out of 403 (11.7%) sites have been tested or partially excavated in BELA, revealing a cultural succession observed across northwest Alaska. Due to the remote nature of the preserve, this 11.7% is a relatively high percentage. Sites are known from the late-Pleistocene through the late-Holocene and historic period. A gap in the chronology exists during the middle Holocene from about 8,000–5,000 years ago.
	Archeological resources are identified and evaluated using appropriate anthropological and historical contexts.		A substantial amount of archeological inventory has been conducted in BELA, with a strong emphasis on coastal resources and the highland lake sites in the southeast portion of the preserve. According the Alaska Historic Resources Survey, 53% of the known sites in BELA have determined cultural affiliation. However, the vast majority of sites have not been evaluated beyond cursory inventory and assessment against known archeological traditions. Most areas of the interior portion of the preserve have not yet been surveyed.
	Number of archeological context statements.		441 archeology sites have been reported to the Alaska Historic Resources Survey. 24% of the known sites have a historic component, while 70% are prehistoric; at least 12% of the sites have multiple occupations by cultures from different time periods. Of the prehistoric sites, 60% represent a known archeological culture. Approximately 43 sites (18%) within BELA have associated radiocarbon dates. The Cape Espenberg Archaeological District comprises most of the research and associated radiocarbon dates (n=42). Current research at Serpentine Hot Springs, Kuzitrin Lake, and Trail Creek Caves are adding to understanding of when people were present in BELA.

Archeological Resources (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Scope of archeological resources in the preserve is understood and a determination has been made whether or not they are a fundamental or other important resource.		Sufficient inventory has established that the archeological resources in BELA are a fundamentally important resource. The protection and interpretation of archeological resources is identified in the preserve's enabling legislation. It is generally agreed that the first people to colonize the Americas did so by crossing the Bering Land Bridge from Asia into Alaska at least 14,000 years ago. The oldest sites in BELA—Trail Creek Caves and Serpentine Hot Springs—contain a record of early occupations, and the excellent preservation of Pleistocene fauna provides opportunity to learn more about the lifeways of the Beringian people and first Americans.
	Percentage of archeology baseline documents with current and complete information.		BELA lacks an Archeological Overview & Assessment, but the Schaaf (1988) and Harritt (1994) reports offer detailed site overviews for many of the known sites in the preserve. These reports provide a general interpretation of the preserve's cultural history. The Cape Espenberg area has seen extensive research over the past two decades. Numerous reports and papers are being published, yet a synthesis of the data has not been produced. None of the existing baseline documents are current and complete.
	The mechanisms affecting site stability and taphonomic influences are understood.		Taphonomy is defined as the physical processes of degradation or preservation of organic remains (i.e., decomposition, fossilization). While the mechanisms affecting site preservation and stability are generally known, they are not precisely understood due to the extreme environmental conditions that characterize the preserve. Climate change further complicates the ability to predict impacts and prioritize preservation efforts. New threats, such as permafrost thaw, might lead to increased loss of preserved organic remains found in frozen contexts. The study of coastal erosion processes is ongoing, allowing for better prioritization for preserving threatened sites.
	Percentage of sites/archeological landscapes that are tied to information regarding influences from the physical and social environment.		For BELA, 100% of known archeological sites have general environmental information available (i.e., coastal, riverine, lacustrine, cave). 64% of known sites are on the coast. Coastal sites are all threatened by sea level rise, increased storm surges, sea ice break-up, and general erosion. The remaining 36% of archeological sites occur on interior uplands, and are presumably in a more stable environmental setting. There is significant use of the preserve by locals for travel, hunting, fishing and camping all along the coast and inland. Local users may have knowledge of archeological sites. Systematic pot hunting and fossil collecting is a continuing threat to resources in BELA.

Archeological Resources (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Percentage of sites with known date ranges associated with a research theme.		The cultural history of northwest Alaska is fairly well established and understood. 53% of the known sites in BELA have identified cultural affiliations and 40% of those are historic Iñupiat sites. 41% of the prehistoric sites have diagnostic artifacts that allow assignment to an archeological culture with a defined timespan. However, a survey of the literature shows that only 35 sites (8%) within the preserve boundaries have been radiocarbon dated. Research themes include the origins and development of Arctic maritime adaptations and peopling of the Americas.
Inventory	Percentage of preserve intensively surveyed.		Less than 1% of the preserve has been systematically surveyed using modern methods. The first surveys in BELA were done prior to ANILCA in the 1950s and 1960s. Many of the sites discovered at this time were not precisely recorded and therefore location information was general. Beginning in the 1980s, NPS personnel conducted intensive surveys of the preserve, covering most of the coastlines and several prominent inland areas. This effort continues today. Cape Espenberg has seen the greatest survey and testing, resulting in the discovery of 163 sites in a roughly 16-square mile area. Increased use of GPS technology is allowing archeologists to better document and quantify survey coverage.
	Percentage of survey data included in the Geographic Information System (GIS) meeting current cultural resource standards.		The preserve has excellent archeological GIS data; however, none of the archeological GIS data meets the CRGIS standards as they are defined. Recent work at Cape Espenberg (Darwent et al. 2013) for example, has created highly detailed maps of the features and beach ridges there, yet much work is required to integrate this into the NPS GIS system.
	Percentage of archeological resources with complete, accurate, and reliable data in the Archeological Sites Management Information System (ASMIS).		Of the sites records in ASMIS, 309 (77%) are complete and 93 (23%) have missing fields that need to be entered. Many of the known sites have legacy location data and need updated GPS-derived coordinates. Reliability of the GPS-derived coordinates are considered low for most of the entries. Efforts in collecting and reporting accurate and reliable data continue to improve, but there is a backlog for updating data fields.
Documentation	Percentage of known sites with adequate National Register documentation.		1.7% (n=6) of known sites have adequate National Register documentation (listed/documentated). 28.4% (n=96) have been recommended eligible, 0.89% (n=3) have been recommended ineligible. 65.7% (n=222) of BELA sites have not been evaluated for the National Register.

Archeological Resources (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Documentation (continued)	Percentage of archeological materials cleaned, conserved, studied, cataloged, and properly stored.		According to the 2015 Collections Management Report, 93% of BELA's archeological materials are cleaned, conserved, studied, cataloged, and properly stored. The actual percentage may be slightly lower, as the collections are in need of being rehoused (proper storage).
	Preserve base maps are prepared showing the location and distribution of archeological resources, the nature and extent of archeological identification activities, and the types and degree of threats and damages.		Site locations are available in a GIS layer, although not all locations reflect the most current, accurate information. ASMIS records indicate that 79% of the known sites in BELA have coordinates derived from a GPS unit, although accuracy values appear to have estimates that are too high for the dates they were collected. Locational and spatial data methods are improving every year and are expected to continue into the near future. Efforts to relocate known sites and update position data are ongoing. There is a need to summarize all of the surveys that have been conducted in the preserve. Survey work in the past 15–20 has GPS tracks with which to reconstruct areas covered. Legacy survey data is limited to general area.
	Percentage or number of sites without assessed and defined threats and damages.		98% of sites have been assessed; only 2% of sites need to be assessed for threats and damages. 52% of assessed sites have been disturbed by natural forces or humans.
	Percentage of archeological reports and publications entered in the Integrated Resource Management Applications (IRMA) database.		There are 58 reports and publications in IRMA related to archeology in BELA. Many of the BELA-specific survey reports and articles are missing from the database and need to be located and uploaded. This work is ongoing.
Certified Condition	Percentage of archeological resources certified as complete, accurate, and reliable in the Archeological Sites Management Information System (ASMIS) in good condition.		39.7% (n=160 out of 403) sites in BELA are certified in good condition.

Resource Brief: Fluted Spear Points, Clues to Human History

When and how did the first Americans get here? What course did they take to populate the Western hemisphere? Connecting the dots between various archeological sites containing distinct Paleo-American tools helps reveal the course of early human migration throughout the Americas. Archeologists have long understood the broad strokes of this early chapter in American (pre)history, yet many details remain unknown. One of the longest-running mysteries is the age and origin of fluted spear points in Alaska.

For some decades, archeologists believed that the highly-specialized spear points found in the Clovis archeological complex, located near Clovis, New Mexico, originated in Beringia and were carried south as people migrated. These points were thought to be indicative of America’s first culture, yet the link between the points from the two archeological sites remained unknown. Were Alaska’s fluted points younger, older, or the same age as Clovis? Did this technology evolve independently or did it spread?

Archeology efforts in BELA may shed some light on the history of human movement into and within the Western Hemisphere. In 2009, archeologists found several fluted spear points near Serpentine Hot Springs. The fluted points were determined to be younger than those in Clovis, suggesting that Clovis points developed in the midcontinent rather than Beringia, and that movement of people in and out of Alaska was complex and multidirectional—not a simple north-to-south migration as previously thought. One possibility is that fluted spear point makers moved northwest into the Yukon and Alaska following bison through an emerging ice-free corridor, spreading their technology into new territories.



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 preserve’s ethnographic resources to the historic context(s) for the preserve.		A variety of anthropological investigations and oral history projects relating to BELA have been undertaken by independent researchers, the Bureau of Indian Affairs, and NPS. Studies document cultural connections to parklands and resources over time with focus largely on Iyat and coastal areas of the preserve (Ray 1992, Koutsky 1981, Schaaf 1988, Schaaf 1995, Fair and Ningeulook 1995). However, additional research is necessary to fully understand the relationship of the preserve’s ethnographic resources to the historic context(s) for the preserve. Of particular concern is knowledge of sites and resources in areas vulnerable to erosion and other natural and human threats, particularly along coastal areas. Ethnographic studies would enhance and inform ongoing archeological field research.

Cultural Anthropology (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Percentage of cultural anthropology baseline documents with current and complete information.		0% – BELA currently lacks an Ethnographic Overview and Assessment and relies on disparate existing sources of information. An Ethnographic Overview and Assessment would provide historical and contemporary data and synthesize information, increasing accessibility for BELA management and education needs.
Inventory	Appropriate studies and consultations document resources and uses, traditionally associated people, and other affected groups, and cultural affiliations.		Several focused anthropological studies have been conducted by NPS and independent researchers; however, efforts should be made to develop collaborative Traditional Ecological Knowledge studies with affiliated communities to document traditional knowledge of the environment and natural resources, particularly those related to subsistence lifeways and vulnerable coastal areas. Each passing year marks the loss of knowledge bearers and Elders who can contribute to the documentation process.
	Traditionally associated groups, and the legislative, regulatory, or policy basis for relationships with them, are identified.		Traditionally associated groups have been identified through years of engagement with local communities and organizations and are regularly consulted under Section 106, Native American Graves Protection Act (NAGPRA), and other laws and regulations. Traditionally associated groups include local tribes, reindeer herders, and miners.
	Resources eligible for the National Register of Historic Places as traditional cultural properties (TCPs) are identified.		Iyat (Serpentine Hot Springs) has been identified as an eligible traditional cultural property with concurrence from the Alaska State Historic Preservation Officer in 2003. Formal designation of Iyat as a TCP is currently being pursued by the preserve and affiliated tribes. No additional TCPs have been identified.
Documentation	Planning documents contain current information on traditional resource users and uses, the status of ethnographic data, and the legislative, regulatory, policy, or other bases for use.		General ethnographic information is included in BELA planning documents; however this information is dated. Planning documents include discussions of subsistence use, allotments, and other ethnographic information.
	Percentage of cultural anthropology reports and publications entered in the Integrated Resource Management Applications (IRMA) database.		Currently there are no cultural anthropology documents available in IRMA.

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 preserve's cultural landscapes to the historic context(s) for the preserve.		Two Cultural Landscape Inventories (CLI) have been completed: Iyat/Serpentine Hot Springs and Goodhope Reindeer Herding Site. Four additional CLIs have been identified, but not documented.
	Cultural landscapes are identified and evaluated using appropriate historical contexts.		All of the preserve's cultural landscapes have been identified and two have been evaluated using the preserve's established historical contexts.
	Scope of cultural landscapes in the preserve is understood and a determination has been made whether or not they are a fundamental or other important resource.		The two completed CLIs for BELA are completely scoped; Iyat/Serpentine Hot Springs and Goodhope Reindeer Herding Site were determined to be fundamental resources. The additional four identified CLIs remain incompletely scoped. NPS managers, recognizing the special relationship of the landscapes to local people, consult with the Tribal Councils, Elders Councils, the City Councils, and the Native Corporations of the villages on a regular basis concerning management issues within the preserve.
Inventory	Percentage of landscapes eligible for the National Register in the Cultural Landscapes Inventory (CLI) with certified complete, accurate, and reliable data.		33% (2/6) of cultural landscapes have current and complete CLIs. There are no cultural landscape reports for BELA.
	Percentage of Cultural Landscapes Inventory (CLI) data included in the Geographic Information System (GIS) meeting current cultural resource standards.		Both the Iyat/Serpentine Hot Springs CLI and Goodhope Reindeer Herding Site CLI have been documented in GIS, but do not meet current cultural resource GIS standards. This data currently is only located at the NPS Alaska Regional Office and should be transferred to the preserve's Cultural Resources GIS.
Documentation	Percentage of cultural landscapes with adequate National Register documentation.		Iyat Hot Springs National Register Nomination will be completed in 2016. There is no other National Register documentation for cultural landscapes in BELA.
	Percentage of cultural landscapes with Determination of Eligibility (DOE) documentation.		33% (2/6) of identified cultural landscapes have completed DOEs and have been determined National Register Eligible with State Historic Preservation Officer Consensus Determinations.

Cultural Landscapes (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Documentation (continued)	Percentage of cultural landscape reports and publications entered in the Integrated Resource Management Applications (IRMA) database.		100% of completed CLIs are in IRMA.
Certified Condition	Percentage of Maintained Landscapes (historic) in the Facility Management Software System (FMSS) with a Facility Condition Index (FCI) indicating good condition.		50% – 1/2 of certified cultural landscapes are in good condition. Iyat Serpentine Hot Springs is in good condition and the Goodhope Reindeer Herding Site is in fair condition. Only two of the six identified cultural landscapes have received condition assessments. The condition of the remaining landscapes has not been evaluated.

Historic Structures


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research is conducted to understand the relationship of the preserve's historic structures to the historic context(s) for the preserve.		BELA has sufficient research regarding the preserve's historic structures. This includes: several historic resource studies (Fjeld 1992, Gerlach 1994, Willis 1986 , Ellanna and Sherrod 2004), a draft historic themes atlas (Demma and Devinney 2013), the Alaska NPS subsistence management history (Norris 2002), a mining site history (Saleeby 2000), and reindeer herding histories (Fjeld 1992, Simon and Gerlach 1992, Simon 1998, Rattenbury et al. 2009). BELA should develop the understanding of the context for the shelter cabins within the preserve.
	Scope of historic structures in the preserve is understood and a determination has been made whether or not they are a fundamental or other important resource.		While there are updated historic resource studies, these do not incorporate how the shelter cabins within the preserve need to be evaluated. The shelter cabins need to be evaluated; evaluation of pre-historic structures has been a long-standing discussion between NPS subject matter experts.

Historic Structures (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Adequate research exists to document and preserve the historic structure's physical attributes that contribute to historical significance.		The Goodhope Reindeer Cabins have a condition assessment and recommended treatment plan. For other structures, adequate research does not exist to document and preserve the structures' physical attributes that contribute to historical significance.
Inventory	Percentage of historic structures eligible for the National Register in the List of Classified Structures (LCS) with accurate, complete, and reliable data.		11% – Only 9 of the total 61 structures on the LCS have been found eligible for the National Register: Fairhaven Ditch, Fairhaven Ditch Cabin 1, Fairhaven Ditch Cabin 2, Fairhaven Ditch Cabin 3, Lava Lake Officer Quarters, Lava Lake Mess Hall, Goodhope River Reindeer Corral, Goodhope Reindeer Herding Site Messhall, and Goodhope Reindeer Herding Site Cabin. Of these eligible structures, only 7 have accurate, complete, and reliable data.
	Percentage of List of Classified Structures (LCS) data included in the Geographic Information System (GIS) meeting current cultural resource standards.		The structures on the LCS have been documented in GIS, but do not meet current cultural resource GIS standards.
Documentation	Percentage of historic structures with adequate National Register documentation.		6% – Only 4 of the total 61 structures on the LCS have adequate National Register documentation: Fairhaven Ditch, Fairhaven Ditch Cabin 1, Fairhaven Ditch Cabin 3, and Fairhaven Ditch Cabin 2.
	Percentage of historic structures with Determination of Eligibility (DOE) documentation.		8% – Only 5 of the total 61 structures on the LCS have Determinations of Eligibility documentation: Lava Lake Officer Quarters, Lava Lake Mess Hall, Goodhope River Reindeer Corral, Goodhope Reindeer Herding Site Messhall, and Goodhope Reindeer Herding Site Cabin.
Certified Condition	Percentage of historic structures certified as complete, accurate, and reliable in the List of Classified Structures (LCS) in good condition.		0% – None of the historic structures certified as complete, accurate, and reliable in the List of Classified Structures (LCS) are listed in good condition. Both shelter cabins are no longer certified as complete, accurate, and reliable; they are currently listed in poor condition.
	Percentage of historic structures in the Facility Management Software System with a Facility Condition Index (FCI) indicating good condition		9.8% – 6 of the total 61 structures on the LCS are in Facility Management Software System (FMSS) and have an FCI indicating good condition. However, it should be noted that only 7 structures on the LCS are listed in FMSS. Fairhaven Ditch Cabin #2 is the only structure on the LCS with an FCI indicating serious condition.

Resource Brief: Goodhope Reindeer Herding



A reindeer antler hangs on the wooden corral gate of this Seward Peninsula cultural landscape. The corral was constructed in 1938 specifically for reindeer herding; it was utilized from 1939 to 1942 and again in the 1960s and 1970s. NPS Photo.

The Goodhope River Reindeer Herding Site is located on the northern Seward Peninsula of western Alaska. The site is located inside the preserve boundary, roughly 15 miles from the mouth of the Goodhope River and 35 miles east of Deering. Goodhope is associated with the herding of reindeer in connection with the Reindeer Act of 1937. The cabins and corral were constructed in 1938. The last recorded use of the facility for reindeer herding was in 1978.

Missionary Sheldon Jackson introduced Reindeer herding to Alaska in 1891. Reindeer are indigenous to Eurasia, which has an arctic to subarctic climate similar to Alaska’s, and were believed to be a good source of food and economic growth for Alaska Natives. The first herd was brought to Deering in 1905, and a year later the population totaled 647. Between 1917 and 1930, the Alaska reindeer population grew from 98,582 to 640,000 (Bucki et al. 2004). In 1937, the Reindeer Act was passed, stating that only Native Alaskans could hold permits to herd reindeer.

The Goodhope River Reindeer Herding Site was established in 1938, and included two cabins and a corral. The site at Goodhope was affiliated with the Association of Teller Unit Herds, which was a combination of herds and companies within the greater peninsula. In 1940, 4,570 reindeer were corralled on the site. In 1942, overgrazing and wolf predation led to the first decline in this reindeer population. Little is known about the uses of the cabins and corral between 1942 and the 1960s. Graffiti on the cabin walls indicate they were used by villagers traveling by dogsled and subsistence hunters in the area. Between 1960 and 1978, there was an increase in the number of people using the site. The reindeer population had increased, allowing Alaska Natives in the area to start corralling again. Korea became very interested in antler sales and helped to stimulate the herders’ incomes. The last recorded herd was in 1978, when the NANA Corporation bought 1,500 reindeer to restart their herd.

In 1980, the Alaska National Interest Lands Conservation Act established BELA, which would allow for the continuation of reindeer grazing in the areas. In the late 1990s, caribou herds returned to this area and reindeer left the site to migrate with the caribou herds. This ended the practice of herding throughout the range. The Karmun family still owns the grazing permit for the Deering reindeer herd. Rehabilitation of the larger cabin was conducted by the NPS in 2010 (Horton and Corran 2012).

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 preserve.		BELA has research regarding the preserve’s history, but lacks an administrative history. Existing research includes several historic resource studies (Grauman 1977, Koutsky 1981–82, Williss 1986, and Russell 2009), a draft historic themes atlas (Demma and Devinney 2013), Alaska NPS subsistence management history (Norris 2002), mining site history (Saleeby 2000), and reindeer herding histories (Fjeld 1992, Ellanna and Sherrod 2004, Gerlach 1994, Simon 1998). In addition, Bureau of Indian Affairs ANCSA 14(h)(1) studies identified historic and cemetery sites of note.

History (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Research at the appropriate level of investigation (exhaustive, thorough, or limited) precedes planning decisions involving cultural resources.		Thorough historic research has focused on Iyat (Serpentine Hot Springs) and Ublasaun on the coast. Historic research has been conducted on military sites and features (Lava Lake and Lane Mountain B29 Crash Site), reindeer herding (Goodhope Reindeer Corral, Ublasaun), and a number of mining related sites.
Inventory	Cultural resources are inventoried and evaluated in consultation with State Historic Preservation Officers (SHPOs).		The preserve actively engages and consults with the SHPO on matters related to archeological, ethnographic, and historic resources.
	Research data are accessioned as part of the preserve's museum collection.		The archives of the preserve contain raw data and research materials from various ethnographic, archeological, and historic studies.

Museum Collections


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Sufficient research and analysis exists to understand the relationship of the preserve's museum collection to the historic context(s) for the preserve.		The preserve currently has an adequate amount of research and reports to demonstrate the significance and context of the items in the museum collection; however, there is potential for both continued and expanded archeological, ethnological, historical, and natural history studies that would expand understanding.
	Scope of museum collection in the preserve is understood and a determination has been made whether or not they are a fundamental or other important resource.		BELA has a current Scope of Collections Statement, signed in 2013. The Scope of Collections Statement was developed with input from preserve staff; however new staff members' understanding of this core document could be enhanced.

Museum Collections (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge (continued)	Percentage of museum collection baseline documents with current and complete information.		70% of museum collection baseline documents have current and complete information. 57% of the current and complete baseline documents are completed by the Alaska Regional Curatorial Center (ARCC), as the ARCC is the official repository for the BELA museum collection. Baseline documents currently needed include a Collections Management Plan and a Collections Condition Survey.
Inventory	Archival and manuscript collections are surveyed and described in the Interior Collections Management System (ICMS) and finding aids are produced.		The vast majority of BELA's archival collections are surveyed and described in the Interior Collections Management System (ICMS). A finding aid is also available.
	Percentage of existing collection that is accessioned and cataloged.		The 2015 Collections Management Report (CMR), reports that 47% of BELA museum collections have been accessioned and cataloged. Since publication of the CMR, a large backlog of archives was processed, bringing the total percentage of collections cataloged to 95%.
	Scope of Collection is consistently implemented; items or objects are researched to determine their appropriateness for inclusion in the museum/archive collection.		Since 2010, there has been consistent implementation of the Scope of Collections Statement (SOCS).
Documentation	Accession and deaccession files are complete with all appropriate signatures		All accession and deaccession files are complete with appropriate signatures.
Certified Condition	Percentage of museum collection reported in Collections Management Report (CMR) and checklist report in good condition.		Overall, the museum collections are in good condition and the storage area is environmentally stable and very secure. There are 25,480 records in the Interior Collections Management System (ICMS), with 10% reported as excellent condition and 35% reported as good condition. A Collection Condition Survey will identify and address existing deficiencies, such as the need for rehousing.

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		Total visitor center and other program visitation (such as special events and informal interpretive contacts) has a five-year average of 8,845 visits from 2011 to 2015. From 2011 to 2015, this number increased by 78%. Visits to the Bering Land Bridge Visitor Center in Nome have increased from 2,107 to 3,366 (37%). Tourism is increasing from an increase in cruise ships visiting Nome. Total visitor contacts in 2015 were 21,916. This number does not include the difficult to track amount of backcountry preserve visits. Calculating a precise number of visitors to the preserve is difficult as, unlike most NPS parks, the preserve has no main entry point and no visitor stations in the preserve. Visitors arrive to BELA by small airplane, boat, snowmobile, bicycle, and foot. Visitors have been counted in certain known high visitation locations; visitation at Serpentine Hot Springs and Nuluk cabin was 3,891 in 2015. Though not considered visitors, the majority of people accessing preserve land are local residents using the area for subsistence harvest or recreation; BELA is a land base for four main communities: Shishmaref, Wales, Deering, and Nome. Coastal and river areas are widely used by locals. During the winter, the preserve sees subsistence use and increased travel from snowmobile as people travel from village to village.
Visitor Satisfaction	Percent of Visitors Satisfied with Visit		The preserve does not conduct formal visitor satisfaction surveys. Information on visitor satisfaction can be estimated from a visitor log at Serpentine Hot Springs, community meetings and from social media efforts. While this information is not normally collected or analyzed, these sources generally indicate that visitor satisfaction is high.

Scenic Resources



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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Scenic Views	Scenic Views Quality & Protection		The preserve has no sources of scenic disturbance. Scenic views of hot springs, lava flows, maar lakes, coastal formations, and barrier island complexes exist throughout the preserve.

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 Programs, Number of Participants		The preserve's education program has grown significantly in the past five years. Since 2011, education program participation has increased 56%, from 1,002 students in 2011 to 2,258 in 2015. The number of formal education programs provided by the preserve also increased, from 52 programs in 2011 to 172 in 2015. In 2014, the preserve added a permanent education technician to its staff, and worked to enhance curriculum-based educational programming to regional and local schools. In addition to offering a full set of curriculum-based lessons for K–12, the preserve utilizes app and tablet technology in school programming focused specifically on ocean and climate change education. Rangers make classroom visits to communities of the Bering Strait School District and local Nome schools. The number of communities visited for education and outreach has grown from 1–2 annual visits to 9–10 annual visits since 2014. In 2016, BELA started its distance learning programs, connecting to schools across the country via Skype.
Ranger Programs	Number and Quality of Programs, Attendance		Annual attendance of formal interpretive programs averaged 929 participants (2011–2015); participation has declined approximately 34% in the last 5 years.
Junior Ranger Programs	Number and Quality of Programs, Attendance		In the past five years, Junior Ranger program participation has declined by 20%, from 430 to 218 participants (2011–2015). The 5-year average is 363 participants. BELA's Junior Ranger program is a weekly summer program held for youth ages 6–12. BELA also offers a weekly summer program, "Tundra Tots," for children ages 3–5.
Special Events	Variety and Longevity of Events, Community Involvement		The preserve participates in a variety of special events, including interpretive programming during the Iditarod Sled Dog Race, Iron Dog Race, Iñupiaq Days, National Park Week, NPS Centennial BioBlitzes, and others.
Community Programs	On- and Off-site Programs in Local Community		Local community programming is important. The preserve participates in a variety of local events (health fairs, career fairs) and community festivals (Blueberry Festival, Midnight Sun Festival, Salmonberry Folk Festival, Kaatiluta Festival). In addition, the preserve hosts trainings and meetings with the U.S. Coast Guard (marine spill response), Arctic Council, and iTREC (teacher professional development). The preserve also provides the community with information about NPS projects and Beringia Program grants at the Kawerak Regional/Rural Providers Conference.

Resource Brief: Bringing Bering Land Bridge to the Classroom

Just how big was the Bering land bridge during the last Ice Age? What is a maar lake? How do animals survive the harsh Arctic environment?

These questions and more are explored through BELA's dynamic and engaging education programs. Through a full suite of curriculum-based lessons, students from K–12 learn about the natural and cultural resources of BELA. Rangers bring BELA to the classroom with school visits in nearly all of the 15 communities within the Bering Strait School District, in addition to Nome Public Schools. Education programs in Nome occur both in the classroom and outside on the tundra. All lessons are correlated to both Alaska state standards and the significant interpretive themes for BELA. A number of lessons created specifically for iPad tablet technology are popular with today's technology-driven students.

The BELA education program continues to grow with the addition of distance learning opportunities for students across the country. During a series of pilot programs in 2016, students from Ohio, Florida, and other states interacted with NPS rangers to discover more about Beringia, the Iditarod, and life in the Arctic. BELA's formal distance learning strategy will be finalized in 2017.

Bering Land Bridge National Preserve is one of the most challenging parks to visit; however, by bringing rangers to the classroom through school visits, lesson plan development, and distance learning opportunities, students locally, regionally, and across the country are able to connect to the preserve in a meaningful (and fun!) way.



Recreational Opportunities


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Sport Hunting and Fishing	Quality of Recreational Opportunities		Moose, caribou, brown bear, and muskoxen are the primary species that would attract sport hunters to BELA. BELA is currently closed for sport hunting of moose and muskoxen. Caribou sport hunting in the preserve, while legal, can be difficult due to remote terrain and access. The most feasible access for caribou hunting is during the winter. Bear hunting primarily occurs during the spring. There is limited sport fishing in the preserve, and no commercial fishing.
Flightseeing, Hiking/ Backpacking, Floating	Quality of Recreational Opportunities		In 2015, BELA had its first commercial services flight operator out of Nome. There are three flight operators that operate into the preserve out of Kotzebue. Opportunities for flightseeing, hiking, and backpacking are improving.
Birding and Wildlife Observation	Quality of Recreational Opportunities		There are opportunities to see unique arctic wildlife such as large bird migrations, caribou herds, and muskoxen. Planes can be chartered from several companies to access areas for wildlife viewing. Visitors to Serpentine Hot Springs in the winter often see caribou and muskoxen.

Interpretive Media – Brochures, Exhibits, Signs, and Website


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Wayside Signs	Condition and Currency of Signs		A site management plan for Serpentine Hot Springs is being drafted. This plan identifies needs for outdoor interpretive signage around Serpentine Hot Springs.
Exhibits	Visitor Center		The administrative offices and Visitor Center for BELA are located in Nome, Alaska. The Northwest Arctic Heritage Center, located in Kotzebue, Alaska, also provides visitor information for BELA. In 2015, the preserve developed new visitor exhibits at the Nome Visitor Center, including 2 touchscreen kiosks with story map technology and internet access to the BELA website. This media and exhibit project won the 2015 Alaska Regional Media Award.
Print Media	Accuracy and Availability of Primary BELA Publications		In 2014, the preserve completed a visitor guide and a brochure with details about Serpentine Hot Springs brochure.
Audio-visual Media	Orientation Films		BELA has produced numerous short videos on specific topics of interest, including resources in the preserve and the surrounding areas. Existing preserve orientation videos are dated (late 1980s to early 1990s) and are technical in nature.
	Multi-media Development		The preserve has created interactive story maps, which are available both on the Nome Visitor Center touch screens and online. A story map is a virtual tour of the preserve, combining mapping technology and location-based narrative features, photos, and videos. At the Nome Visitor Center, visitors can use the story maps to guide themselves through the preserve, while an interpretive ranger stands by to answer questions. The preserve has also significantly updated its NPS website for the National Park Service Centennial. A unique sound recording from Serpentine Hot Springs plays through multimedia displays in the Nome Visitor Center, which facilitates further visitor connection to the preserve.
	Local Radio Spots		Interviews on local radio stations are frequently conducted in conjunction with press releases for special events, changes to regulations, and as other public information become available. Bering Land Bridge's first Artist-in-Residence was featured through interviews on the local radio as part of the NPS Centennial celebration.
Websites	Number of Website Visitors, Social Media (Facebook updates and "likes," overall activity)		The NPS BELA webpage receives an annual average of nearly 150,000 visits, a 25% increase between 2013 and 2015. The preserve began developing its social media presence in 2009. The BELA Facebook page has over 9,000 "likes." The preserve also has over 8,000 followers on Twitter, 82 followers on Flickr, and periodically contributes videos to the NPS Alaska Region's YouTube page.

Resource Brief: Nome Visitor Center Multimedia Upgrades



Displays in the Nome Visitor Center. NPS Photo.

The upgraded displays completed in the Nome Visitor Center in 2015 allow a wide variety of audiences to discover the Ice Age giants that once roamed the tundra. The colorful displays include life-size skull and bone replicas that bring to life their large dimensions and enrich the visitors' multisensory discovery. Displays also feature large panels profiling the animals' characteristics and behaviors.

In addition to the 2015 updates, the Beringia Room, an adjacent multi-use classroom, will soon highlight a full spectrum of cultural and anthropological history related to the preserve. This addition will include exhibits featuring the Clovis spear points found near Serpentine Hot Springs, artifacts found in the Lost Jim Lava Flow, and photographs from "A Divided Maritime Family."

Both the Visitor Center and the Beringia Room are equipped with large touchscreen monitors that feature two story maps and have the capacity to display films and future multimedia products. Story maps are desktop applications that allow visitors to explore the landscape, flora and fauna, and cultural history of the preserve and the surrounding area. The production of these maps was an NPS Centennial undertaking for BELA; these projects support the National Park Service goal to engage 21st-century audiences. A third story map is scheduled to be finalized during the winter of 2016–2017. This new story will highlight traditional knowledge and place names between the areas of Shishmaref and Cape Espenberg.

The Bering Land Bridge kids' mobile application, an "app" currently under development, will present a digital park-like experience while challenging worldwide users to survive in the Arctic ecosystem. This new technology will enable the preserve to share interesting information with a diverse set of visitors, reaching far beyond the Nome Visitor Center.

Safety



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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Visitor Safety	Recordable Incidents		There have been no recordable visitor incidents since 2010. It is unknown how many injuries truly occur in BELA; due to the remote nature of the preserve, it is likely that incidents go unreported unless they are extremely urgent. The preserve has limited capability to participate in emergency response.
Staff Safety and Training	Completion of Required Safety Training		Operational Leadership Training has been completed by all permanent BELA staff. CPR and first aid training are offered to staff on a space available basis. A job hazard analysis is conducted before work is to be completed throughout the preserve.

Accessibility


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Mobility	ADA Compliance		BELA is located in remote Alaska, with no road access or trails and with only limited facilities. Accessibility is challenging for all visitors; however the Nome Visitor Center offers a window into the preserve through various accessible exhibits and films. The visitor center is located within a leased building and all facilities are located on the ground floor. Currently, the door-opening mechanism is not functioning. Bathrooms are wheelchair accessible. The visitor center has peripheral access devices to operate the touch screen monitors.
Visual Accommodation	ADA Compliance		BELA does not currently have any braille or audio-description devices in the visitor center. Alternative text is used in all photographs on the webpage and digital documents (PDFs) are formatted for reading by a computerized reader.
Auditory Accommodation	ADA Compliance		All videos and new displays have closed captions.
Multi-lingual Resources	Audio and Print Materials in Multiple Languages, Bi-lingual Staff		Visitor's guides are available in Russian. Some preserve films are available in Iñupiaq and Russian. Many preserve materials are not available in the Iñupiaq language. For the past 3 years, cruise ship passengers visiting the preserve have been primarily French- and German-speaking Europeans. Two staff members are fluent in Spanish.

Partnerships


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Volunteers	Number and Hours Contributed		Volunteers are important to all operations in the preserve. BELA has an average of 12 volunteers per year. Volunteer numbers (Volunteers-in-Park and interns) increase every year, with over 1,000 hours donated annually. In the past 5 years, volunteers have donated a total of 10,630 hours to the preserve.

Partnerships (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Partnerships	Number of Partnerships		BELA has several long-term partnerships with regional and local community entities. Non-federal partners include: • Tribes (Native Villages of Shishmaref, Wales, Deering and Kotzebue) and Nome Eskimo Community • University of Alaska • Bering Strait and Nome School Districts • Nome Literacy Council • Cultural Planners Group • Kawerak, Inc. • City of Nome • Nome Convention and Visitors Bureau • Norton Sound Education Workgroup • Reindeer Herders Association • Student Conservation Association • Alaska Department of Fish and Game Federal partners include: • Alaska Reindeer Council • Oceans Alaska Science and Learning Center • U.S. Forest Service • Bureau of Land Management (BLM) • National Oceanic and Atmospheric Administration (NOAA) • United States Coast Guard • U.S. Fish and Wildlife Service Office of Subsistence Management.

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 2010 / 2015	FCI 2010 / 2015	Condition Status/Trend	Rationale
Buildings	23 / 25	0.16 / 0.12		BELA manages 7 housing facilities in Nome. 3 housing facilities are in either good or fair condition. 2 housing facilities are in poor condition. 2 housing facilities are in serious condition, and will soon be replaced. The average FCI for the housing facilities not scheduled to be replaced is 0.12 (fair condition). The BELA Visitor Center and office is in good condition. The building is leased from the Sitnasuak Native Corporation. The BELA maintenance shop is in good condition. It is leased from Crowder, LLC. The facilities at Serpentine Hot Springs are in fair condition. BELA needs to repair the main bunkhouse and redesign the outhouse. The airstrip and bathhouse are in good condition. Other BELA facilities, such as the emergency public use shelter cabins, are in poor to serious condition.
Trails	1 / 7	0.000 / 0.000		Trails in BELA are primarily marked for winter snowmobile usage only. There is a marked trail from Serpentine Hot Springs south to the preserve boundary (13 miles) for hiking. Trails are not maintained, except for winter tripod trail markers that BELA maintains as needed and in partnership with Kawerak, Inc. and the Native Village of Shishmaref. Tripods are fixed and/or replaced as resources are available.
All Others	3 / 6	0.000 / 0.000		Other assets include fuel tanks, dog lot storage area, duplex site grounds, and other maintained landscapes.

2.5. Wilderness Character and Stewardship

The Wilderness Act of 1964 requires the NPS to maintain Wilderness character, including the qualities of being “...untrammelled by man...undeveloped...natural,” and allowing for “...solitude or primitive and unconfined recreation.” A summary of wilderness character for the Bering Land Bridge is below.

Overall Wilderness Character  web ▶		
Wilderness Quality	Condition Status/Trend	Rationale
Natural		BELA represents a remote landscape with intact natural ecosystems; as such, the natural quality of BELA’s Wilderness is considered to be in good condition. Climate change threatens the natural quality of BELA’s Wilderness. The preserve has already begun to experience localized permafrost thaw, increased severity of coastal storms, habitat change, and shrub increase.
Undeveloped		BELA’s Wilderness is relatively undeveloped. Developments within BELA include: • The preserve maintains five public use emergency shelter cabins, mainly utilized by local people during the winter months for travel in the preserve and from village to village. • Reindeer herding and husbandry is still practiced in BELA today, and some buildings and corrals remain. • Snowmobile travel is common in winter and some float plane access occurs in summer, but no motorized use otherwise occurs. BELA has begun to map unauthorized ATV use in GIS, but use and damage appears to be light. In the future, the BELA Wilderness may be affected by development. In particular, relocation of the Village of Shishmaref to a nearby new location on the mainland is proposed. Constructing a new village will require large amounts of rock materials for building foundations and roads. If Ear Mountain (the closest source of rock materials, 13 miles from Shishmaref Inlet) is used for materials, a new road would need to be constructed, and about 6 miles of the road would cross BELA. Existing law and regulation provide an orderly process for applying for, processing, and granting access. The Village can apply for a right-of-way across Bering Land Bridge National Preserve and if it is found to be necessary to develop access from Shishmaref Lagoon to obtain rock from Ear Mountain (rather than from other sources), a right-of-way could be granted under the authority of section 1110(b) of ANILCA.
Untrammelled		Due to the remoteness of the preserve, most areas remain free from modern human control or manipulation. Virtually no trammeling actions have occurred in BELA since the preserve was established, with the exceptions of wildfire suppression and wildlife collaring activities. These trammeling activities have a relatively minor impact on the preserve’s overall untrammelled quality.
Solitude or Primitive and Unconfined Recreation Opportunity		There are many opportunities for solitude or primitive and unconfined recreation in BELA. The majority of the visitation in BELA is by local residents from communities bordering the preserve. In addition to these subsistence activities and lifestyles, there are a small number of sport hunters, hikers, boaters, and visitors to Serpentine Hot Springs. Those looking for a primitive and secluded camping experience can be transported to a remote area in the preserve and experience a majestic landscape with few signs of human presence.

Wilderness Stewardship


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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Stewardship to Preserve Wilderness Character	Key Information		BELA receives key information about Wilderness management from the National Park Service's Alaska Regional Office. Wilderness-related guidance and assistance from NPS Alaska Regional Office employees is readily available.
	Management Operations		Wilderness character is considered in all planning and management actions with potential impacts to resources. BELA scopes all potential projects for impacts to Wilderness character and utilizes the Wilderness Minimum Requirements Analysis (MRA) for projects thought to have a moderate or greater impact. During evaluations of research projects, the preserve uses the Science in Wilderness evaluation framework. BELA maintains an active compliance team headed by a NEPA coordinator who presides over evaluation of each project for impacts to natural resources, cultural resources, subsistence, and Wilderness.
	Status of Plans		BELA has a draft Wilderness Character Narrative, but has lost the wilderness specialist staff position, which would be responsible for completing the report. The Wilderness Character Narrative will be completed when a new specialist becomes available. BELA has utilized the Environmental Impact Statement wilderness suitability information from 1986 as part of the preserve's original General Management Plan (GMP).
	Completed Training		Currently, none of the staff located at BELA headquarters has completed wilderness-related training.

2.6. Subsistence

Subsistence  web ▶			
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Knowledge	Up-to-date documentation is available about subsistence resources and their uses in communities eligible to harvest resources in the preserve		BELA has three primary communities affiliated with the preserve and heavily dependent on subsistence resources from the preserve: Deering, Shishmaref, and Wales. Additionally, some residents of Kotzebue, Buckland, Teller, Brevig Mission, Koyuk, Elim, White Mountain, and Nome occasionally pursue subsistence activities within the preserve. Sharing of subsistence foods with relatives and friends is an important cultural practice, even extending beyond the region. Each of these communities has a baseline comprehensive community household harvest survey. In addition, several communities have more focused surveys related to use of specific subsistence resources, as well as sharing and trading activities. These studies roughly span the last thirty years; many of the more recent studies were completed within the last five to ten years. There is also extensive anthropological and historical literature, which provides descriptive information about subsistence resources.
Opportunity and Continuity for Subsistence Activities	Proportion of users who are able to engage in all the subsistence uses they would like to pursue		The opportunity to pursue key subsistence activities is decreasing. This is due to four primary reasons: (1) declines in the biological status of several important wildlife species (caribou, muskox, and moose; (2) reduction in access to resources due to climate change (lack of snow cover for winter travel and increased safety hazards from thinning marine ice); (3) a regulatory system that often conflicts with traditional harvest practices; and (4) increasingly higher costs of pursuing subsistence activities (Arctic Council 2009b).

Subsistence (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Opportunity and Continuity for Subsistence Activities (continued)	Subsistence users are engaged in subsistence management		Opportunities exist for local subsistence users to participate in a number of federal and state advisory groups (Federal Regional Subsistence Councils, Local Fish and Game Advisory Committees, and NPS Subsistence Resource Commissions) and special groups established for targeted recommendation (Western Arctic Caribou Herd Working Group, Unit 23 Working Group, and Statewide Sheep Management Group), which make recommendations to the regulatory boards (Federal Subsistence Board and State Boards of Fish and Game). During public meetings, many subsistence users state that they are insufficiently represented in the actual decision making bodies, and/or they should share decision making responsibility through some other regulatory structures, such as co-management arrangements (ICC 2014).
	Continuity of Subsistence Uses		There is strong continuity of subsistence uses in outlying villages, in terms of resources as well as the cultural systems of beliefs and practices in which uses are embedded. The adoption of new technologies—such as snowmachines replacing dogsleds and use of rapid fire firearms—represents the most noticeable change in subsistence. Adoption of technology may reshape the harvest patterns. Continuity of subsistence uses is less strong in regional centers—such as Nome and Kotzebue—where populations have greater ethnic and cultural variety. However, these regional centers contain significant components of the underlying regional culture, which remains strong.
Harvest of Fish, Wildlife, and Vegetation	Fish Resource Availability		Fish of several species comprise very significant components of the subsistence harvest for all communities in the region. Overall, fish remain available (Menard et al. 2015), but no rigorous fish monitoring data have been collected. Changes in run timing of anadromous species and changes in weather patterns (which disrupts processing fish harvests), both potentially linked to climate change, pose significant concerns for subsistence users. In the long term, ocean acidification may also impact fisheries and subsistence resource availability.

Subsistence (continued)

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Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Harvest of Fish, Wildlife, and Vegetation (continued)	Terrestrial Wildlife Resource Availability		Wildlife species of primary importance for subsistence users in the region are caribou, muskoxen, and moose. Caribou have been declining over the past decade. The overall Seward Peninsula muskoxen population stabilized between 2012 and 2015, but the number of muskoxen in BELA has declined. Moose are at the northern limits of their range and tend to remain at a fairly low density. This has resulted in regulatory attempts to lower harvest by shortening seasons, closing seasons, reducing overall estimates of harvestable surplus, and restricting individual harvest by reducing the individual harvest limits and/or reducing the number of harvest permits that are made available. The result is a situation where the availability of important wildlife resources is being reduced for an increasing number of subsistence users (Dau 2013 , Schmidt and Gorn 2013). This may also result in increased competition for whatever subsistence resources remain available.
	Marine Mammal Resource Availability		Marine mammal resource availability is influenced both by animal populations and by access challenges to hunting these animals. Seals, walrus, and beluga are important subsistence commodities. These animals constitute 60%–80% of the local population’s subsistence harvest (Arctic Council 2009b). Currently, the availability of marine mammal resources is decreasing. Decreased availability is primarily due to deteriorating sea ice conditions—which reduces hunters’ access to the animals—but is compounded by a documented decline in the abundance of marine mammal species. Subsistence users experience difficulty accessing marine mammal hunting areas due to lack of sufficient sea ice; reduced boat access and timing of open water presence both influence hunting opportunities (Aurand and Essex 2012). Timing of sea ice presence has serious implications for when subsistence users can go out, and where animals can be processed (Arctic Council 2009b , ICC 2015). There are also increased safety risks due to ship traffic in the Chukchi Sea.
	Vegetation Resource Availability		Vegetation resources (such as berries and greens) generally remain available, although there have been fluctuations in abundance and/or timing of availability of individual species. Climate change may lead to an increase in these fluctuations, as number of shrubs (including berry-producing shrubs) increases.

Resource Brief: Subsistence

Subsistence as a Way of Life

Since people first entered Alaska, they have (until very recently) depended upon the harvest of naturally-occurring living resources (fish, wildlife and plants) from the land and sea. The majority of Alaska's rural residents still depend upon these resources. This necessity of hunting, fishing, and gathering has given rise to both an economy and a way of life often referred to today as "subsistence." Even today, given the increasingly rapid cultural change and globalization, subsistence remains at the core of life for the majority of northwest Alaska's residents, most of whom are Alaska Natives.

The economic and nutritional importance of wild foods is significant; in a year, residents of Arctic Alaska harvested 438 pounds per person of wild foods, and residents of Anchorage harvested 17 pounds per person ([ADF&G 2014](#)). The estimated replacement cost of those harvested wild foods ranges between approximately \$44 million and \$88 million ([ADF&G 2014](#)). Wild foods also contributed 280% of the required protein and 39% of the required calories for people in Arctic Alaska, compared to 11% and 2% respectively in the Anchorage area ([ADF&G 2014](#)).



Salmon drying on a fish rack in Shishmaref, overlooking the Chukchi Sea. NPS Photo.

Less apparent is the fact that subsistence is entwined in the broader social and cultural patterns of the rural communities of northwest Alaska. The procurement of wild food helps shape the social organization and structure of a community, as well as its beliefs, attitudes, values, behaviors, and even the mental health of its members. Consider the role and place of an esteemed whaling captain, a skilled caribou hunter who brings in meat enough for many in the community, and a skilled seamstress who can convert caribou skins into clothing items. Elders are respected as repositories of the traditional knowledge that has ensured the survival of families and communities for countless generations. Subsistence lifestyles are also associated with a holistic view of the world as a system of interrelated elements (including people), held together by behavioral norms of sharing, respect, and mutual obligations.

Subsistence is characterized by a number of distinctive features:

- it is heavily focused around a strong sense of place; harvesting is largely focused on the resources closer to home when they are adequate to support the group;
- practices related to the harvesting, processing, distribution and consumption of resources generally take place within the framework of kinship and community ties;
- cultural practices, beliefs and values related to subsistence are based on tradition, and are transmitted across generations largely by observation and practice supported in the oral traditions of stories, myths, and legends;
- it facilitates a very detailed knowledge and understanding of the environment of the local area, which is made possible only by very close and sustained contact and interaction with that environment over a very long time;
- as an economic system, it tends to be marked by efficiency; the methods and means of harvest as well as resource selection tend to favor maximizing the harvest amount while reducing the harvest effort, given the available technology and the characteristics and nature of the resource;
- it features the utilization of a very wide range of different resources; and
- its focus is on the community and not on the individual.

The importance of subsistence in the lives of people of and from the region can be seen in the persistence of two behavioral characteristics: (1) the expectation that a young hunter will give his first kill to an elder outside of his own family, thus reinforcing the value of sharing and the role of community provider and (2) the strong need to provide traditional foods to relatives who have left the community for any number of reasons, illustrating the great degree to which traditional foods are a part of who they are as a people.

Resource Brief: Subsistence (continued)



A family harvesting oogrük, or bearded seal, on the sea ice outside of Shishmaref. NPS Photo / Fred Tocktoo

The activities of subsistence users in northwest Alaska are largely structured around a cycle of biological events that make available for harvest the food resources that are needed by communities. These events include the spring and fall migrations of the Western Arctic Caribou Herd, as well as its distribution on the winter range; the summer runs of salmon up rivers and streams in the region; the spring and fall migrations of key marine mammal resources, such as whales and walrus; the spring and fall migrations of waterfowl; the winter freeze of sea ice, allowing access to polar bears and seals; the spring and early summer gathering of plant greens; and the summer ripening of berries.

The Communities

BELA has three communities that depend heavily on resources from the preserve (Wales, Shishmaref, and Deering totaling 830 people, almost 87% of whom are Alaska Natives) ([Alaska DCCED 2016](#)). However, some residents from communities adjacent to the area including Brevig Mission, Buckland, Teller, Nome, Kotzebue, White Mountain, and possibly Koyuk

occasionally seek subsistence resources from within the preserve or are part of exchange networks. All three of the primary communities are located along the northern coastline of the Seward Peninsula, yet each has a distinctive subsistence economy:

1. Wales is located on the western tip of the Seward Peninsula (closest to Russia) and sea mammals (predominately whales, walrus, and larger seals) tend to dominate their subsistence harvest (almost 78% of the total harvest weight in a 1993 harvest survey) ([ADF&G 2016](#)). Fish came in a distant second (just over 13% in the same study). Differences are reflected in the size of their boats, the size of crews to man boats, and the social organization of the crew.
2. Shishmaref is almost centrally located along the coastline east of Wales. Its harvest is also dominated by sea mammals, mostly by seals (almost 56% of the total harvest weight in a 1995 harvest study) ([ADF&G 2016](#)). Fish were second at almost 20%, followed closely by large land mammals (caribou and moose, close to 19%).
3. Deering is the easternmost of the three communities. A 1994 harvest survey found a much more balanced (i.e., diversified) harvest. Fish of several species topped their harvest, contributing to almost 34% of the total harvest weight. Marine mammals came in a close second (about 33% of the total harvest weight), followed closely by large land mammals (caribou and moose, about 28%) ([ADF&G 2016](#)).

The Future – Challenges

The subsistence way of life will likely face significant challenges in the coming years. The three major threats to subsistence are:

1. *Global climate change.* Climate change may be the greatest long-term threat as ecosystems are transformed, including potentially significant changes in the abundance and distribution of key subsistence resources. In addition, there may be climate-associated difficulties in accessing resources (increased frequency and severity of storms, coastal erosion, thinning ice, longer periods of open water, and reduced snow cover limiting the use of snowmachines). Will people be able to adapt and still maintain a subsistence way of life?
2. *Development.* Development in the Arctic—such as mining, oil and gas development, and increased shipping activity through the Bering Strait—may have impacts from construction, operations, and accidents (ship collisions, groundings, oil spills into key habitat areas).
3. *External Influences.* The increasing influence of external management and regulatory systems that are disruptive or counter to subsistence practices may result in the erosion of the subsistence way of life. One example of this is that most Euro-American harvest limit restrictions in hunting are focused on the individual hunter (one moose per year, five caribou per year) whereas in subsistence-based communities, a relatively small number of hunters may be harvesting enough animals to meet a community's needs.

The challenges faced by subsistence users will be reflected in the challenges park managers also face as they continue to implement Federal Law in the form of Public Law 96-487 (ANILCA of December 1980). ANILCA mandates the NPS to provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so in accordance with recognized scientific principles of fish and wildlife management and the purposes for which each park unit was established.

Chapter 3. Summary of Key Stewardship Activities and Accomplishments

Activities and Accomplishments

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

Natural Resources

- NPS Arctic Network Inventory and Monitoring Program conducted monitoring in BELA on vital signs including: muskoxen, brown bears, terrestrial vegetation, lichen communities, permafrost, caribou, yellow-billed loons, large lakes, shallow lakes, streams, lagoons, weather and climate, fire, and landscape and physical processes.
- BELA completed Shorezone mapping and videography of its entire coastline (including interiors of lagoons and estuaries). The resulting oil spill physical and biological risk maps and logistical aid maps are posted on Shorezone.org. This large project is part of a statewide effort including partnerships with the National Oceanographic and Atmospheric Administration, the Landscape Conservation Cooperative Programs, and the State of Alaska.
- BELA obtained major funding and is working with the NPS Alaska Regional Office to develop scientific and logistical preparedness for an oil spill. Eighteen projects have been completed or are ongoing, including:
 - Vessel traffic modeling
 - Community incident preparedness training
 - Ground truthing of the U.S. Coast Guard's Geographic Response Strategies for spill response
 - Gathering baseline data on biophysical properties of lagoons and estuaries
 - Study of lagoon fish assemblages
 - Coastal avian synthesis report
 - Studies of waterbird/shorebird seasonal use patterns and abundance
 - Mapping of coastal vegetation including sensitive saltmarsh and marine vegetation
 - Yellow-billed loon genetics and contaminant burdens
 - Waterbird habitat mapping via remote sensing
 - Updating of coastal Environmental Sensitivity Index
- NPS partnered with the U.S. Forest Service to produce a model of the effects of climate change on the habitat of over 200 species of birds and mammals. 73% of Arctic mammal species and 43% of bird species are expected to lose habitat in coming years, though some boreal species are expected to gain habitat.
- NPS partnered with Alaska Department of Fish and Game to complete Seward Peninsula muskox survey. This is the largest interagency wildlife survey in the state.
- NPS partnered with the Alaska Department of Fish and Game to conduct an aerial brown bear survey of the Seward Peninsula. This survey generated the first rigorous estimate of the brown bear population on the Seward Peninsula in approximately 25 years.
- A team of youth volunteers, staff, and residents from the villages of Shishmaref and Wales held a marine debris cleanup near Cape Espenberg and Wales for a week in July 2015. A total of 30 km of beach was cleaned of fishing gear (ropes, nets), plastic garbage, foam, and other materials. Youth produced videos about the cleanup and related research, which also occurred in all five coastal parks in the Alaska Region.
- Coastal erosion rates from 1950 to present were determined and mapped. Mean erosion rates are currently approximately 0.9 m/yr.

Cultural Resources

- All archival processing has been brought up-to-date. Forty-seven linear feet of archives with a finding aid were produced for the Arctic Parks (Bering Land Bridge, Cape Krusenstern, Kobuk Valley, and Noatak).
- NPS financially supported several Iñupiat place name documentation projects in the region during the 1970s and 1990s. For a number of recent years, NPS staff has been working to identify existing Iñupiat place names data sets that may be suited for digitization into a Geographic Information System (GIS). The preserve will benefit from this important indigenous knowledge.
- In the summer of 2015, the National Park Service collaborated with Alaska Geographic, Bering Straits Native Corporation, Kawerak Incorporated, Carrie McClain Museum, and UAF Northwest Campus to host Nome Archaeology Camp, an opportunity for Alaskan teens to learn more about the heritage of the Bering Straits region through archeological methods, oral history, and museum studies.
- Since 2012, the National Park Service has administered a vulnerability assessment program to identify the most significant and at-risk cultural and paleontological resources on the BELA and Cape Krusenstern National Monument coasts. These sites are in danger of being washed away by increasingly frequent storm surges as the climate changes impact Arctic waters.

Visitor Experience

- In 2015, BELA had a grand re-opening of the Nome Visitor Center. New interpretive signs were installed for a variety of distinct Ice Age mammals, and new display cases were installed to share unique features, including mammoth tusks. New dynamic maps on 44-inch touch screen kiosks present interactive content.
- Story map content was created to provide visitors with a virtual visit to the preserve and assist visitors with trip planning on the remote and logistically challenging Seward Peninsula. These story maps are presented on the 44-inch touch screen Nome Visitor Center kiosks and the BELA website.

Park Infrastructure

- The preserve continues to participate in a partnered winter trail-staking project with native village of Shishmaref and Kawarak (trail from Shishmaref to Cape Espenberg).
- BELA completed a new bathhouse at Serpentine Hot Springs.
- The preserve developed a robust recycling program in cooperation with Kawarak, Inc. and the City of Nome.
- BELA reduced gasoline consumption in vehicles by encouraging employees to walk or bike between offices, as well as walk and bike to meetings. Gasoline expenses have been reduced from \$5,000 to less than \$3,000 annually.
- BELA installed LED lighting in the dormitory and renovated housing facilities.

Wilderness

- BELA introduced Wilderness scoping for every internal and external project in 2008, and a Minimum Requirements Analysis where appropriate, resulting in significant Wilderness impact mitigations and interdisciplinary input on projects.
- BELA tested the Science in Wilderness Evaluation Framework on grazing exclosures in 2012, resulting in a large amount of interdisciplinary input into the project and potential Wilderness impact mitigations.
- BELA continues to use the Framework for Evaluating Commercial Filming and Photography Requests for all related permit applications. BELA has used this framework since it was initiated in 2014.
- A first draft of the BELA Wilderness Character Narrative was created.

Subsistence Use

- NPS is completing work on proposed regulation changes allowing customary and traditional uses of horns, antlers, and plant materials collected from parklands.
- NPS continues to work within a regulatory framework to balance subsistence uses with conservation of wildlife populations. The NPS continues to manage four muskox hunts within and adjacent to BELA and coordinate with the State of Alaska. The NPS also continues to manage one moose hunt on federal public lands in Game Management Unit 22E, including Bering Land Bridge National Preserve.
- BELA continues its support of the Western Arctic Caribou Herd Working Group, which was established to “ensure conservation of the Western Arctic caribou herd, safeguard the spiritual and cultural well-being of Alaska Natives and the interests of all users of the herd, and to integrate indigenous knowledge with Western Science.”
- NPS embarked on a project to investigate whitefish health and seasonal dynamics in and around lagoons in BELA and the fishery catches of neighboring communities (i.e., Kotzebue, Deering). A key output will be a poster depicting the “Story of the Lagoons,” which will be produced in collaboration with the Native Village of Kotzebue.

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

Natural Resources

Declines in Game Species

There are declines in several game species important to the ecology of the preserve and important for subsistence and sport hunting: muskoxen, caribou, and moose. In addition, there are perceptions that there is an overabundance of wolf and bear populations and increased human/wildlife conflicts. This mix of lower numbers of game species for harvest, and perceived increases in predator species could increase intensive management practices by the State of Alaska adjacent to the preserve. The preserve has no quantitative information regarding the status of wolf and bear populations.

1. *Muskoxen*. After many years of high population both on the Seward Peninsula and in BELA, there has been a significant decline in the population. The Seward Peninsula experienced population decreases between 10% and 30% between 2010 and 2012, after which populations appear to have stabilized. Localized declines in BELA are thought to have exceeded the greater Seward Peninsula trends. The next muskoxen surveys are scheduled for 2017–2018.
2. *Moose*. Although stable in much of BELA, the surrounding Game Management Units have seen a reduction in abundance.
3. *Caribou*. The Western Arctic herd has a declining population, which could increase the State of Alaska's intensive management efforts. Bering Land Bridge contains prime winter range for this herd.

Lack of Fisheries Resource Information

The preserve is lacking fisheries information. There is no baseline data for fish species, and there is concern that climate change could be shifting fish species distributions. Little is known about fish in the preserve's montane lakes that may contain clues to the evolutionary history of fish in Beringia. Fisheries are a major concern for communities who rely on fish for their food harvest: an average of 95% of households in the villages of Shishmaref, Wales, and Deering harvest fish ([Georgette and Utermohle 2000](#)). BELA needs to develop a resource stewardship strategy, in order to identify long-term, science and scholarship-based strategies to increase research and achieve desired future resource conditions.

Terrestrial Ecosystem Changes

Many changes to terrestrial ecosystems are already occurring and others are likely to occur over the coming decades due to climate changes. These include: increase in tall shrubs, loss of ungulate lichen winter range and open tundra currently hosting abundant lichen cover types, increase in fire frequency, increase in winter icing events leading to wildlife winter forage difficulties, and a mismatch of migration, forage, and pollination timing because of earlier green-up and longer snow-free season. In addition, some permafrost features have begun to degrade; this trend is expected to intensify, causing increased erosion, land surface drying, disappearance of shallow lakes, alternated stream and river flows, increased release of stored carbon, methane, and contaminants, and increased thaw slumps.

Increased Coastal and River Erosion

Rates of coastline erosion in BELA averaged 0.9 m/yr for the period 2003 to 2014, compared to the long-term average of 0.4 m/yr (1950 to 2014). Sand bars adjacent to the closed lagoon systems and upland bluffs are eroding most rapidly. The later onset of shore-fast ice (accompanied by reduced ice thickness and quicker spring melt) has exposed the coastline to powerful storm surges. For over 25 years, the community of Shishmaref has been threatened by coastal erosion. Coastal erosion threatens private native allotments, where allottees lose land (and occasionally structures) that people depend for subsistence hunting, gathering, and recreation. Coastal erosion directly affects beaches, nearshore ecosystems, fragile archeological sites, and terrestrial habitat. Release of sediment and organic carbon alters nutrient fluxes in nearshore marine and lagoon ecosystems (Jorgenson and Brown 2005). It is important that the preserve work with local communities—like Shishmaref—that are bordered by preserve lands, in order to create mutually-beneficial strategies that could include land exchanges, transportation infrastructure, and exploration of new technology to continue to responsibly utilize BELA resources.

Increased Development and Shipping in the Bering and Chukchi Seas

There is an increase in shipping, oil and gas development, tourism, and commercial fisheries in the Bering and Chukchi Seas. Many of these changes have been facilitated by the opening of the Northern Sea Route, due to retreating sea ice. There is great potential for resource damage and problems with subsistence harvest due to contamination, resource overharvest, and increased vessel traffic. Oil spills are a major concern. Increased ship traffic could cause collisions with marine mammals, and disturbance of communication and migration routes for marine mammals and fish (due to undersea vessel noise pollution). Coastal and lagoon resources have limited baseline information; BELA has very limited ability to protect coastal areas or to conduct emergency response if offshore spill or vessel accident occurs. BELA will continue to work with the NPS Alaska Regional Office to develop the lagoons monitoring protocol, gather baseline data on coastal and nearshore resources, and update spill response strategies with newly gathered field data.

Ear Mountain Road and Shishmaref Village Relocation

The village of Shishmaref is subject to major coastal erosion. Relocation of the village to a nearby new location on the mainland is proposed. Constructing a new village will require large amounts of rock materials for building foundations and roads. Ear Mountain is the closest source of rock materials—13 miles from Shishmaref Inlet. A new road would need to be constructed to access Ear Mountain, and about 6 miles of the road would cross BELA. If built, the entire road (up to 25–30 miles) would cost approximately 60–80 million dollars.

There was a Congressional hearing in September 2016 and the Department of Interior testified that it was premature for Congress to authorize a road easement or right-of-way through the preserve. The Department further stated that existing law and regulation provide an orderly process for applying for, processing, and granting access. In addition, it would be best to wait until there is a determination that surface transportation to Ear Mountain is needed; the Village can apply for a right-of-way across Bering Land Bridge National Preserve and if it is found to be necessary to develop access from Shishmaref Lagoon to obtain rock from Ear Mountain, rather than from other sources, a right-of-way could be granted under the authority of section 1110(b) of ANILCA. No site for relocation of the village has yet been decided upon. Funding for the proposed village relocation and a road to Ear Mountain has not been secured.

Cultural Resources**Archeological and Paleontological Resource Loss**

Coastal zones and watersheds are being impacted by increased erosion due to the lack of sea ice, faster sea ice melt, permafrost thaw, and increased and stronger storm events. The preserve is home to thousands of archeological sites that date back an estimated 13,000 years or more. The preserve has not been surveyed for paleontological resources. While recent survey work has uncovered some new sites, an equal or greater number have been lost to erosion. The preserve needs to continue to create an inventory and monitoring protocol for these sites and develop a method to assess which sites are at most risk so that plans can be made to mitigate site damage or conduct excavation. In addition, exposed resources are at a higher risk for looting, which has become one of the preserve's most pressing resource protection concerns. The preserve lacks adequate resources and plans for reducing archeological and paleontological looting.

Lack of Baseline Documentation

BELA needs to increase baseline documentation of its ethnographic resources, cultural landscapes, and historic structures. Complete baseline documentation will enable the preserve to better care for these resources. Several baseline documents need to be completed, including an ethnographic overview and assessment, several cultural landscape inventories and cultural landscape reports, and several historic resource studies. It is also important that BELA complete National Register documentation for key cultural resources.

Visitor Experience**Increased Cruise Ship Visitation**

In 2015–2016, the opening of the Northern Sea Route brought increased tourism via cruise ship to Nome. This has increased the number of interpretive programs that BELA offers; however, there has not been an increase in support for staffing or supplies. The preserve needs to complete the Serpentine Hot Springs Strategic Plan and update its Interpretive Prospectus to address increased visitation, changes to visitation and new multi-media and educational programs.

Park Infrastructure**Lack of Facilities Maintenance**

BELA has over \$900,000 in deferred maintenance costs. Most of this cost is associated with the estimated cost of repair of two old NPS houses, planned for removal. New housing will be needed to replace the removed homes. Backcountry facilities that are critical to visitor safety (including four public emergency shelter cabins and facilities at Serpentine Hot Springs) receive limited funding for maintenance. The emergency shelter cabins are in serious condition; the cost to rehabilitate these facilities has not been calculated. Winter snowmobile tripod trail markers need maintenance along the approximately 120 miles of winter trail marked in the preserve. A Park Asset Management Plan is needed to create a strategy to work on facilities and maintenance issues so that facilities are maintained on a preventative basis, with fewer emergency issues.

Subsistence**Food Security Concerns**

Subsistence foods are the main dietary source in the communities around the Bering Land Bridge area. Climate change has changed freeze-up timing, snowfall, and ice thickness, which has impeded local people's ability to travel into the preserve by snowmobile to hunt and fish for species like caribou, moose, white fish, and muskoxen. Climate change affects the duration and thickness of sea ice that marine mammals require to migrate into Arctic waters. Due to this, hunters who depend on marine mammals must travel many more miles to hunt for walrus and seal and once-stable sea ice is now much more treacherous. The need to travel far from villages to find these animals has also created unsafe situations for hunters.

It is estimated that more than 67% of households surrounding the preserve harvest marine mammals ([ADF&G 2016](#)). Communities are reporting subsistence food shortages and as the climate changes, the demand for and competition for subsistence food resources will continue. It is important that the preserve work with local people to identify flexible harvest strategies and embrace adaptive management techniques to help ensure that subsistence food sources are managed for continued harvest. In addition, the preserve should work to document and utilize indigenous knowledge to make informed decisions with local peoples who have gained extensive ecological knowledge from their experiences with the land and other sources (e.g., formal schooling and contact with biologists).

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See the [State of the Park Report for the Park website](#) for a more complete list of references to documents and data sets upon which the assessments in this State of the Park report are based. References for several of the key documents cited in this report are as follows:

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See Also:

[Collection of Natural Resource-Related References](#)

[Collection of Cultural Resource-Related References](#)

[Collection of Visitor Experience-Related References](#)

[Collection of Subsistence-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.
Arctic Network (ARCN)	One of 32 I&M networks established as part of the NPS Inventory and Monitoring Program . The Arctic Network provides scientific data and expertise for natural resources in five parks located in Alaska.
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.
Exotic Plant Management Team (EPMT)	One of the ways the NPS is combating invasive plants is through the Exotic Plant Management Team Program. The program supports 16 Exotic Plant Management Teams working in more than 225 park units. EPMTs are led by individuals with specialized knowledge and experience in invasive plant management and control. Each field-based team operates over a wide geographic area and serves multiple parks.
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 Historical Park (NHP)	Historic areas in the National Park System that have great physical extent and complexity. NHPs are automatically listed on the National Register of Historic Places.
National Historical Landmark (NHL)	National Historic Landmarks are nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States. Today, fewer than 2,500 historic places bear this national distinction.
National Natural Landmark (NNL)	The National Natural Landmarks Program recognizes and encourages the conservation of sites that contain outstanding biological and geological resources, regardless of landownership type. It is the only natural areas program of national scope that recognizes the best examples of biological and geological features in both public and private ownership.
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.
Natural Resource Condition Assessment (NRCA)	A synthesis of existing scientific data and knowledge, from multiple sources, that helps answer the question: what are current conditions of important park natural resources? NRCAs provide a mix of new insights and useful scientific data about current park resource conditions and factors influencing those conditions. NRCAs have practical value to park managers and help them conduct formal planning and develop strategies on how to best protect or restore park resources.
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 .