National Park Service
U.S. Department of the Interior

Gates of the Arctic National Park and Preserve
Noatak National Preserve
Kobuk Valley National Park
Cape Krusenstern National Monument
Bering Land Bridge National Preserve

Alaska

Finding of No Significant Impact

Climate Monitoring Program in the Arctic Alaska Network (ARCN) National Park Service Units

April 2011

Recommended: _____ 4/10/11
Superintendent, Gates of the Arctic National Park and Preserve Date

Recommended: _____ 4/6/11
Superintendent, Western Arctic Parklands Date

Recommended: _____ 4/12/11
Superintendent, Bering Land Bridge National Preserve Date

Approved: _____ 4/20/2011
Regional Director, Alaska Date

FINDING OF NO SIGNIFICANT IMPACT

Climate Monitoring Program
in the Arctic Alaska Network (ARCN)
National Park Service Units
April 2011

The National Park Service (NPS) is considering expansion of the remote automated weather station (RAWS) network in the Arctic Alaska Inventory and Monitoring Network (ARCN). The Arctic Network consists of Gates of the Arctic National Park and Preserve (GAAR), Noatak National Preserve (NOAT), Kobuk Valley National Park (KOVA), Cape Krusenstern National Monument (CAKR), and Bering Land Bridge National Preserve (BELA). The proposed action would expand the RAWS program by establishing additional stations to collect basic climatological data including air and soil temperature, precipitation, relative humidity, wind speed and direction, solar radiation, and snow depth.

The NPS has selected Alternative B (NPS Preferred Alternative) with mitigating measures which would establish long-term remote automated weather stations in Gates of the Arctic National Park and Preserve (4 sites), Noatak National Preserve (6 sites), Kobuk Valley National Park (1 site), Cape Krusenstern National Monument (2 sites), and Bering Land Bridge National Preserve (4 sites).

Forty-four comment letters were received on the EA during the 30-day public comment period. The alternative was not modified by public comment. An attachment to the FONSI provides NPS's responses to substantive comments.

ALTERNATIVES

Two alternatives were evaluated in the EA.

Alternative A, No Action

Under the No Action alternative, no additional climate stations would be established in Gates of the Arctic National Park and Preserve, Noatak National Preserve, Kobuk Valley National Park, Cape Krusenstern National Monument, and Bering Land Bridge National Preserve.

Alternative B – Expand the Climate Monitoring Program in GAAR, NOAT, KOVA, CAKR, and BELA (NPS Preferred Alternative)

In support of the Arctic Alaska Inventory and Monitoring Program, the National Park Service would establish long-term remote automated climate stations in Gates of the Arctic National Park and Preserve (up to 4 sites), Noatak National Preserve (up to 6 sites), Kobuk Valley National Park (up to 1 site), Cape Krusenstern National Monument (up to 2 sites), and Bering Land Bridge National Preserve (up to 4 sites). All climate stations would be located on NPS administered lands. Table 2-1 in the EA identifies the individual RAWS sites and provides

information as to elevation, location, access, land status, and site preparation. Deployment of these stations is anticipated for 2011 and 2012.

The climate stations would collect basic weather observations including air temperature, precipitation, relative humidity, wind speed and direction, solar radiation and snow depth and transmit these observations hourly via satellite. These observations would be posted to the Western Regional Climate Center's (WRCC) web site in near real-time (http://www.wrcc.dri.edu/NPS.html).

The climate stations were specifically designed for remote, high latitude, extreme cold conditions. Special consideration was taken to minimize visual and physical impacts by making the stations as compact as possible and to conform to the minimum tool requirement for gathering climate data across these 20 million acres of park land, 13.1 million acres of which is wilderness. The stations have a small footprint and low-impact anchoring systems compared to other climate stations. Stations are powered year-round by a solar panel and two sealed lead-acid batteries that are enclosed in an insulated cargo container.

Each climate station would be composed of a 10-foot tripod mast hosting all the sensors and a datalogger enclosure (Photo 1). The batteries would be enclosed in a separate enclosure at the base of the tripod. At a few select sites, an additional datalogger may be added to measure permafrost and soil conditions adjacent to the tower. These ancillary systems would be no more than a few minute walk from the site and be imperceptible if looking from the site or from the air. The additional instrumentation at certain locations would attempt to monitor multiple vital signs at one location, with the priority being the basic suite of climate data. In addition, if the weather information from certain sites is useful for fire management issues, a 20-foot mast could be substituted for the 10-foot mast to obtain wind speed measurements in compliance with fire weather index standards.

Photo 1.

The tripod mast would house the temperature, precipitation, relative humidity, solar radiation, wind speed and direction, and snow depth sensors, a GPS antenna, and a GOES satellite transmission antenna. A fiberglass equipment enclosure (18" x 16" x 6") on the mast houses the electronic equipment such as the datalogger, and geostationary satellite transmitter (GOES). Two soil sensors would be placed in the ground in separate holes at 10 cm and 50 cm with a 1 inch soil auger. The batteries are sealed, starved electrolyte-type batteries. The wind speed and direction sensors are located on the top of the 10-foot tall mast. The footprint of the tripod is approximately 12 feet in diameter. A 48 inch x 13 inch solar panel would also be attached to the south side of the mast. The tripod will be anchored to the ground with three 2-foot long, 3/4 inch diameter steel pins. The tower components will be assembled on site.

Installation: A Campbell Scientific, Inc. (CSI) climate station can be installed in a few hours by two people once all equipment is onsite. Getting the climate stations to a deployment site would require one or two trips using a helicopter. A single helicopter flight would transport personnel to each site. Transporting the components of a climate station to a point where helicopter operations can begin may also use a fixed-wing aircraft. Climate station installation would occur in June, July, and August. Consultation with NPS subsistence managers would occur prior to the field season so the schedule could be adjusted to minimize any potential impact to subsistence users. Non-motorized hand tools would be used for climate station assembly.

Annual Maintenance: Each station would require one annual maintenance visit. Maintenance activities would be confined to a single day and would primarily occur from June through August, after consultation with park subsistence managers. Helicopter access would be used for most sites. Three to four hours would be required to change sensors and remove and download data and perform any necessary maintenance including periodic vegetation clearing at each climate station, if necessary.

PUBLIC INVOLVEMENT

The EA was issued for public review and comment from June 11, 2010 to July 12, 2010. The EA was sent by mail to 176 agencies, communities, organizations, and individuals and was posted on the NPS Planning, Environment, and Public Comment website.

Comments on the EA were received from the State of Alaska (SOA), National Parks and Conservation Association (NPCA), Northern Alaska Environmental Center, Wilderness Watch, Forest Service Employees for Environmental Ethics, Scenario Networks for Alaska and Arctic Planning and 38 individuals. The public comment changed the EA conclusion concerning the environmental effects of the proposed action on visitor experience. Thirty-five substantive comments required NPS responses which are attached to the FONSI.

DECISION

The NPS decision is to select Alternative B (Expand the Climate Monitoring Program in GAAR, NOAT, KOVA, CAKR, and BELA) with mitigating measures. Alternative B would provide for 17 climate monitoring stations to be installed in Gates of the Arctic National Park and Preserve (4 sites), Noatak National Preserve (6 sites), Kobuk Valley National Park (1 site), Cape Krusenstern National Monument (2 sites), and Bering Land Bridge National Preserve (4 sites). This is the minimum number of stations necessary to effectively monitor climate patterns and trends in the ARCN parks, 65 percent of which is designated wilderness (See Wilderness Minimum Requirements/Minimum Tool Analysis attached to and made a part of this finding). For ARCN parks, climate was determined to be one of the most important vital signs for monitoring under the NPS Inventory and Monitoring Program.

Fundamental to the climate monitoring program is data management, data summarization, data analysis and reporting. Climate monitoring protocols will be reviewed every 5 years to evaluate whether the methods and sampling design continue to meet the objectives of the monitoring program. Where the data from any station is duplicative of data available from outside the park

units, and does not contribute to improving climate models already in use or under development, the station will be removed from the park.

MITIGATING MEASURES

Vegetation

Most of these sites are located above treeline and in areas where the soils and vegetation are minimal. Where the surfaces of rocks are covered with lichen, disturbance of those rocks would be minimized. Where other plants are present, care would be taken to minimize disturbance (e.g., stepping on rocks where possible rather than on plants and clearing the minimal amount of vegetation necessary).

Mud, dirt, and plant material would be removed from project equipment, footwear, and clothing prior to traveling to the climate station sites, to minimize the possibility of introducing invasive plants to the parks. Climate station sites would be monitored, during the annual maintenance visit, for the presence of invasive species.

Wildlife

To the extent possible, installation and maintenance activities would be timed to avoid sensitive periods, such as nesting season, or caribou migration or subsistence activities involving wildlife. Care was taken in the site selection process to avoid locations that were in the main wildlife migration corridors, specifically in relation to movements of the Western Arctic caribou herd through Noatak and Kobuk Valley.

In addition to meeting all Federal Aviation Administration and NPS helicopter policy and aircraft requirements, mitigation common to all alternatives for both fixed wing and helicopter flights would include:

- Maintenance of a 2,000 foot vertical or horizontal clearance from traditional summer and calving or other habitats supporting reproduction as well as adult animals whenever feasible. This includes brown and black bear, moose, caribou, Dall's sheep, wolves, wolverines.
- Pilots would not hover over, circle, harass, or pursue wildlife in any way.
- Helicopter activity would be scheduled to avoid sensitive bird migration or nesting periods in the project areas. Known seabird colony areas would be avoided.

Visual Quality

Where possible, the antenna/tower would be installed in such a way so as not to protrude beyond the silhouette/horizon of a ridge.

Visitor Experience

Signs would be posted on the climate station equipment explaining its purpose and listing a person to contact if visitors who happen upon the site have any questions. Use of helicopters during hunting season in areas of known hunting would be avoided when possible. Flights would avoid known wilderness users and high use visitor areas where users are known to concentrate.

In planning flights, measures would be undertaken to avoid and/or minimize impacts to backcountry users. Planned flights would be approved by the park superintendent. Travel routes would be as efficient as possible to minimize flights over areas used by visitors. Aircraft altitude and horizontal distances would be maintained according to the park policy.

Wilderness

To minimize impacts on wilderness values, the stations would be as compact as possible and would be painted green or brown to blend in with the summer landscape the time of year when most visitors are in the area. Mitigation measures as described under Visual Quality and Visitor Experience would also apply to Wilderness areas.

Cultural Resources

Archeological site clearance will be conducted concurrent with installation of equipment, as necessary. Ground disturbance will be minimized. If archaeological features are encountered during equipment installation, work will cease immediately and the Superintendent and park Cultural Resource Specialist will be notified. Procedures will be followed, as per Director's Order 28 and found in the guiding regulations in 36 CFR 800.13. No further action will take place until the NPS provides clearance.

In addition, all personnel installing and servicing the weather stations would complete an orientation to cultural resources prepared by the park archaeologist.

The Alaska SHPO will be consulted with regard to the installation climate stations and the installation of climate stations in Cape Krusenstern National Historic Landmark Archaeological District and the Iyat (Serpentine Hot Springs) Cultural Landscape.

With regards to the Iyat Serpentine Hot Springs Cultural Landscape, an effort will be made to locate the climate station so it will not be prominent on the landscape and not in view from the hot springs basin. Alternatively, the climate station will be located with the other modern features, such as by the airstrip. Since Iyat's significance is tied to the cultural values of the Inupiaq, the potential impact of the proposed climate station(s) is largely dependent upon the Inupiaq perception of whether these modern devices are an intrusion on the cultural landscape. Some of the defining characteristics for which Iyat has been determined eligible, as concurred with by the State Historic Preservation Officer for listing on the National Register of Historic Places, includes views from the landscape. Consultation with the appropriate group(s) will be conducted before locating the climate station.

RATIONALE for the DECISION

Alternative B (Expand the Climate Monitoring Program) will satisfy the purpose and need for the project better than the no-action alternative. Current weather station coverage in the Arctic Network is extremely thin. There are insufficient reliable long-term climate records available within the Arctic Network. Large portions of all ARCN units have no station coverage. These areas include western GAAR, northern KOVA, far eastern and west-central portions of NOAT, all of CAKR, and northwestern (coastal) areas of BELA. Deployment of 17 climate stations within the ARCN parks is necessary to allow the NPS to achieve the goal of the Climate Monitoring program. With additional information, NPS will be better positioned to predict and protect natural processes in wilderness within the context of predicted climate change. This information will contribute resource data for park management decisions and will also contribute to future efforts in broader-scale climate monitoring and modeling efforts. Seventeen climate stations are the minimum number of stations necessary to effectively monitor climate patterns and trends in the ARCN parks (See Wilderness Minimum Requirements/Minimum Tool Analysis).

Climate is a fundamental driver of ecological condition and the patterns of plant and animal communities found in NPS park units. It was determined to be a priority vital sign for monitoring because changes in climate will impact these ecosystems, including the natural character of the wilderness units. Ample evidence is available to document a global warming trend over the last 150 years. Climate models predict that high latitudes, such as those occupied by the Arctic Network, will likely be some of the first regions to experience warming. Temperatures have already started to warm in northern Alaska resulting in the loss of sea ice, permafrost melting, coastal erosion, changes in hydrology, increases in fire extent and severity, environmental stress on plant and animal communities, and changes in subsistence opportunities.

Recognizing the potential for substantial climate-related impacts to park and wilderness areas, the NPS has completed climate change response strategies for the National Park System (NPS 2010a) and for the Alaska Region (NPS 2010b). Both documents stress the importance of providing park and wilderness managers with accurate and detailed information about the status, trend, and spatial distribution of ongoing and projected changes in key climate attributes; along with information about which areas are most likely to experience relatively rapid or severe changes. Without an understanding of climatic drivers and the long-term outlook for additional changes, park and wilderness managers would be more likely to react to changes as isolated events, possibly implementing costly, ineffective, or ultimately counterproductive actions.

The NPS conducted a rigorous site selection process to select the 17 remote automated climate stations identified in Alternative B. Numerous weather and climate professionals participated in a 2006 workshop in an the effort to identify potential sites, including: park personnel, National Weather Service, Natural Resource Conservation Service, Western Regional Climate Center, and the University of Alaska. All agreed that the current coverage was inadequate (Nolan, 2007; Redmond and Simeral 2010). The recommendation from the 2006 workshop was an array of 58 weather stations and included winter transects to assess snow condition. After numerous discussions, refinements, and iterations that included guidance from park management, the site list was trimmed to the proposed 17, based on a comprehensive site evaluation which included an

analysis of potential sites based on weather station siting criteria, wilderness mitigation efforts, and management concerns. The number of new climate stations that were proposed represents a balance of science and wilderness concerns in an area with a sparse network of climate stations. The proposed inter-station spacing of about 40 miles (65 km), or one station per 1.1 million acres, was determined to be a reasonable density to help understand regional climate patterns (Redmond and Simeral, 2010). The number is not a result of statistical analysis, but instead represents a consensus among an expert panel of climatologists and resource managers who agreed on the proposed spatial density and distribution.

Several criteria were used in identifying potential sites, including these 3 main criteria: 1) to provide the best possible coverage across each park, 2) to sample different ecoregions within each park, and 3) to get a good elevational gradient between sites. Additional siting criteria included evaluating data gaps, elevation and aspect, land management concerns, wilderness impacts, use patterns (hiking, floating, hunting, etc.), wildlife movement patterns and access. An effort was made to co-locate new stations with existing infrastructure or other facilities such as airstrips, repeater sites, and buildings.

Based on siting criteria, the advice of climate experts, and spatial density considerations, as well as logistical constraints, budget considerations, and other factors the number of stations was reduced from the originally proposed 58 sites to 17 sites. The 17 sites will span over 20 million acres of NPS park, preserve or monument lands, about 13.1 million of which is designated wilderness. Nine of these sites will be in designated wilderness. The array of 17 sites is the minimum number necessary to effectively monitor climate patterns and trends in the Arctic parks and for administration of the wilderness areas (See Wilderness Minimum Requirements/Minimum Tool Analysis).

The number of sites recommended for each of the Arctic parks represented the minimum number of locations that could characterize the complex topography of the parks given the management concerns (Redmond and Simeral, 2010). The seventeen sites represent an adequate spatial density of climate stations that will enable NPS to monitor climate gradients across the five Arctic parks.

The NPS Management Policies (2006) direct the agency to monitor the long-term condition and trends of wilderness resources. Part of what defines wilderness areas are the natural resources found in them. In order to manage appropriately, the NPS applies the best available science to document existing conditions and document changes. Information collected will help managers make decisions that will promote the natural quality of wilderness.

The statutory purpose of wilderness includes science and scientific activities are encouraged in wilderness as long as they are consistent with the Service's responsibility to preserve and manage wilderness. "Even those scientific activities (including inventory, monitoring, and research) that involve a potential impact to wilderness resources or values (including access, ground disturbance, use of equipment, and animal welfare) should be allowed when the benefits of what can be learned outweigh the impacts on wilderness resources or values" (NPS Management Policies 6.3.6.1., 2006). By monitoring climate patterns and trends, managers can be more informed about potential changes to ecological conditions that may affect management

decisions or require a management response. These include changes in climate that could potentially impact: wildlife population fluctuations or movements, wildland fire frequency and intensity, disease outbreaks, and invasive species. By using accurate climate data, managers will be better equipped to protect wilderness resources in a changing environment, especially if climatic tipping points were to trigger rapid resource changes, such as pest eruptions or widespread tree mortality. This information will assist mangers in protecting and interpreting the natural character of wilderness. It may be used to implement changes to resource and visitor uses to protect resources stressed by climate changes

Alternative A (No Action) was not selected because it would result in a lack of baseline knowledge for park managers to make scientifically backed resource decisions in these large natural resource parks. As documented in the EA the NPS has assessed the overall impact on the environment from the placement of 17 remote automated climate stations as minor.

SIGNIFICANCE CRITERIA

The preferred alternative will not have a significant effect on the human environment. This conclusion is based on the following examination of the significance criteria defined in 40 CFR Section 1508.27."

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The EA evaluated the effects of Alternative B on vegetation, wildlife, visual quality, soundscape, visitor experience, wilderness and cultural resources. As documented in the EA the effects of the proposed action would range from negligible to minor depending on the resource. There would be no significant restriction of subsistence uses.

(2) The degree to which the proposed action affects public health or safety.

Establishing a set of climate stations in this remote part of Alaska, with near real-time updates of weather conditions, will provide public safety benefits for aviators, boaters, and backcountry users. Real-time weather data will assist park users in making better travel decisions with regard to weather conditions which would improve safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetland, wild and scenic rivers, or ecologically critical areas.

The 17 climate station sites would be located in designated (9 sites) or eligible (8 sites) wilderness in national parks and preserves. The EA evaluated the effects of climate station installation and maintenance and concluded that the impacts on wilderness would be minor.

(4) The degree to which effects on the quality of the human environment are likely to be highly controversial.

The establishment of climate stations in NPS designated and eligible wilderness is controversial. The level of controversy revolves around the appropriateness of such facilities for the management of wilderness rather than a controversy over the effects. However, NPS policy (2006) notes that the statutory purpose of wilderness includes scientific activity and "scientific activities are encouraged to be in wilderness. Even those scientific activities (including inventory, monitoring, and research) that involve a potential impact to wilderness resources or values (including access, ground disturbance, use of equipment, and animal welfare) should be allowed when the benefits of what can be learned outweigh the impacts on wilderness resources or values."

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The effects of the selected alternative do not involve unique or unknown risks.

(6) The degree to which the action may establish a precedent of future actions with significant effects or represents a decision in principle about a future consideration.

The climate monitoring program would not set a precedent for future actions. Future proposals for climate stations in the ARCN parks or other NPS units in Alaska will be evaluated on their own merits and not be affected by this action.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

The ARCN Climate Monitoring Program is not related to other actions that could have cumulatively significant impacts. The program is a discrete action that will not lead to future proposals.

(8) Degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

The selected alternative would not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The selected alternative would not adversely affect an endangered or threatened species or its habitat.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The selected alternative would not violate any Federal, State, or local law.

FINDINGS

The levels of adverse impacts to park resources anticipated from the selected alternative will not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the natural or cultural integrity of the park.

The selected alternative complies with the Endangered Species Act, the National Historic Preservation Act, and Executive Orders 11988 and 11990. There will be no significant restriction of subsistence activities as documented by the Alaska National Interest Lands Conservation Act, Title VIII, Section 810(a) Summary Evaluation and Findings.

The National Park Service has determined that the selected alternative does not constitute a major federal action significantly affecting the quality of the human environment. Therefore, in accordance with the National Environmental Policy Act of 1969 and regulations of the Council on Environmental Quality (40 CFR 1508.9), an environmental impact statement is not needed and will not be prepared for this project.

NPS RESPONSE TO PUBLIC COMMENTS
for the
Climate Monitoring Program in the Arctic Alaska Network (ARCN)
National Park Service Units
Environmental Assessment

In response to the environmental assessment, the NPS received 44 comment letters during the public comment period. Described below are the substantive comments and the NPS responses.

Comment: The proposed action would be significant Federal Action which should be addressed through an Environmental Impact Statement.

Response: The NPS does not consider the installation and maintenance of 17 site-specific climate monitoring stations (144 ft^2 each) in five (5) park units totaling more than 20 million acres to be a major federal action requiring an environmental impact statement. The NPS has evaluated the environmental impacts of other climate monitoring programs in other Alaska parks using an environmental assessment. The Climate Monitoring Program in the Arctic Alaska Network EA along with other weather station installation EAs in Alaska parks have concluded that climate monitoring stations do not have a significant impact on the environment and thus do not require the preparation of an environmental impact statement.

Comment: By establishing a minimal public comment period of 30 days in the middle of summer you are circumventing the intent of NEPA and your own regional guidelines.

Response: NPS policy requires that environmental assessments be available for public review for a minimum of 30 days. The comment period began on June 11, 2010 and ended on July 12, 2010 (32 days). The EA was sent to 179 individuals, state and federal agencies, tribes, local communities, native corporations, and special interest groups. Forty-four comment letters were received on the EA and no respondents indicated they could not comment within the 30-day period.

Comment: The Environmental Assessment fails to provide an adequate range of alternatives for consideration as required by the National Environmental Policy Act.

Response: The NPS considered a number of options for the collection of basic climatological data in the Arctic Alaska Network National Park Service Units. This included (1) locating climate monitoring stations outside park and preserve boundaries, (2) locating climate monitoring stations on non-wilderness lands (villages, native allotments, or inholdings), (3) installing climate monitoring stations at existing sites accessible by foot, river or fixed-wing aircraft, and (4) using remote sensing technologies and seasonal field crews for gaining site-specific climate information. These options were not considered viable options for collecting climatological data on 5 park units covering over 20 million acres. Further explanation as to why these options were rejected from further consideration is provided in response to other specific comments.

Comment: Climate monitoring stations should be sited on non-wilderness lands (villages, native allottments, inholdings or outside park).

Response: Section 2.5 of the EA (Alternatives Considered But Rejected) has been amended by adding additional detail about options the NPS considered for the collection of climatological data in the Arctic Alaska Network National Park Service Units (See Errata).

Comment: An alternative that addresses whether installing additional climate monitoring stations at existing, accessible (foot, river or fixed-wing) sites can meet Wilderness needs should have been considered.

Response: The text in section 2.5 of the EA (Alternatives Considered But Rejected) has been amended by adding additional detail about options the NPS considered for the collection of climatological data in the Arctic Alaska Network National Park Service Units (See Errata).

Comment: The EA should include an alternative that uses remote sensing technologies and seasonal field crews for gaining site-specific climate information along permanent transects.

Response: The text in section 2.5 of the EA (Alternatives Considered But Rejected) has been amended by adding additional detail about options the NPS considered for the collection of climatological data in the Arctic Alaska Network National Park Service Units (See Errata).

Comment: The EA indicates that there is a need for weather sites at elevation. Would the areas around the Dalton Highway Corridor, the Mascot Creek inholding, or Anaktuvuk Pass area be sufficient?

Response: There are existing sites at Anaktuvuk Pass and along the Dalton Highway. The proposed new sites in the park would complement data from the existing sites. The Dalton Highway corridor and Anaktuvuk Pass sites are on the edge of the area to be monitored and do not cover the entire area. The Mascot Creek inholdings are similarly located on the edge of the area to be monitored,

Comment: An alternative needs to be presented that addresses climate monitoring needs for each National Park Service unit based on the objectives for which the unit was established.

Response: The purpose and significance of each individual park was included in the EA. The five Arctic Park areas are sufficiently similar that analysis could be combined for this project.

Comment: For this EA we (NPCA) can support a modified version of what is proposed. We suggest the following:

Eliminate the five most remote stations as identified in the EA on pages 71 & 97:
o Killik Pass (Gates of the Arctic)
o Howard Pass (Noatak)
o Kugururok (Noatak)
o Rabbit Creek (Cape Krusenstern)

o Devil Mountain (Bering Land Bridge)

Eliminate all additional stations in Gates of the Arctic
o Ram Creek
o Pamichtuk Lake
o Chimney Mountain

We feel this strikes a balance between the needs of science and protection of Wilderness by removing sites in the most remote places and all sites in Gates.

Ideally NPCA prefers no structures or helicopters in any designated Wilderness, but we note that the remaining Wilderness sites are located in Noatak where the enabling legislation (in addition to "wilderness opportunities") also includes "opportunities for research". Avoiding 3 the most remote sites but retaining a few climate stations in Noatak seems reasonable. Similarly Kobuk Valley, Cape Krusenstern and Bering Land Bridge are all eligible Wilderness, but not designated and so retaining all but the most remote locations seems appropriate.

Response: This recommendation eliminates all of the higher elevation Brooks Range Ecoregion sites from Gates of the Arctic and western Noatak. There is no scientific basis to conclude that the spatial variability of climate inside the parks can be adequately assessed from edge measurements. The NPS considered sufficient baseline knowledge to consist of the following: the ability to reconstruct the spatial variability inside the park boundaries, the ability to distinguish different elevation effects, the ability to track slow and sometimes subtle changes in climate associated with changes in ecological communities, the ability to quantify changes in near surface soil conditions, in wind patterns, or in diurnal or seasonal cycles of weather (especially temperature), and to document the occurrence of extreme events that may lead to physical or biological disturbances. Because the wilderness lands of Gates of the Arctic and Noatak comprise millions of acres of contiguous land across the Brooks Range Ecoregion, the region cannot be adequately characterized without placing stations within the higher elevation wilderness areas.

In the contiguous United States, the National Weather Service has recommended a minimum density of about one station per 25 miles (40 km) or approximately one station per 625 mi^2 (about one per 1,600 km^2 or one per 400,000 acres). This would result in about 48 stations in the five ARCN units. Other studies have shown (e.g. Janis et al, 2004) that in topographically complex terrain, about twice the density is needed to extract regional climate signals as well as they can be extracted in flatter terrain.

This EA balances science and wilderness issues in an area with a sparse network of climate stations focusing on those areas least represented in the broad regional context. The proposed sites are intended to help address the unintentional bias of the observed historical records. The inter-station spacing of about 40 miles (65 km) will better define regional climate patterns .

Comment: Why are helicopters used as the primary tool for accessing sites for the installation of climate monitoring stations?

Response: In order to minimize visual impacts, and to accomplish the purpose of gathering data at high elevations, sites for climate monitoring stations were chosen that were well away from points that could be accessed by fixed-wing aircraft. NPS targeted higher elevation areas that were out of main river corridors and away from recreational/ subsistence access points. Much of the Arctic area is above treeline, so minimizing the impact of the site from view of most park users was one of the siting criteria. Most proposed sites are located in out-of-the-way locations that are not reliably accessible by foot or fixed-winged aircraft. Thus, helicopters are the only feasible access option for several sites.

Comment: Why is climate data needed to manage wilderness areas? The EA does not adequately iterate or describe how the data from such a system of installations will inform future management decisions to better preserve wilderness character and wilderness recreational experiences.

Response: Many scientists agree that climate change is likely to become the career-defining issue facing managers of parks and wilderness in the twenty-first century (Cole et al. 2010). Climate change is already changing habitats in Alaska, access to and use of park and wilderness areas, plant and animal communities, diseases and other characteristics, and the types of management actions required to maintain park values and mission (Marcy 2006). While there remains considerable uncertainty about some details of how climate will change Alaska's park and wilderness areas, there is little disagreement within the scientific community about the directions of recent changes. Future conditions are also likely to be very different from current conditions, and perhaps well outside the range of historic variability (Aplet and Cole, 2010). Remoteness and isolation will not protect any area from the effects of climate change and other regional- to global-scale stressors (Landres 2010).

Recognizing the potential for substantial climate-related impacts to park and wilderness areas, the NPS has recently completed climate change response strategies for the National Park System (NPS 2010a) and for the Alaska Region (NPS 2010b). Both documents stress the importance of providing park and wilderness managers with accurate and detailed information about the status, trend, and spatial distribution of ongoing and projected changes in key climate attributes; along with information about which areas are most likely to experience relatively rapid or severe changes. Without an understanding of the climatic drivers and the long-term outlook for additional changes, park and wilderness managers may react to changes as isolated events and take counterproductive actions.

As its first goal, the Alaska Region's climate change response strategy calls for science through resource inventories, monitoring and research to better understand the current and potential impact of changing climate on park resources and future recreational or subsistence use of the parks. Accomplishing this goal will require basic datasets for accurate assessments, forecasting, planning and decision making, and the development and use of modeling, forecasts, and other decision support tools (NPS 2010b). Collecting accurate climate data at appropriate spatial and temporal scales is essential for understanding and forecasting such changes to critical wilderness processes and resources. Such information will also be needed for testing and validating such models and forecasts. Models and forecasts are no substitute for actual monitoring data, as the available analyses, trends, and models for Alaska are based on too few observations spaced across enormous areas (Sousanes 2010). A well-designed and effectively spaced network of

climate monitoring stations will be important for managing National Park and wilderness areas in Alaska for many years into the future.

Comment: Why does the NPS need additional climate monitoring station in wilderness areas?

Response: Ample evidence is available to document a global warming trend over the last 150 years. Climate models predict that high latitudes, such as those occupied by the Arctic Network, will likely be some of the first regions to experience this warming (Arctic Climate Impact Assessment 2004). Evidence from scientific sources as well as local observations indicate that temperatures have already started to warm in northern Alaska resulting in the loss of sea ice, permafrost thaw, coastal erosion, changes in hydrology, increases in fire extent and severity, environmental stress on plant and animal communities, and changes in subsistence opportunities. The current weather station coverage in the Arctic Network is extremely thin and there are insufficient reliable long-term climate records available within the Arctic Network (Weather and Climate Inventory, NPS, Arctic Network 2007). The NPS Management Policies (2006) direct the agency to monitor the long term condition and trends of wilderness resources. Part of what defines a wilderness areas are the natural resources found in them. In order to manage appropriately, the NPS applies the best available science to document existing conditions and document changes. The NPS Management Policies (2006) state that scientific activities, including assessing physical, biological, and cultural resources and social impacts, are encouraged in wilderness areas as long as they are consistent with Park Service's responsibility to preserve and manage wilderness.

Comment: There should be a thorough evaluation of climate data from existing facilities surrounding parks. This data should be extrapolated for park uses so climate monitoring stations would not need to be installed in the wilderness units.

Response: Climate change is impacting the northern areas of Alaska first and foremost. It is a large area, it is remote, it is difficult to access and there is little to no infrastructure. NPS partnered with other federal agencies, state agencies, and university researchers to design a climate monitoring program that takes full advantage of existing sites outside the park boundaries. The scale of the project has been vetted by an array of experts including climate scientists from the National Weather Service, the Alaska Climate Research Center, the Western Regional Climate Center, the University of Alaska Fairbanks, and others in the meteorological field. There is no scientific basis to conclude that the spatial variability of climate inside the parks can be adequately assessed from edge measurements.

Comment: EA should consider carbon footprint of Climate Monitoring Station installation, maintenance, & removal.

Response: Considering changes in carbon emissions due to management activities can be a valuable exercise. With over 20 million acres, the Arctic Network units contain a considerable amount of sequestered carbon. This is due to the vast size of the region as well as the cold temperatures which maintain a store of frozen carbon. This project would provide information on potential changes to that carbon pool by providing important information for a number of ecological processes and factors including length of growing season, length of season for soil

microbial activity, and permafrost stability. The carbon emissions associated with installation, maintenance, and removal of these sites is miniscule in comparison to these other sources of carbon flux.

Comment: The presentation of cumulative effects is also limited and incomplete. When attempting to address the cumulative effect of additional helicopter flights associated with the proposed action, on page 105, it is stated: "There is currently no accurate data to approximate the total existing number of helicopter and fixed wing flights so it is difficult to assess the affects to the cumulative total." This is unacceptable. Why does the NPS not know how many helicopter flights are made into these Wilderness areas? Without an appropriate range of alternatives, and adequate cumulative effects analyses, this document fails to meet NEPA requirements.

Response: While park areas maintain records on total hours of NPS flight time in the unit by year, there is often no breakdown by specific landing area or region. There is no collection of private aviation fixed wing use in the park. In such large areas, total flight hours, although indicative of management presence, are less significant than concentrated hours flown in specific areas or drainages. The NPS is improving its monitoring and data collection on management flights, both helicopter and fixed wing, but current information is minimal for specific places or areas.

Comment: Does the NPS have a regional plan or strategy for analyzing cumulative effects in wilderness?

Response: In summer of 2010, additional guidance was issued to parks for conducting cumulative effects analysis in wilderness for scientific activities with the goal of making these analyses more consistent.

Comment: Gates of the Arctic is currently engaged in amending the 1986 GMP in order to better address emergent issues, significant land status changes and emphasis on Wilderness Stewardship for the pre-eminent Wilderness in the National Park System. Postpone a decision on these installations within Gates to allow the over-arching GMP process to properly analyze this specific issue and others in the context of the strong enabling language and Congressional intent for Gates of the Arctic Wilderness.

Response: The climate stations will be placed on the ground surface with little alteration to the surface. Climate stations within Gates of the Arctic National Park and Preserve could be relocated or removed at a later date if it is determined they are ineffective, unnecessary, or inappropriate with other park purposes with no lasting impact to the area.

The GMP Amendment and Wilderness Study is a broader discussion on what the management goals and objectives for Gates of the Arctic National Park and Preserve should be for the next 15 to 20 years. We consider climate research to be a long-term endeavor. Climate stations, however, may be temporal depending on the development of new technologies to monitor climate and weather. If appropriate technologies emerge to monitor climate, the stations can be removed, following an appropriate period of parallel data collection and calibration, with little or no long term impact to the site.

Comment: The reiteration of pertinent laws and policies in these documents does not properly emphasize the unique legislative language and unambiguous intent regarding wilderness.

Response: The laws and regulation provided in section 1.4 of Chapter 1 provide guidance for the development of the EA. The NPS Management Policies and Wilderness Act sections are quoted from the appropriate source material and accurately reflect the intent of the documents.

Comment: Soil sensors should be placed in the ground to be compatible with existing State and BLM monitoring programs.

Response: The soil temperature sensors will be placed in the ground at depths that are consistent with other monitoring programs around the state of Alaska.

Comment: In table B-1 under Required Site Preparation it is noted that none of the sites require site preparation. Would you explain to me why then on the next page (Appendix B, pg 97) the EA states that "Some site preparation would be necessary to facilitate erecting the previously-described structures?"

NPS Response: The word "disturbance" should have been used instead of the word "preparation" in the second paragraph on Appendix B page 97. The correction will be made.

Comment: Soundscape: (Environmental Consequences, pg 67) Please address the contradiction in the EA that states earlier that hand tools would be used in the installation of the monitoring stations and on this page it is indicated that "noise from power tools, which would be used for weather station assembly, would be temporary." Please address this use of power tools in designated wilderness areas where the use of power tools is not allowed.

NPS Response: As indicated in the description of the Alternative B, only non-motorized hand tools would be used for climate station assembly. The text in the soundscape analysis (page 67) has been modified to address the contradiction. (See errata).

Comment: The number of cabin sites that are mentioned are on private in holdings and there are no "miles of OHV trails" located in the designated wilderness area of GAAR. The area around Anaktuvuk with the OHV trails is no longer a part of designated wilderness in GAAR. Please see a current map of the park. There are no repeater sites currently located in GAAR designated wilderness, the last site at Sillyasheen was pulled in 2006-2007.

NPS Response: The text will be revised to indicate the number of cabins that are located in designated and eligible wilderness and remove reference to ORV trails in designated wilderness (See Errata).

Comment: Alternative B would result in no adverse effects to cultural resources because sites with cultural resources would be avoided" I am confused by this statement when in all the paragraphs above dealing with each park unit carefully describe how field assessments of potential archaeological inventories should be done prior to the installation of the monitoring stations? Will a separate MR/MT be done for each of the proposed inventories?

NPS Response: Conducting archaeological surveys prior to or concurrently with monitoring station installation can insure that the selected site does not contain cultural resources. If a survey finds cultural resources on the proposed site the station can be relocated.

Comment: We recommend that the NPS conduct adequate study to obtain traditional and local ecological knowledge about weather from these National Parks and the surrounding communities, as well as consult with local experts to obtain recommendations about the locations for weather stations to ensure that their distribution in the landscape and the expectations of their representative nature are correct.

NPS Response: Traditional and local ecological knowledge is an important source of knowledge on climate and weather in those areas for which it is available. In regards to using traditional and ecological knowledge in the Arctic Network to adequately address information needs for climate monitoring, there are a number of practical limitations. These include spatial coverage, representation across elevations, and quantifiable measures of weather and climate. Within the boundaries of the 20+ million acres of the Arctic Network there is one community (Anaktuvuk Pass). This substantially limits the amount and breadth of local knowledge available to inform us about the climate and weather across the entire Arctic Network. In addition, those communities around the periphery of the Arctic Network are situated along the lowlands within the park units (major river drainages and coastal areas) resulting in the under representation of high elevation sites. Finally, ecological models that extrapolate climate conditions across time and space, or that use climate variables to model other ecological scenarios, require quantifiable measures of weather and climate. Quantifiable metrics also allow for comparison between different regions of the state or different regions of the world.

Comment: The EA underestimates the impact of the climate monitoring stations and helicopters access on visitor experience.

NPS Response: The NPS has reviewed the Alternative B impact analysis for Visitor Experience and the Summary of Impact Levels (Table 4-1) and agree that the EA underestimates the effect level on the topic. Based on the Summary of Impact Levels the appropriate impact level would be Minor (See Errata).

Comment: The EA underestimates the impacts of climate monitoring stations and helicopters on wilderness.

NPS Response: The NPS has evaluated the environmental impact of climate monitoring stations and the use of helicopter in numerous wilderness areas in National Park Service units throughout Alaska. The NPS in Alaska has consistently found that properly sited climate monitoring stations and associated helicopter use have minor effects on wilderness resources and values. As documented in the EA the impacts to wilderness resulting from the climate monitoring program would be minor.

Comment: Only a few components of wilderness character (untrammeled, natural, undeveloped and solitude) were used to evaluate impacts from the proposed action. Impacts to other components such as respect, restraint and humility were not included.

NPS Response: Using current literature (Landres et.al. 2008b), the wilderness character description and impacts analysis were based on four components of wilderness character described in the Wilderness Act. Wilderness character is a complex and multidimensional concept that encompasses tangible and intangible aspects of wilderness at both a local and national scale. The definition of wilderness character is derived from Section 2(c) of the Wilderness Act, and the four qualities used are directly tied to wilderness character, and not on other qualities of wilderness. Although the four qualities are not meant to be all-encompassing, they were developed by an interagency working group as the basic and more quantitative framework for describing and analyzing wilderness character and have been endorsed by all four wilderness management agencies. Although respect, restraint and humility are components of appropriate stewardship and intent in making management decisions, they are not directly stated in the law and therefore were not included in the ARCN EA evaluation.

Comment: Could effects on wilderness character be mitigated with access by fixed wing planes in the spring?

NPS Comment: Fixed wing airplanes used for access were considered to have slightly less impacts to wilderness character than helicopter access. By changing the timing of access to spring, fewer visitors would likely be encountered, resulting in potentially less affect to the quality of solitude. However, accessing sites in the spring by ski plane may not provide adequate access to all sites due to their location in high elevations, so restricting access solely to spring fixed wing airplanes is not feasible.

Comment: Given the lack of knowledge and understanding of wilderness character how can the NPS conclude the RAWS will have a minimal impact on wilderness?

NPS Response: Area managers are familiar with the significance of the wilderness resource and have an understanding of the wilderness character through planning efforts, day to day management decision making, and research and monitoring of resources within the wilderness. More recently, managers have had the guidance of the interagency working group product "Keeping it Wild" (Landres et al 2008b) upon which to base their description of and evaluation of impact to wilderness character. This EA assessed potential impacts of the proposed action. Best available information was used in the preparation of the document and impact level determinations were determined based on that evaluation.

Comment: How can the NPS evaluate soundscape if a soundscape inventory on the potential sites has not been conducted?

NPS Response: The soundscape analysis assumes that natural sounds predominate at potential climate monitoring sites. The effects on wilderness users from the installation and maintenance of climate monitoring stations are analyzed in Chapter 4: Environmental Consequence in the soundscape and visitor experience sections and in the Wilderness Minimum Requirements/Minimum Tool Analysis.

Comment: The climate monitoring program is not consistent with the park's general management plans or the Wilderness Act.

NPS Response: The Inventory and Monitoring (I&M) Program vital signs monitoring was developed based on a national park system-wide strategy. Because of its influence on the ecology of ARCN park units and the surrounding areas, climate was identified as a high-priority sign for ARCN and is one of the 12 basic inventories to be completed for all NPS I&M networks. This is not in conflict with overall management guidance in park GMPs. The Wilderness Act does not prohibit scientific inquiry, and scientific use is one of the purposes of the Act. The analysis in the EA establishes the need for the climate monitoring stations.

Comment: The NPS has wrongly used the undefined term of "naturalness" as the hinge in your specious argument in both the EA and MRDG purpose and need statements as to why these RAWS installations are necessary. By its very nature and legal intent designated Wilderness is not to be managed beyond protection of site-specific resources based upon other pertinent laws. Recreational use, subsistence use, commercial use and administrative activities are the only elements of the wilderness landscape that can or should be "managed". And even then actions must be taken in the context of preserving wilderness character.

NPS Response: Use of the term "natural" refers to "wilderness ecological systems are substantially free from the effects of modern civilization" (Landres et al 2008b) and is monitored by trends in terrestrial, aquatic and atmospheric natural resources (both communities and processes) inside wilderness. The intent in using information from climate monitoring is to increase understanding of the natural ecosystems which make up the wilderness resource in northwest Alaska. The monitoring is not intended to maintain static or unchanging natural conditions but rather to gain sufficient understanding about natural conditions and how they vary over time and across landscapes to better position the NPS to predict and protect natural processes in wilderness, and to plan for and carry out future management actions within the context of wilderness and the context of predicted climate change. The NPS Management Policies (2006) recognize that “without natural resources…a wilderness experience would not be possible." and "Natural resources are critical, defining elements of the wilderness resource, but they need to be managed within the context of the whole ecosystem." and “Management intervention should only be undertaken to the extent necessary to correct...the impacts of human use, and influences originating outside of wilderness boundaries". Without a minimal level of understanding, the NPS would not have enough information to make informed management decisions, whether or not they result in on the ground changes within the wilderness.

Comment: The environmental assessment fails to justify that the proposed installations and helicopter flights are the minimum necessary to administer and protect the Wilderness.

NPS Response: The NPS is considering weather stations in wilderness areas and the means by which to service them using the minimum requirement concept.

A number of climate station designs were considered in the development of this program and the proposed station design was specifically chosen to reduce visual impacts on the landscape. Station designs that were considered, but rejected, include the design based on the National Oceanic and Atmospheric Administration’s Climate Reference Network (Photo 2). It was not selected due to: Large footprint, 3 meter tower with concrete plug, large diameter double fence around precipitation sensor at 12 meters and 4 meters, and large power consumption.

Photo 2

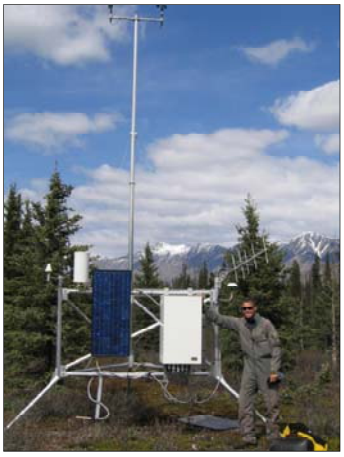

Photo 3

Also considered was the standard fire RAWS (Photo 3). It was not selected due to its high profile, 6 meter mast, and large diameter tripod base.

The research grade Campbell Scientific station (See Photo 1 on page 2) was selected because the footprint was small, the mast was short, the station could be anchored to withstand 100+ mile per hour winds without the use of a concrete base, while still retaining the scientific soundness of a research grade instrument with standardized measurement heights. This was the minimum tool for climate monitoring.

A variety of access methods were considered for locating and servicing weather stations. In a number of cases, access by helicopter was determined to be the minimum tool to accomplish the task. The use of helicopters to install the stations is the only feasible way to accomplish the installation in such a large area given the size and weight of the stations. Although it is conceivably possible to hike to the climate stations annually to do routine maintenance, the reality of staff availability and time would not permit reaching all of the stations in any given year or with the needed tools and replacement components. Without some annual maintenance, the data stream from a station would likely be in jeopardy and therefore access by air is necessary. In all cases where possible, fixed wing airplanes will be used.

Comment: Researchers desires and concerns were given priority over the Wilderness Act and the preservation of the character of wilderness.

NPS Response: The minimum requirements analysis and the EA examined the impacts to wilderness character as well as the benefits of the scientific information to the wilderness locally and across arctic Alaska. The NPS Inventory and Monitoring program does not have priority over the Wilderness Act. NPS complies with all laws when managing park areas and wilderness.

Comment: This selection is confusing for it implies that a decision has been made to select 12 sites, but it is not described as a Decision Notice. If a decision has been made, why has the NPS

asked for additional review and comments? I trust that a decision is not being rushed in order to acquire RAWS equipment with FY 2010 funds.

NPS Response: The NPS prepares Environmental Assessments on projects or plans, solicits and analyzes public comment, and then determines if the project has the potential for significant impacts. At the time of public review of the EA the NPS had not made any decisions regarding selection of an alternative regarding weather stations placement.

Comment: The rejection of the Killik highlands site in the MRDG is a step in the right direction for the right reasons but falls short of a truely objective analysis by concluding that the other 3 stations somehow ensure the preservation of wilderness character and solitude.

NPS Response: The analysis of benefits and impacts indicates that there would be some impact to wilderness character from the installation of the stations. We agree that it is probably best to look at the entire group of stations as a whole instead of trying to articulate the specific benefits and impacts of any one of the proposed locations. The Wilderness Minimum Requirement Analysis has been revised to look at the group as a whole.

ERRATA
Climate Monitoring Program in the Arctic Alaska Network NPS Units
Environmental Assessment

Document wide changes.

The word "permanent" when used to define the duration of climate monitoring stations is changed to "long-term."

The term "weather station" is changed to "climate station."

Page 21, 2nd paragraph, 3rd sentence. The sentence is revised to provide additional information concerning soil sensors. Sentence is revised as follows:

Two soil sensors would be placed in the ground in separate holes at 10 cm and 50 cm with a 1 inch soil auger.

Page 21, 2nd paragraph second to last sentence. The sentence is revised to provide additional information concerning tower anchoring. Sentence is revised as follows:

The tripod is typically anchored to the ground with three 2-foot long, ¾ inch diameter steel pins.

Page 21, 3rd paragraph, last sentence. The sentence is revised to provide additional information on hand tools. Sentence is revised as follows:

Non-motorized hand tools would be used for climate station assembly.

Page 29, Section 2.3.7 Cultural Resources. Paragraphs added to the Cultural Resource Mitigation.

All personnel installing and servicing the weather stations would complete an orientation to cultural resources prepared by the park archaeologist.

The Alaska SHPO will be consulted with regard to the installation weather stations and the installation of weather stations in Cape Krusenstern National Historic Landmark Archaeological District and the Iyat (Serpentine Hot Springs) Cultural Landscape.

With regards to the Iyat Serpentine Hot Springs Cultural Landscape, an effort will be made to locate the proposed weather station so it will not be prominent on the landscape and not in

viewsight from the hot springs basin. Alternatively, the weather station will be located with the other modern features such as by the airstrip. Since Iyat's significance is tied to the cultural values of the Inupiaq the potential impact of the proposed weather station(s) is largely dependent upon the Inupiaq perception of whether or not these modern devices are an intrusion on the cultural landscape. Some of the defining characteristics for which Iyat has been determined eligible, as concurred with by the State Historic Preservation Officer for listing on the National Register of Historic Places, includes views from the landscape. Consultation with the appropriate group(s) will be conducted before locating the proposed weather station.

Page 29, Section 2.5 Alternatives Considered But Rejected. The text in this section has been amended by adding additional detail about options the NPS considered for the collection of climatological data in the Arctic Alaska Network National Park Service Units

Locate Climate Monitoring Stations On Non-Wilderness Lands, Villages, Native Allottments, Inholdings Or Outside Park.

There is an existing array of climate stations in villages and other areas surrounding the park areas. The proposed ARCN climate stations would complement these existing sites by providing information in data sparse areas that would help to characterize the baseline conditions of the topographically complex park ecosystems.

The spatial variability of climate inside the parks can not always be assessed from edge measurements outside the parks. Sufficient baseline knowledge for monitoring climate consists of the following: the ability to reconstruct the spatial variability inside the park boundaries, the ability to distinguish different elevation effects, the ability to track slow and sometimes subtle changes in climate associated with changes in ecological communities, the ability to quantify changes in near surface soil conditions, in wind patterns, or in diurnal or seasonal cycles of weather (especially temperature), and to document the occurrence of extreme events that may lead to physical or biological disturbances. The designated wilderness and eligible wilderness in the Arctic Network comprise millions of acres of mostly contiguous land across the Brooks Range Ecoregion. The NPS is unable to accurately characterize the region without placing stations within the designated wilderness and eligible wilderness areas of those parks.

Locating climate monitoring stations on private land were inadequate in providing the desired data due to lack of sufficient variety in elevation and topography, and the difficulty of negotiating long-term leases for equipment placement and access.

Install Additional Climate Monitoring Stations At Existing, Accessible (Foot, River Or Fixed-Wing) Sites.

The proposed sites were selected to complement existing weather stations and are not meant as replacements. The site selection and evaluation process has been ongoing for 3.5 years, and during that time there were multiple iterations of sites selected based on an ongoing dialogue with park superintendents, park staff, and climatologists. Throughout the process NPS took into consideration wilderness values, mitigation techniques, and minimum impacts and minimum tools. The EA is the culmination of many years of effort to balance the goals of locating these

sites in areas where they would provide robust climate data that will benefit some aspects of wilderness while having the least possible impacts to other wilderness values.

Fixed-wing access is the most appropriate tool for low elevation access to sites in the Arctic parks and sites with potential access via this method were considered for climate sites if they met the siting criteria. However, river bars and accessible lakes are generally in valley bottoms and do not offer access to upper elevation areas. The complex topography of the parks, and the availability of low elevation climate data from surrounding areas of the park, makes higher elevation sites the most useful locations for improved climate monitoring within the parks.

In some cases, fixed-wing sites were rejected from the beginning because they were recreational nodes for park users. In Gates of the Arctic, the NPS determined that it would be preferable to look for potential sites that were away from popular recreation areas to minimize the impact to visitors. Sites were selected that were out of view of main recreational corridors. Since many of the lakes in Gates of the Arctic are used as access points, they were eliminated from further evaluation. In Noatak, the Noatak River corridor was avoided for the same reason. In Kobuk Valley, Cape Krusenstern, and Bering Land Bridge access to the higher elevations was not possible by fixed wing (float or wheels). One high elevation site (Ear Mountain) was considered in Bering Land Bridge because it did have a fixed-wing landing strip. The site was not ideal climatically because the mountain is rather anomalous in the area, and after discovering crash debris from multiple aircraft on the landing field, the site was rejected.

Although it is conceivably possible to hike to the climate stations annually to do routine maintenance, the reality of staff availability and time would not permit reaching all of the stations in any given year or with the needed tools and replacement components.

Use Remote Sensing Technologies And Seasonal Field Crews For Gaining Site-Specific Climate Information Along Permanent Transects.

Climate and climate change are critical emerging issues for all national park units in Alaska. Having the best, most refined, baseline dataset on temperature and precipitation patterns within the parks would help park managers address this issue. Remote sensing applications need to be validated by means of statistically valid field measurements to ensure complete understanding. There are many challenges associated with the development of high-quality, long-term, satellite-based time series suitable for detection of climate change as well as for characterization of climate-related processes and there are few examples of continuous data records based on satellite measurements where data quality is consistent. The technology is evolving, but still needs to be grounded in surface measurements to be useful. The presence of the proposed weather stations will enhance the possibilities of using remotely sensed technology to extrapolate conditions in other areas of the Arctic parks that would not have surface measurements from climate stations.

NPS determined that the most appropriate technology for documenting climate trends would be surface station observations of temperature, precipitation, wind speed and direction, relative humidity, incoming solar radiation, soil temperatures, and snow depth.

Data collected for individual field efforts is also important as this information is typically collected at a scale appropriate for that particular survey. Data collected through field surveys would also be included in the comprehensive view of climate for the park. However in order to attain a complete baseline of temperature, precipitation and other climate elements, a continuous high quality data record is necessary. Within the Arctic Network there are no current or proposed field efforts to stay in a single location continuously for many years. Measurement of meteorological events taken during field surveys can thus be characterized best as weather. A few weeks or months of data would generally not contribute substantially to meeting long-term climate monitoring needs. Climate data is integral to other long-term monitoring components and would be used by other scientists to correlate changes or conditions in vegetation patterns, wildlife abundance and distribution, hydrologic flow regimes, etc.

Page 31, Table 2-2 Comparison of Alternatives, Visitor Experience, Alternative B. Text has been modified to change the impact level on visitor experience from "negligible, temporary, adverse impacts" to "minor adverse impacts".

Page 61, Section 4.3.6 Wilderness, Cumulative Impacts. The 1st sentence has been revised to better describe the wilderness character of GAAR. The text is revised as follows:

GAAR contains one of the largest wildernesses in the NPS system and it is also one of the least developed. There are no trailheads or trails. Primary access is through airplanes, yet the park is without any developed airstrips. Three cabins exist for administrative purposes and safety, other cabins and other structures are in a state of benign neglect, slowly folding back into the natural landscape. Amenities such as designated campsites, groomed trails, and hardened access portals do not exist, instead undeveloped conditions prevail.

Page 67, Section 4.4.4 Soundscape, 1st paragraph last sentence. The sentence has been modified to eliminate the reference to power tools. Power tool would not be used in weather station installation. The sentence should read as follows:

Noise from hand tools, which would be used for weather station assembly, would be negligible and temporary.

Page 71, Section 4.4.6 Wilderness, Cumulative Impacts. The 1st sentence has been revised to better describe the wilderness character of GAAR. The text is revised as follows:

GAAR contains one of the largest wildernesses in the NPS system and it is also one of the least developed. There are no trailheads or trails. Primary access is through airplanes, yet the park is without any developed airstrips. Three cabins exist for administrative purposes and safety, other cabins and other structures are in a state of benign neglect, slowly folding back into the natural landscape. Amenities such as designated campsites, groomed trails, and hardened access portals do not exist, instead undeveloped conditions prevail.

Page 70, 4.4.5 Visitor Experience, paragraph 3. Text has been modified to change the impact level on visitor experience from “negligible” to “minor”. The sentence should read as follows:

The impact on visitor experience at all five parks would be minor as the likelihood of visitors encountering the sites would be very low and few visitors would be disturbed by aircraft accessing the sites for installation and maintenance.

Page 70, Section 4.4.5 Visitor Experience, Conclusion. The conclusion has been modified to change the impact level on visitor experience from “negligible” to “minor”. The sentence should reed as follows:

Conclusion: Alternative B would likely result in minor, adverse impacts to visitor experience from encounters with the weather stations and noise from overhead aircraft during installation and maintenance of weather stations

Page 72, Section 4.4.7 Cultural Resources. The following paragraph is added to the beginning of the cultural resource analysis.

The installation of this type of climate station appears to have a low potential to impact archeological remains. The soil disturbance would be limited to a 10 cm and 50 cm deep auger holes that are 1 inch in diameter. The potential for harm to a typical lithic scatter appears slight.

APPENDIX B: WILDERNESS MINIMUM REQUIREMENT/MINIMUM TOOL ANALYSIS

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE WORKSHEETS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

It is generally accepted that global warming is occurring, and that it is especially evident in high latitude regions (Sanzone, 2006). The arctic parks are forecasted to have the most ecological change due to climate change. However, scientists have little information from northern Alaska to contribute to climate models to make those predictions. As the change in biological assemblages and physical processes plays out in the arctic parks, certain information, including the establishment of quantifiable and measureable baseline conditions that describe unimpaired or current conditions, are needed to understand the potential implications to the parks from climate change. Information from climate monitoring affects management of all other components of an ecosystem and is consistently rated as a high priority to be monitored in national parks.

According to the 2006 Climate Inventory Report, there are large portions of the Arctic Alaska Inventory and Monitoring Network (ARCN) park units that have no station coverage, including western GAAR, northern KOVA, far eastern and west-central portions of NOAT, all of CAKR, and northwestern areas of BELA (Davey et al, 2006). In general there are very few observations from the interior of the Seward Peninsula, and there are no climate stations that adequately characterize the higher elevation of the Brooks Range, the upland areas of the Noatak River drainage or the northern mountainous areas of Kobuk Valley. There is also a lack of weather observations from

the coast of the Chukchi Sea to the inland areas of Cape Krusenstern. These are the areas of focus that could help characterize the changing arctic climate.

Numerous studies describe the effects of climate change on selected ecosystems, but it is important to directly and quantitatively monitor meteorological conditions so that a reliable record of long term change can be established, and future conditions can be more accurately predicted. Climatic variations are a primary driver of ecosystem dynamics, impacting both terrestrial and aquatic flora and fauna. Some of the potential implications of a changing climate regime within the arctic national parks include lake ice duration, precipitation, precipitation as snow, glacier mass balance, snow duration, growing season duration and thawed active layer – depth and duration, permafrost dynamics, snowpack persistence, variations in timing of wildlife migrations, plant phenology, albedo, and sea ice extent and duration. It will also change how people, who are interested in subsistence and/or recreation, use the land.

The climate monitoring program will be incorporated with other NPS monitoring efforts to help to advance understanding of the holistic functioning of ecosystems within the network of parks. This understanding would come in the form of the monitoring data that would be collected, analyzed, interpreted, and reported. The NPS can contribute to more accurate climate modeling by collecting more instrumented information from parklands at high elevations since most of the existing climate stations sites are located in low elevations. An understanding of ecosystem function is critical because it will allow NPS to fulfill the legislative mandate to manage parks in a manner that leaves them unimpaired for the enjoyment of future generations and protects those integral ecosystems which are at the heart of the wilderness values of these vast parks. At the most basic level, the NPS cannot evaluate appropriate ecosystem function when bounds of natural variability are not known because it is not possible to identify when conditions are outside an expected range of variation. Similarly, in this situation, reliable identification of resource trends is also difficult (MacCluskie and Oakley, 2002).

Climate and climate change are crucial emerging issues for all national park units in Alaska. Climate change is already changing habitats in Alaska, access to and use of park and wilderness areas, plant and animal communities, diseases and other characteristics, and the types of management actions required to maintain park values and mission (Marcy 2006). These data will be used by a myriad of researchers and park staff to understand other research and monitoring questions; it is the foundation data for understanding changes in the arctic parks. The data will provide park and wilderness managers with information about the status, trend, and spatial distribution of ongoing and projected changes in key climate attributes. Having information about which areas are most likely to experience relatively rapid or severe changes will enable park and wilderness managers to make decisions for planning and for adaptive management strategies to deal with uncertain futures. It will also be a tool to help predict or project trends in flora and fauna given different climate scenarios. Additionally, the benefits of enhancing understanding of climate change reach beyond the individual parks to the circumpolar realm will contribute to improved understanding of wilderness resources in a much larger context.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: X☐ **No:** ☐

Explain: Of the lands within the five park units proposed for climate monitoring, 97% of the land is either designated or eligible wilderness. Therefore options for using non-wilderness lands are essentially restricted to lands outside of the parks, or privately owned parcels within the parks.

Consideration was given in this evaluation as to whether the climate of the ARCN network of parks could be monitored sufficiently well to meet the goals of the I&M Program by means of a set of stations located just outside the periphery of the park units, by locating stations within current private inholdings, or through remote sensing means from above (satellites) or the side (e.g., radar). Here, "sufficiency" consists of the following:

- the ability to reconstruct the spatial variability of climate inside the park unit,
- the ability to distinguish differing elevation effects,
- the ability to track slow and sometimes subtle changes in climate associated with changes in ecological communities, including in near surface soil conditions, in wind patterns, in the diurnal cycles of weather (temperature in particular), and in the occurrence of extreme events (wind bursts, heat or cold spells, heavy precipitation) that lead to physical or biological disturbances,
- the ability to retrospectively identify changes in climate behavior that led to ecological changes noted after the fact rather than at the time of their occurrence.

A network should be able to provide these things. A consensus of NPS and external climatologists concluded that this is not currently possible to accomplish within acceptable error limits using only "edge" measurements from outside the boundaries of wilderness. Locations on private land were equally inadequate in providing the data due to lack of sufficient variety in elevation and topography, and have additional disadvantages including the difficulty of negotiating long term leases for equipment placement and access.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain: There is no provision in ANILCA which requires the NPS to place these facilities for its own purposes; ANILCA 1310(b) does not apply in this situation.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain: Monitoring climate is not required in any other legislation, but climate monitoring data research is strongly supported by enabling legislation for NOAT in Section 201 of the Alaska National Interest Lands Conservation (ANILCA) which states that the preserve shall be managed for the following purposes, among others:

- To maintain the environmental integrity of the Noatak River and adjacent uplands within the preserve in such a manner as to assure the continuation of geological and biological processes unimpaired by adverse human activity;
- To protect habitat for and populations of fish and wildlife, including but not limited to caribou, grizzly bears, Dall sheep, moose, wolves, waterfowl, raptors, and other species of birds;
- To protect archeological resources;
- To provide opportunities for scientific research.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: X☐ **No:** ☐ **Partially:** ☐ **Not Applicable:** ☐

Explain: NPS Management Policies 2006 (NPS, 2006a) addresses the importance of and need for weather and climate monitoring efforts as well as scientific inquiry in wilderness in a number of sections:

Section 4.7.2 *Weather and Climate:* "parks containing significant natural resources will gather and maintain baseline climatological data for perpetual reference".

Section 4.2 *Studies and collections* "The Service will encourage appropriately reviewed natural resource studies whenever such studies are consistent with applicable laws and policies. These studies support the NPS mission by providing the Service, the scientific community, and the public with an understanding of park resources, processes, values, and uses that will be cumulative and constantly refined... Studies include projects conducted by researchers and scholars in universities, foundations and other

institutions, tribal colleges and organizations, other federal and state agencies, and Service staff".

Section 2.3.1.5 *Science and Scholarship* "The collection and analysis of information about park resources will be a continuous process that will help ensure that decisions are consistent with park purposes."
Section 6.3.6 *Scientific Activities in Wilderness* "The statutory purposes of wilderness include scientific activities, and these activities are encouraged and permitted when consistent with the Service's responsibilities to preserve and manage wilderness".

Section 6.3.6.1 *General Policy* "The National Park Service has a responsibility to support the appropriate scientific activities in wilderness and to use science to improve wilderness management. The Service recognizes that wilderness can and should serve as an important resource for long-term research into, and study, and observation of, ecological processes and the impacts of humans on these ecosystems. The National Park Service further recognizes that appropriate scientific activities may be critical to the long- term preservation of wilderness".

"Scientific activities are to be encouraged in wilderness. Even those scientific activities (including inventory, monitoring, and research) that involve a potential impact to wilderness resources or values (including access, ground disturbance, use of equipment, and animal welfare) should be allowed when the benefits of what can be learned outweigh the impacts on wilderness resources or values. However, all such activities must also be evaluated using the minimum requirement concept and include documented compliance that assesses impacts against benefits to wilderness. This process should ensure that the activity is appropriate and utilizes the minimum tool required to accomplish project objectives".

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: Yes ☐ **No: X** ☐ **Not Applicable:** ☐

Explain: Although the project is not necessary to preserve the untrammeled quality, it would not control or manipulate the ecological systems within the wilderness.

Undeveloped: Yes: ☐ **No: X** ☐ **Not Applicable:** ☐

Explain: The project would not preserve the undeveloped quality of wilderness and would have an impact on this quality.

Natural: Yes: X ☐ **No:** ☐ **Not Applicable:** ☐

Explain: When using adaptive management strategies to support stewardship of parklands and wilderness, it is important to understand the pattern of climate change.

Information collected by this project would help managers to plan strategies and make decisions that would promote naturalness and allow natural changes to occur. Monitoring and understanding the effects of global climate change on wilderness are a part of maintaining the natural quality of wilderness.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☐ **No:** X ☐ **Not Applicable:** ☐

Explain: The project would not preserve the solitude or unconfined recreation quality of wilderness and would have an impact on this quality.

Other unique components that reflect the character of this wilderness:

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** X☐ **Not Applicable:** ☐

Explain:

Scenic: **Yes:** ☐ **No:** X☐ **Not Applicable:** ☐

Explain:

Scientific: **Yes:** X☐ **No:** ☐ **Not Applicable:** ☐

Explain: The NPS has the responsibility to advance understanding of the ecosystems in the arctic parks. This understanding would come in the form of the monitoring data that would be collected, analyzed, interpreted, and reported. Further, the NPS recognizes that while scientific work has been conducted in each of the network parks, this information needs to be incorporated with NPS monitoring efforts to improve its understanding of the holistic functioning of ecosystems within the network. An understanding of ecosystem function is important because it will allow NPS to fulfill the legislative mandate to manage parks in a manner that leaves them unimpaired for the enjoyment of future generations. Identifying future sensitive resources and allowing for the development of management plans for species migration shifts are just two examples of how the data may be specifically used.

It is generally accepted that climate change is occurring and that it is especially evident in high-latitude regions (NAST 2001); The temperature increases in the ARCN that have been observed in the last several decades (e.g. Stottlemyer et al. 2001) will likely have significant impacts on permafrost in the ARCN (Lachenbruch and Marshall 1986; Osterkamp and Romanovsky 1999; Jorgenson et al. 2001; NAST 2001; Hinzman et al.

2005; Sanzone et al. 2005). In particular, higher temperatures may be associated with increased soil active layer depth and permafrost depth which may in turn be linked to alterations in characteristics such as soil moisture, soil temperature, and soil respiration rates. These in turn can alter rates of nutrient inputs into the ARCN ecosystems, which could have far reaching impacts on the biological community of the ARCN.

Long-term changes in climate are also associated with reductions in sea ice cover (Maslanik et al. 1996; Maslanik et al. 1999) and changes in the distributions of various organisms in the ARCN region (Serreze et al. 2000; Hinzman et al. 2005). In the North, the most conspicuous and well-studied expression of this is the location of the treeline. Changing climate and associated factors have already resulted in increased plant growth (Myneni et al. 1997) and associated advancement of treeline into the tundra biome (Sanzone et al. 2005).

Numerous studies describe the effects of climate change on selected ecosystems, but it is important to quantitatively monitor meteorological conditions directly so that a reliable record of long term change can be established. These data will be used by a myriad of researchers and park staff to understand other research and monitoring questions; it is the foundation data for understanding changes in the arctic parks. It is also data that can be used in a circumpolar perspective of climate change and the immediate and long term effects on global arctic ecosystems.

Education: **Yes:** X☐ **No:** ☐ **Not Applicable:** ☐

Explain: National parks have a significant interpretive mission and education and outreach are important components of wilderness stewardship. Climate has always been an element in that interpretation, and climate change is rapidly being incorporated into that mission. The interpretation messages can address climate itself, or the relation of climate to other ecological communities and physical processes in a given park. Because the public values the national parks, a message about climate change and the effects on parks has the ability to influence broad societal values and actions, and could garner more support for wilderness areas that protect ecosystems and processes. The NPS seeks to promote understanding of how science benefits park management decisions, including wilderness, and to actively share scientific findings in a compelling and understandable way.

Conservation: **Yes:** ☐ **Possibly:** X☐ **No:** ☐ **Not Applicable:** ☐

Explain: If protection of natural resources and processes is to be achieved during the coming decades of climate change, managers need to use adaptive management strategies to deal with uncertain futures. Often there is a lag between a climate shift and a change in species composition, but understanding the changes in climate can give managers a tool to help predict or project trends in flora and fauna, given different climate scenarios. Climate observations feed models that help project future conditions, given the complex topography. Better understanding of climate change and its implications will better inform managers as they make decisions about broader preservation issues such as refugia for species and the need for additional

wilderness areas, and will help managers be proactive, rather than reactive, in their managment.

Historical use: **Yes:** ☐ **No:** X☐ **Not Applicable:** ☐

Explain:

Step 1 Decision: Is any administrative action necessary in wilderness?

Explain: Yes, this project is the minimum necessary in wilderness. Climate is a fundamental driver to ecological condition and to the patterns of plant and animal communities found in NPS park units as critical components of arctic wilderness. Changes in climate will impact these ecosystems. Climate monitoring is important to understanding how climate variability and change relates to complex ecological systems within the arctic network. Better understanding of the changes in climate, and the relationships between these changes and the impacts to the park's cultural and natural resource is necessary for longterm, pro-active, scientifically based and informed decision making for park and wilderness management. Although the proposed project would not contribute directly to the preservation of the untrammeled or undeveloped qualities, nor to outstanding opportunities for solitude or a primitive and unconfined type of recreation within the wilderness, the weather and climate information would significantly contribute to the understanding of the relationship between climate change and impacts on natural resources, therefore improving our ability to model future conditions and protect or at least reduce the potential degradation of the natural quality of the wilderness character. The data could be used to monitor how the natural quality of wilderness is affected by global climate change. Climate data will be used immediately and be used by other scientists to correlate changes or conditions in other vital signs such as vegetation pattern, wildlife abundance and distribution, and flow regimes, as well as the practical application of providing information on current conditions for park visitors, park staff and pilots. It is the minimum for modeling and extrapolating climate envelopes into the future.

Without accurate long-term climate data, park and resource managers will be less well informed for making decisions that affect park and wilderness resources. Consequently, they may fail to take necessary measures to mitigate impacts or adapt to the effects of climate change, or may implement ineffective or counterproductive measures (such as reintroducing rare species to unsuitable habitat). Management of wildland fire, invasive species, wildlife, fisheries, subsistence harvests, recreational activity and cultural resources requires information; not only about the particular resource, but also about the factors that influence it's status and trends. For example, severe weather events, such as ice storms, have sometimes been documented to result in high losses to wildlife populations. However, without accurate information of the actual weather conditions in the preceding months, an unusual change in population numbers could erroneously be attributed to overharvest by humans or predatory wildlife, either of which could have management implications for NPS or other agencies. Likewise,

agency strategies for management of wildland fire and invasive species, if based on regional trends rather than current data, could fail to protect wilderness resources in a changing environment, especially if climatic "tipping points" were to trigger rapid resource changes, such as pest eruptions or widespread tree mortality. Perhaps even more importantly, by lacking accurate information about long-term climate trends, or by using unverified proxy data, models, forecasts, or interpretations the NPS and other agencies could fail to implement changes to resource and visitor uses that would be needed to protect particularly sensitive resources already stressed by climate change.

Climate monitoring will contribute resource data for park management decisions and will also contribute to future efforts in broader-scale regional and circumpolar climate monitoring and modeling efforts. The project would also benefit the scientific purpose of wilderness. Further, the proposed climate station installation and maintenance project is supported by the NPS policies related to scientific activities within wilderness under certain conditions.

While there remains considerable uncertainty about some details of how climate will change Alaska's park and wilderness areas, there is little disagreement within the scientific community about the directions of recent changes. This research would expand significantly on previous work and attempts to answer major questions. Examples of applications of climate data for further understanding arctic ecosystems are:

- Snowfall data for population dynamic modeling for caribou, muskoxen and wolves
- Weather anomalies affecting wildlife distribution and abundance
- Small mammal abundance based on derived climate indices
- Watershed data for vegetation simulation modeling in forest and tundra biomes
- Precipitation and maximum temperatures for sediment discharge in large river basins
- Precipitation data to calibrate a numerical model that simulates surface runoff response
- Relating tree growth to tree location and microclimate
- Fire weather data for indices/rating and providing information for management decisions on fire
- Temperature and precipitation data used to refine down-scaled climate models

The impacts of the project on the undeveloped quality of wilderness character as well as opportunities for solitude or primitive and unconfined recreation will be long term due to the relative permanence of the installations. Climate monitoring installations negatively affect the undeveloped quality of wilderness character and corresponding experiential factors. For some people, the existence value of the wilderness will be affected simply by knowing that the stations are in place even if they will never see them, and the stations could be viewed as a lack of restraint in administering the wilderness. Access by airplane or helicopter would have a short-term temporal affect on the undeveloped quality of wilderness character in any given year, but would be an annual long term increase in aircraft activity in the parks as long as the stations are in

place. Activities involved with maintaining the stations could also affect solitude or primitive and unconfined recreation.

Using climate stations is the proposed way to collect this data over the long term and over diverse ecosystems and topography. Placing all of the climate stations outside of the wilderness would limit the precision and applicability of the data and would not meet the goals and objectives of the proposed project. The benefits of collecting this data outweigh the impacts associated with installation of longterm structures for the following reasons:

- The results of this project would address an urgent stewardship issue, ecosystem impacts from changing climate conditions, the urgency of which is likely to accelerate.
- Data from this project would address an important wilderness stewardship issue, one that affects one or more key biophysical or social aspects of wilderness over a large area or long timeframe, with potential concern for human health/safety.
- The results of this applied research would be applicable to the wilderness in which the research is conducted, and it would benefit science in similar bioregions globally.
- Results would provide a long term benefit for people nationally or globally.
- It would be conducted on a single process of the ecosystem that affects many components.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

In order to minimize impacts to wilderness character, a number of options were considered for monitoring climate in the arctic parklands. The ERRATA as well as the EA (Section 2.5 Alternatives Considered but Rejected) describe, for example, why locating climate stations outside of the wilderness or using remote sensing technologies to obtain the information are not feasible alternatives. Similarly, the MRA that accompanied the EA evaluated a more limited number of climate stations in the arctic parks. It looked at establishing 8 long-term, remote automated climate stations in Gates of the Arctic National Park and Preserve (2 sites), Noatak National Preserve (2 sites), Kobuk Valley National Park (1 site), Cape Krusenstern National Monument (1 sites), and Bering Land Bridge National Preserve (2 sites), as well as an alternative that evaluated the installation of 12 stations in Gates of the Arctic National Park and Preserve (3 sites), Noatak National Preserve (4 sites), Kobuk Valley National Park (1 site), Cape Krusenstern National Monument (1 sites), and Bering Land Bridge National Preserve (3 sites). However, this number of sites would not achieve the objectives of the project, as described in step 1.

Installation of 8 new permanent structures would degrade the undeveloped quality of wilderness character as well as opportunities for solitude or primitive and unconfined recreation of these arctic parklands. The impacts associated with permanent

installations and access methods required to maintain them would be less than those associated with other alternatives. NPS would be able to retain the most remote parts of these wilderness parks as free from developments. Since all installations would be co-located with existing installations or would replace existing installations, no new undeveloped areas would be degraded. Helicopter access would be required for 5 of the sites; however, this alternative would produce less air traffic than the others because fewer installations are proposed, and the higher altitude sites that could potentially require more maintenance (and be more visible) are not included in this alternative.

Installation of 12 new permanent structures would also impact wilderness character, but the degree of impact would be somewhere between that associated with 8 installations and the preferred alternative (17 sites). Impacts would be less than the preferred alternative because stations would not be deployed in the more remote undeveloped portions of the park units. The five stations eliminated from this alternative were: Killik Pass (GAAR), Howard Pass and Kugururok (NOAT), Rabbit Creek (CAKR) and Devil Mountain (BELA). Neither the 8 or 12 structure alternatives would meet the goals of the project or provide the minimum necessary information to monitor climate in these parks effectively.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative A_(No Action)

Description:

Under the No Action alternative, no additional climate stations would be established in Gates of the Arctic National Park and Preserve, Noatak National Preserve, Kobuk Valley National Park, Cape Krusenstern National Monument, or Bering Land Bridge National Preserve.

Effects on Wilderness Character

Untrammeled – The ecological systems within the wilderness would not be further controlled or manipulated.

Undeveloped – The existing vast stretches of the arctic national parklands would remain largely undeveloped.

Natural –Additional information regarding the predicted ecological changes resulting from climate change and the potential effects of those changes to the naturalness of wilderness within the study area would be unavailable to managers for strategic

planning and management decisions, and for improved/increased understanding regarding the future of arctic wilderness ecosystems.

Outstanding opportunities for solitude or primitive and unconfined recreation – Visitors to the arctic national parklands and associated wilderness areas would continue to experience opportunities for solitude or primitive and unconfined recreation.

Alternative B_(Expand Climate Monitoring Program: 17 Sites)

Description:

In support of the Arctic Alaska Inventory and Monitoring Program, the National Park Service would establish long-term, remote automated climate stations in Gates of the Arctic National Park and Preserve (4 sites, Figure 2-1), Noatak National Preserve (6 sites, Figure 2-2), Kobuk Valley National Park (1 site Figure 2-3), Cape Krusenstern National Monument (2 sites, Figure 2-4), and Bering Land Bridge National Preserve (4 sites, Figure 2-5). Measures were included as part of the siting criteria for wilderness impacts, the 17 sites were carefully chosen to avoid high use areas by visitors, including river corridors, lakes, and the more popular hiking areas. Access was also considered in the siting criteria and flight paths and base locations were purposefully selected to minimize the number of flights and the need for fuel caches. The density of climate stations was reduced from the 58 sites originally proposed by climate experts, as the recommendation needed to capture climate gradients, to the 17 that were selected in the final iteration. The seventeen sites represent those sites that met the site selection criteria of a good climate site and the mitigation efforts for wilderness concerns. Each of the 17 sites represents approximately 1.1 million acres; this was considered to be the minimum number necessary to effectively monitor climate patterns and trends in the Arctic parks given wilderness concerns.

Table B-1 identifies the individual RAWS sites and provides information as to elevation, location, access, land status, and site preparation. Deployment of these stations is anticipated for 2011.

The climate stations would collect basic weather observations including air temperature, precipitation, relative humidity, wind speed and direction, solar radiation and snow depth and transmit these observations hourly via satellite. These observations would be posted to the Western Regional Climate Center's (WRCC) web site in near real-time (http://www.wrcc.dri.edu/NPS.html)

Each climate station would be composed of a 10-foot tripod tower hosting all the sensors and a datalogger enclosure. The batteries would be enclosed in a separate enclosure at the base of the tripod.

The tripod mast would house the temperature, precipitation, relative humidity, solar radiation, wind speed and direction, and snow depth sensors, a GPS antenna, and a GOES satellite transmission antenna. A fiberglass equipment enclosure (18" x 16" x 6") on the mast houses the electronic equipment such as the datalogger, and geostationary satellite transmitter (GOES). The batteries are sealed, starved electrolyte-type batteries. The wind speed and direction sensors are located on the top of the 10-foot tall mast. The footprint of the tripod is approximately 12 feet in diameter. A 48"x 13" solar panel would also be attached to the south side of the mast. The tripod will be anchored to the ground with three 2-foot long, 3/4 inch diameter steel pins.

Installation

A Campbell Scientific, Inc. climate station can be installed in a few hours by two people once all the parts and pieces are onsite. Getting the climate station to a deployment site would typically require one or two trips using a helicopter. A single helicopter flight would transport personnel to each site. Transporting the components ofthe climate station to a point where helicopter operations can begin may require fixed-wing aircraft. Climate station installation would occur in June, July, and August. Non-motorized hand tools would be used for climate station assembly.

Annual Maintenance

Each station would require one annual maintenance visit. Maintenance activities would be confined to a single day and would primarily occur from June through August. Helicopter access would be necessary for most sites, but fixed wing access and hiking to the site is available for some of them and would be used when possible. Three to four hours would be required to swap sensors and perform other routine maintenance.

Table B-1. Potential new climate station sites under Alternative B

Park	Site Name	Elevation (ft)	Latitude DM_NAD83	Longitude DM_NAD83	Access for Maintenance	Land Status & (Wilderness)	Concurrent Land Uses	Required Site Preparation
GAAR	Chimney Mountain	3,100	67° 45.3454'	150° 29.6020'	Helicopter or float plane	Park (Wilderness)	None	None
GAAR	Pamichtuk Lake	2,700	67° 46.3160'	152° 11.7000'	Helicopter or float plane	Park (Wilderness)	None	None
GAAR	Ram Creek	3,000	67°41.1110'	154° 28.3870'	Helicopter	Park (Wilderness)	None	None
GAAR	Killik Pass	3,000	67° 58.2210'	154° 55.4500'	Helicopter or float plane	Park (Wilderness)	None	None
NOAT	Kaluich Creek	2,486	67° 34.4030'	158° 25.9030'	Helicopter	Preserve (Wilderness)	None	None
NOAT	Imelyak	3,620	67°32.6890'	157° 04.6460'	Helicopter	Preserve (Wilderness)	None	None
NOAT	Howard Pass	2,062	68° 09.3610'	156° 53.7490'	Helicopter	Preserve (Wilderness)	None	None
NOAT	Sisiak	1,823	67° 59.7020'	160° 23.7390'	Helicopter	Preserve (Wilderness)	None.	None
NOAT	Kugururok	1,028	68° 19.9870'	161° 22.5530'	Helicopter	Preserve (Wilderness)	None	None

NOAT	Asik (High elevation)	1329	67° 28.4930’	162° 15.9860’	Helicopter	Preserve	None	None
KOVA	Salmon River	1,262	67° 27.5940’	159° 50.4750’	Helicopter	Park	None	None
CAKR	Mt. Noak	809	67° 08.4860’	162° 59.6720’	Helicopter	Monument	None	None
CAKR	Rabbit Creek	966	67° 33.0090’	163° 34.0310’	Helicopter	Monument	None	None
BELA	Midnight Mountain	2,267	65° 49.2200’	164° 32.5645’	Helicopter	Preserve	NPS Radio Repeater	None
BELA	Serpentine Hot Springs	518	65° 51.1380’	164° 42.4690’	Fixed-wing to Serpentine Hot Springs Airstrip	Preserve	None	None
BELA	Devil Mountain	285	66° 16.5530’	164° 31.851’	Helicopter	Preserve	None	None
BELA	Ella Creek	2258	65° 16.2890’	163° 48.6810’	Helicopter	Preserve	None	None

Effects on Wilderness Character

Untrammeled -- The stations would not control or manipulate the ecological systems within the wilderness.

Undeveloped -- The installation of 17 new permanent structures would impact the undeveloped character of these arctic parklands. All stations except Midnight Mountain and Serpentine Hot Springs would be installed in places that currently do not have any developments. Impacts would extend to some of the most remote parts of the arctic parklands including Killik Pass (GAAR), Howard Pass and Kugururok (NOAT), Rabbit Creek CAKR), Devil Mountain (BELA).

The climate stations would be placed primarily within undisturbed locations and would require a footprint of approximately 12 feet by 12 feet (144 sq ft).

Some minor vegetation clearing could be necessary to facilitate erecting the previously-described structures, but no major site preparation is necessary. Visual impact of the structures in areas otherwise devoid of human presence would be long-term and would detract from the undeveloped wilderness character. All structures would likely be visible from the air, at least during one season. (If they were camouflaged to blend with vegetation, they would be visible in winter, if painted white, they would be visible in summer.)

The amount of helicopter and fixed-wing air traffic would increase due to the installation and maintenance of 17 new structures. Helicopter access would be required for most of the sites. It can be expected that due to severe weather at higher elevations and near the coast, climate stations in those areas would require additional maintenance to repair sites damaged by severe wind and ice. This increase in air traffic would be long-term given the intent to leave these stations in place for decades.

Natural -- The natural conditions and biological diversity within the wilderness would continue to be protected. Information collected by this project would help managers plan for and make decisions that would promote naturalness and allow natural changes to occur. (See Step One)

Outstanding opportunities for solitude or primitive and unconfined recreation -- Throughout the majority of the wilderness parklands visitors would continue to experience opportunities for solitude or primitive and unconfined recreation. However, those opportunities could be impacted due to 17 new installations and increases in air traffic associated with installation and maintenance activities. Placement of monitoring stations in these remote areas could impact visitor experience especially if encountered on the ground. All structures have the potential to be seen from the air and many would be on exposed ridges visible from great distances.

The amount of helicopter and fixed-wing air traffic would increase due to the installation and maintenance of 17 new structures. Helicopter access would be required for most of the sites. This increase in air traffic would be an annual commitment given the long-term nature of the installations. Visitors may observe fixed-winged aircraft and/or helicopter activities within and surrounding the climate monitoring sites. Personnel may also be seen and heard. Noise from aircraft could diminish a sense of solitude in the vicinity, as motorized noise, especially helicopter noise, can be heard over long distances. These intrusions could extend beyond the immediate climate monitoring station site, but would be of short duration.

The availability of such weather data also decreases the sense of self-reliance, adventure, and discovery of the wilderness areas. The knowledge that daily climate information is available, even if a person chooses not to view it, may diminish the sense of the area being unknown and unexplored. For some, the idea of a blank spot on the map has tremendous value; information collected by this project would add definition and consequently remove some of the mystery associated with those blank spots. In this sense, the project would decrease the sense of mystery, exploration, discovery, risk and adventure associated with these wilderness areas.

Other wilderness values -- Lands included in these wilderness parks are important spiritually and culturally for many local people and communities; seeing modern human developments like climate stations could detract from the sense of place some cultures associate with lands encompassed by the park units. For some people who may never visit these areas, the existence value of wilderness is very important, and just knowing that these facilities are on the ground would detract from their value to them.

Safety of Visitors, Personnel, and Contractors

Providing additional information on current weather conditions in remote areas would enhance the safety of pilots and passengers traveling through these regions. Pilots would be able to make better informed decisions on flight routes.

Safety Criterion

If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation: Safety is not an overriding consideration in choosing between alternatives for implementing this project. Safety will always be the highest priority in whichever alternative is implemented.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG Instructions before describing the selected alternative and describing the rationale for selection.

Selected alternative: Alternative B : (Install 17 sites)

Rationale for selecting this alternative (including documentation of safety criterion, if appropriate):

Weather monitoring is important to understanding how climate variability and change relates to complex ecological systems within the arctic network. Using climate stations is the proposed way to collect this data over the long term and over diverse ecosystems and topography. The benefits of collecting this data outweigh the impacts associated with installation of long-term structures in designated and eligible wilderness.

Alternative B would provide for 17 climate monitoring stations to be installed in Gates of the Arctic National Park and Preserve (4 sites), Noatak National Preserve (6 sites), Kobuk Valley National Park (1 site), Cape Krusenstern National Monument (2 sites), and Bering Land Bridge National Preserve (4 sites). This is the minimum number of stations necessary for a successful project.

During the initial site selection process a series of workshops were held to solicit input from climatologists, meteorologists, and resource managers concerning the need for climate data in the Arctic parks. All agreed that the current coverage was inadequate (Nolan, 2007; Redmond and Simeral 2010). The number of new climate stations that were proposed represents a concerted effort to balance science and wilderness concerns in an area with a sparse network of climate stations. The proposed inter-station spacing of about 40 miles (65 km), or one station per 1.1 million acres, was determined to be a reasonable density to help understand regional climate patterns (Redmond and Simeral,

2010). The number is not a result of statistical analysis, but instead represents a consensus among an expert panel of climatologists and resource managers who agreed that the proposed spatial density and distribution was a reasonable optimization between a 'dream network' and a viable one.

Approximately 58 locations were proposed early in the project. After numerous discussions, refinements, and iterations that included guidance from park management, the site list was trimmed down to the proposed 17. NPS staff did a comprehensive site evaluation and analysis of potential sites based on siting criteria, wilderness mitigation efforts, and management concerns. Based on expert judgment, the review panel that included climatologists, meteorologists, and resource managers, agreed that the number of sites recommended for each of the Arctic parks represented the minimum number of locations that could characterize the complex topography of the parks given the management concerns (Redmond and Simeral, 2010).

This project was developed as a strategic plan for monitoring weather into the future. If select stations are removed from the proposed array, then the plan would be incomplete and the work would be unable to proceed. These sites provide data which is extrapolated from site to site, so more than the loss of data from one site, the removal of even one site impacts the overall ability to model from the proposed station locations.

The selected alternative conforms to NPS 2006 Management Policies, and the parks' GMPs. The information obtained from the climate stations is important for the administration and preservation of wilderness ecosystems and cannot be obtained from a location outside of the wilderness without significant loss of precision and applicability preventing the NPS from meeting the goals and objectives of the climate monitoring within the ARCN Vital Signs Monitoring Plan. The data collected by this alternative will contribute resource data for planning and future management strategies and decisions, and will also contribute to future efforts in broader-scale climate monitoring and modeling efforts.

While the No-Action Alternative and other alternatives considered would create less direct impact to wilderness character, none of the other alternatives would meet the goals of the project or provide the minimum necessary information to effectively monitor climate in these parks. The seventeen sites represent an adequate spatial density of climate stations that will enable NPS to monitor climate gradients across the five Arctic parks.

Cumulative Impacts: There currently exists the following number of structures/installations in the arctic parklands:

The following table lists facilities / installations that have been permitted by NPS and installed in WEAR.

WEAR	Number of Installations	Purpose	Notes
NPS Radio Repeaters	3	Supports communication	Permanent

		and park operations	
NPS Administrative Cabins	7	Supports a variety of protection and research activities	Permanent
NPS Snow Course	1	Gathers information on snow conditions & water content to help predict stream flow.	Permanent
NPS Remote Automated Weather Station (RAWS) Installations	3	Collects basic climatological data including air & soil temperature, precipitation, relative humidity, wind speed and direction, solar radiation, & snow depth	Permanent

In addition, there are approximately 75 natural resource markers and approximately 25 cultural resource markers. They consist of either an aluminum stake with a stamped 3.25" cap, a wooden stake, or a tagged rebar stake. There are no plans for their removal.

The following table lists facilities/installations that have been permitted by NPS and installed in GAAR.

GAAR	**Number of installations**	**Purpose**	**Notes**
NPS/other cabins	3	Public health & safety, administrative and park operations use	Some maintained; some under review for removal
WBAN weather Station	1	Collects basic climatological data	Permanent

In addition, there are several hundred cultural resource markers consisting of a rebar stake buried in the ground with a small aluminum tag remaining above the surface. There are no plans for their removal.

Under Alternative B: The selected alternative would contribute 13 additional installations in WEAR, increasing the number of installations from 14 to 27 and 4 additional installations in GAAR increasing the number of installations from 4 to eight (8). Counting only more similar installations, the total number of climate stations and radio repeaters in WEAR is 7 and adding 13 additional climate stations would increase the number to twenty (20). In GAAR the number would increase from 1 to four (4).

The cumulative impact of airplane and helicopter landings and flights would also increase by approximately 14-18 additional helicopter flights per year, assuming that an additional 3-5 additional fixed wing flights were used where that type of access is feasible. If a helicopter were used exclusively for access under this alternative, there

would be approximately 17-21 additional helicopter flights annually. There is currently no accurate data to approximate the total existing number of helicopter and fixed wing flights so it is difficult to assess the effects to the cumulative total.

Mitigation requirements under all alternatives:

After the climate stations have been in place for 5 years, the ARCN program staff will conduct a thorough review of the efficacy of all of the stations and analyze their contributions to climate models. Where the data from any station is duplicative of data available from outside the park units, and does not contribute to improving climate models already in use or under development, the stations will be removed from the parks. This will be determined by coordination with other research and monitoring programs in the circumpolar region. In addition, when technological improvements (i.e. wireless instruments, portable instruments, remote sensing) become available that can duplicate existing data collection, the stations will be replaced with less intrusive techniques. GAAR has a successful history of removing outdated or underutilized equipment and facilities from the wilderness, and park management will monitor and ensure that this review takes place.

The selected alternative would mitigate adverse impacts to the wilderness resource by minimizing the number and duration of field activities, minimizing ground disturbance to the smallest practicable footprint, and installing each climate station in such a manner as to minimize the impact on wilderness character. Construction activities would be attempted during times when visitor use is minimal. Flight paths will be used that minimize or avoid impacts to sensitive wildlife or higher public use areas.

The sites are to be anchored in a way that yields minimum disturbance to the substrate (by means of rods driven into the ground), rather than a typical concrete plug, for example. To avoid guy wires, the towers are shortened from the recommended WMO standard of 10 meters to 3 meters, typical of many tripod mounts. Climate stations deployed for CAKN are also 3 meter tripods. When the stations are constructed, only hand tools will be used.

Stations can be painted to blend in with surroundings, though unlike snowshoe hares one color scheme must suffice all year. The usual choice is the mottled greenish and tan colors of vegetative camouflage, with overlapping patterns of different color and contrast to break up visual shape patterns. However, thermometer housings must remain as white as possible for adequate measurements under all circumstances.

Project managers will consult with park staff to determine the most appropriate timing for maintenance trips based on local knowledge of visitor, subsistence and wildlife activities. They will also coordinate flights whenever possible to minimize aircraft hours and landings. Whenever possible, fixed wing/foot access will be the method of choice.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

☐ mechanical transport

☐ motorized equipment

☐ motor vehicles

☐ motorboats

X☐ landing of aircraft

☐ temporary road

X☐ structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	**Signature**	**Name**	**Position**	**Date**
Prepared by:		Team: Adrienne Lindholm, Dan Stevenson, Judy Alderson, Pam Sousanes, Jim Lawler, Ashley Adams, Vic Knox		Mar. 22, 2011
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Approved:				