Fire Management Plan Review and Update
For
Western Arctic Parklands
May 7, 2014

The National Park Service Director's Order (DO) 18, Wildland Fire Management, and the subsequent Reference Manual (RM) 18 provide wildland fire management guidelines. DO 18 states that "every park area with burnable vegetation must have a fire management plan approved by the Superintendent." Chapter 4 of RM 18 requires each NPS unit to review and update their fire management plan (FMP) annually, stating that "an annual review is essential to ensure that the FMP continues to conform to current laws, objectives, procedures, and strategies."

Plan review and updates are intended to keep the fire management plan current; changes in terminology, cooperative agreements, and modifications of multi-year treatment plans are examples of appropriate annual revisions to a fire management plan using this plan review and update format.

The updates identified in this document will become effective upon signature by the NPS unit Superintendent. The updated information should be incorporated into the Park unit's FMP, and records kept in the park files. Please send a copy of this completed and signed document to the Alaska Regional Fire Management Officer.

A comprehensive Fire Management Plan revision and NEPA compliance review of this plan is required every 5 years (DO 18, chapter 4). The FMP for Western Arctic Parklands was originally approved September 29, 2004. It received a comprehensively review in 2011-2012 and approved in the fall of 2012. The next comprehensive review is due in 2019-2020.

Directions. Please review the following in the NPS unit FMP. If no updates are required, please check "no update"; if updates are required, please check "update included here", and identify the specific update(s) in the space provided. Some items may require discussions with park resources management personnel.

Terminology updates/revisions
__X__ No update
_____ Update included here:

Compliance (are the following still valid? NEPA, NHPA – Section 106, ESA – Section 7) NOTE: If major changes have occurred invalidating the NEPA, then the FMP may be suspended. The park unit would revert to suppression-only until a new NEPA process, and a new or revised FMP would be completed and approved.
_____ No update
__X__ Update included here: Inserted reference to the NPS Alaska Region Programmatic Fire Hazard Fuels Management Plan, Environmental Assessment (2013).

Policy Change
__X__ No update:
_____ Update included here (does this require additional compliance work?):

Step-up Staffing Plan (Appendix G. of the FMP)
__X__ No update
_____ Update included here:

Delegation of Authority (Appendix G. of the FMP)

_____ No update:

__X__ Update included here: 2013 Delegation of Authority on file and still valid

Wildland Fire Response (Section 4.3. of the FMP)

__X__ No update

_____ Update included here:

Organizational Responsibilities (Section 4.9 of FMP)

_____ No update

__X__ Update included here: Updated Organization Chart (Figure 8) and further defined fire management staff's non-incident duties.

Agreements/Coordination/Contracts (Appendix G and M. of FMP)

_____ No update

__X__ Update included here: Updated Interagency Contact List (Appendix M) and updated references to the Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the Alaska Statewide Annual Operating Plan.

Multi-year Treatment Plan (Appendix E)

_____ No update

__X__ Update included here: Updated Hazard Fuels Plan and Alaska Western Area Multi-year Treatment Plan (Appendix E). Included update in Section 4.5.1.b: Identifying Candidate Projects

Preattack Plan (Sections 4.3 C and Appendix G)

_____ No update

__X__ Update included here: Update how to report a wildfire procedures.

Other Updates

_____ No update

__X__ Update included here: Updated Figure 2: Fire statistics for fires that have burned in and around WEAR from 1956-2013; Updated Figure 5: Acres Burned on NPS Lands in Western Arctic National Parklands; Updated Appendix S1. – Fire Statistics & Graphs; Appendix S2. – Maps.

Prepared by: Larry Weddle Date: 6/16/14
Fire Management Officer

Approved by: [signature] Date: 6/18/14
Superintendent

FIRE MANAGEMENT PLAN

For

Western Arctic National Parklands

ALASKA

July 20, 2012

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Western Arctic National Parklands

FIRE MANAGEMENT PLAN

SIGNATURE PAGE

Prepared/ Recommended by: _____ Date 6/24/12
FMO, Western Area Fire Management Officer

Recommended by: _____ Date 7/20/12
Chief, Rangers, Western Arctic Parklands

Recommended by: _____ Date 8/18/12
Chief, Natural Resources, Western Arctic Parklands

Recommended by: _____ Date 8/7/12
Chief, Cultural Resources, Western Arctic Parklands

Reviewed by: _____ Date 11/14/12
Regional Fire Management Officer, Alaska, NPS

Approved by: _____ Date 8/10/12
Superintendent, Western Arctic Parklands (BELA)

Approved by: _____ Date 7/20/12
Superintendent, Western Arctic Parklands (CAKR, KOVA, NOAT)

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1.0 INTRODUCTION

1.1 Reason for the Fire Management Plan

The following Fire Management Plan (FMP) is a specific action plan for the implementation of agency-wide and park-specific policies with regards to the management of Wildland Fire on Park/Preserve Lands. This plan will provide consistent operational guidance to management as to questions arising in the inevitable event of a wildfire within its jurisdictional boundary. Additionally, National Park Service Policy (DO-18) was recently updated (January 1, 2008) and currently spells out its mandate as follows:

> *"Each park with burnable vegetation must have an approved Fire Management Plan that will address the need for adequate funding and staffing to support its fire management program. Parks having an approved Fire Management Plan and accompanying National Environmental Policy Act (NEPA) compliance may utilize wildland fire to achieve resource benefits in predetermined fire management units. Parks lacking an approved Fire Management Plan may not use resource benefits as a primary consideration influencing the selection of a suppression strategy, but they must consider the resource impacts of suppression alternatives in their decisions."*

Other Purposes of the Plan:

This Fire Management Plan is intended to aid in the accomplishment of goals and objectives for the fire management program. Fire management goals and objectives were derived from the general management plan (GMP), resource management plan (RMP, BELA only), Foundation Statements and other founding documents for the Western Arctic National Parklands (WEAR). At present there is only one operational Resource Management Plan among the four units that comprise WEAR. Due to this circumstance, fire managers have no alternative but to work under direct guidance of the GMPs, Foundation Statements, coupled with the Alaska Interagency Wildland Fire Management Plan (AIWFMP) to delineate how fire will be managed in WEAR. Stated slightly differently but with the same objective in mind, the GMPs clearly outline how the NPS will deal with fire management in the Western Arctic National Parklands. The NPS will "Manage natural resources to perpetuate ecological processes and systems." (CAKR GMP: 196) (KOVA GMP: 179) Units within WEAR will "allow fire to fulfill its natural role in vegetation succession." (NOAT GMP: 79) In addition the GMPs realized that "fire is an integral part in vegetation management, through the periodic removal of certain types of vegetation, the recycling of nutrients and the returning of areas to earlier stages of succession." (BELA GMP: 80).

This FMP provides park managers a concise communication tool for understanding actions, roles and responsibilities of involved fire personnel. It is designed to support management goals and objectives defined in the Western Arctic Parklands GMP, and RMP but will additionally give clearly defined direction in regards to fire and its management within the Park/Preserve. It is vital that park managers are aware how fire is managed in Alaska and, how as a NPS staff member they will be able to assist in ensuring fire management objectives are met when fire visits the Western Arctic landscape.

1.2 General Description of the Park

1.2.1 Purpose of the Park/Preserve

In 1980, with the passage of the Alaska National Interest Lands Conservation Act (ANILCA), the National Park Service in Alaska attained management responsibility for millions of acres of new Monuments, Parks and Preserves. In return the NPS became responsible for the care, proper management and longevity of resources that existed on these lands.

In the northwest corner of Alaska four management units were designated for Federally Protected Status. These units were the Bering Land Bridge National Preserve, Cape Krusenstern National Monument, Kobuk Valley National Park and Noatak National Preserve. Not long after their inception, the NPS realized that the management of these four separate units was challenging geographically, logistically, financially and managerially. Due to this unique situation the NPS has over the years sampled various management regimes for the four units. These four units are known collectively as the Western Arctic Parklands (WEAR). These lands together encompass 11.6 million acres of arctic and sub-arctic wildlands.

This grouping together of the individual units was incorporated to increase management efficiency by combining human and organizational resources. The National Park Service, however, recognized that each unit contained individualized resource goals and objectives based on each units' fundamental legislative purpose. It was therefore decided that separate general management plans and resource management plans (RMP) would be created for each of the four units. Currently only Bering Land Bridge has a RMP. For all units, the GMP and Foundation Statements provides guidance needed for management decisions.

Although subtle differences occur in the wording, the fire management goal remains the same in each of the four general management plans. This collaborative goal states, "Park units in northwest Alaska are to allow natural forest and tundra fires to fulfill their ecological role." (KOVA GMP 1986:63) This goal coupled with ecological factors that promote treating the entire region as arctic/sub-arctic fire management zone, has lead to the decision that the Western Arctic Parklands although different with respect to Resource Management purpose, goals, and objectives, are very similar with respect to resources warranting protection, fuels and fire behavior. Therefore one fire management plan will be written for the Western Arctic Parklands.

Each of the four management units will be described individually as necessary. However, where appropriate these units will be referred to as the Western Arctic Parklands (WEAR) and managed as a single fire management area.

Bering Land Bridge National Preserve

Comprising 2,690,993 acres, the Bering Land Bridge is located at the northern tip of the Seward Peninsula in northwestern Alaska. This Monument was set aside for the following purposes as directed by ANILCA. "To protect and interpret examples of arctic plant communities, volcanic lava flows, ash explosions, coastal formations and other geological processes; to protect habitat for internationally significant populations of migratory birds; to provide for archeological and paleontological study, in cooperation with Native Alaskans, of the process of plant and animal migration, including man, between North America and the Asian Continent, to protect habitat for, and populations of, fish and wildlife including, but not limited to, marine mammals, brown/grizzly bears,

moose and wolves;…to continue reindeer grazing use…in accordance with sound range management practices; to protect the viability of subsistence resources; and in a manner consistent with the foregoing, to provide for the outdoor recreation and environmental education activities including public access for recreational purposes to the Serpentine Hot Springs area."

Cape Krusenstern National Monument

Located on Alaska's Northwestern Coast, Cape Krusenstern encompasses 646,484 acres of coastal arctic ecosystem. The Monument was established, " To protect and interpret a series of archeological sites depicting every known cultural period in arctic Alaska; to provide for scientific study of the process of human population of the area from the Asian Continent, in cooperation with Native Alaskans, to preserve and interpret evidence of prehistoric and historic Native cultures, to protect habitat for seals and other marine mammals; to protect habitat for and populations of birds, and other wildlife, and fish resources; and to protect the viability of subsistence resources…"

Kobuk Valley National Park

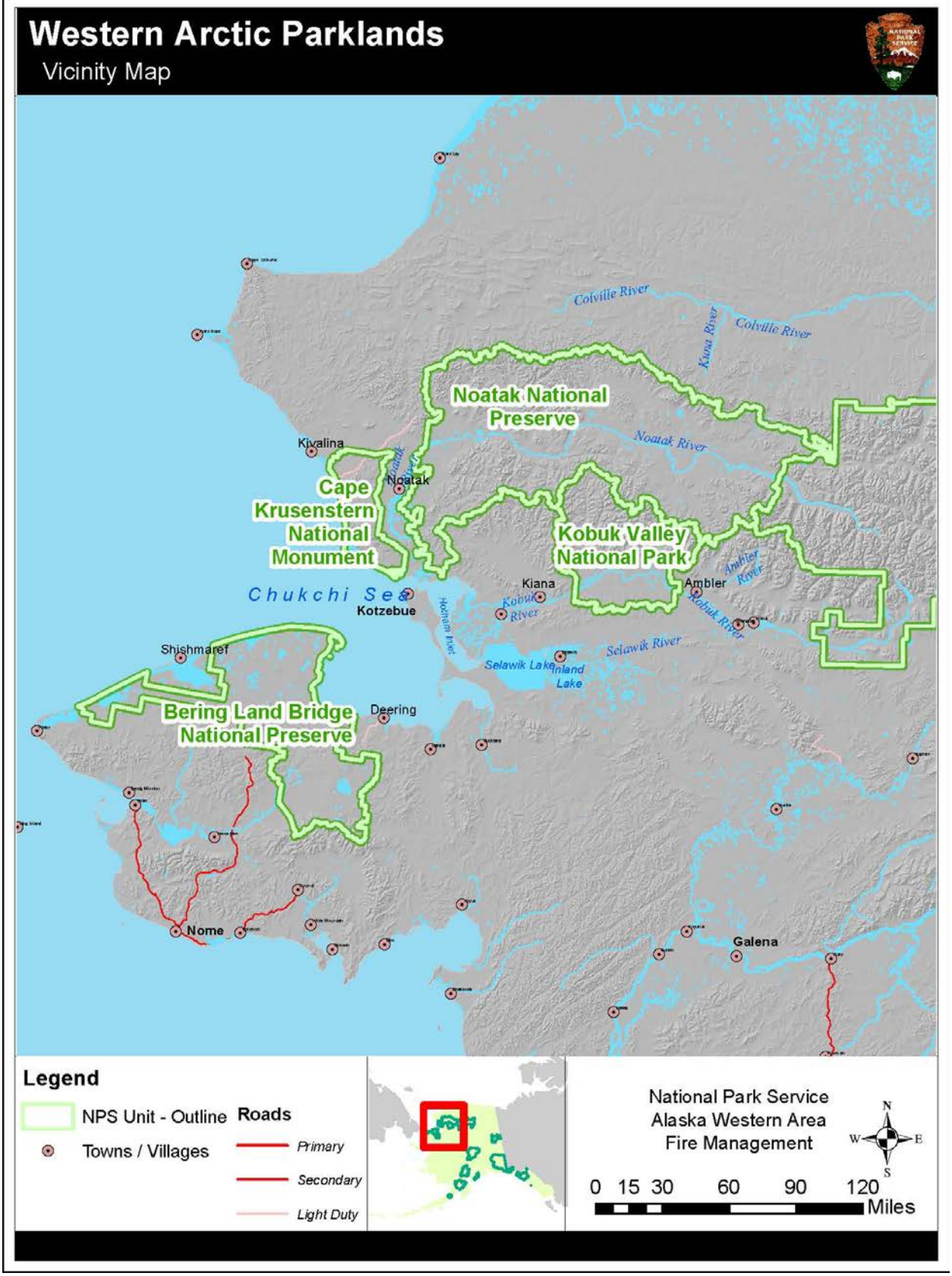
The Kobuk Valley National Park protects a 1,751,149 acre parcel surrounding the central section of the Kobuk River. Enclosed by the Baird and Waring mountains this area was designated as a National Park, " To maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon and other rivers, the boreal forest, and the Great Kobuk Sand Dunes, in an undeveloped state, to protect and interpret, in cooperation with Native Alaskans, archeological sites associated with Native cultures; to protect migration routes for the Arctic caribou herd; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl and to protect the viability of subsistence resources."

Noatak National Preserve

The largest of the four units at 6,563,709 acres the Noatak River basin is one of the largest undisturbed watersheds in North America. This area was set aside, "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, and for waterfowl, raptors, and other species of birds; to protect archeological resources; and in a manner consistent with the foregoing, to provide opportunities for scientific research."

Recognized as a National Biosphere Reserve, the Noatak possesses internationally significant scientific value with regard to vegetative communities and fish and wildlife populations. Wildlife biology, ecology, botany, and numerous other disciplines acknowledge the unique opportunity for scholarship that is possible in the preserve. As a result, maintaining the natural ecosystem within Noatak National Preserve is a primary priority in all management decisions.

Figure 1: Western Arctic Parklands – Vicinity Map



1.2.2 Management Environment

1.2.2.1 Land ownership, significant resources, mission and management direction

Land Ownership

Cape Krusenstern National Monument shares its boundaries with a variety of different land owners. The northwest coastal section of CAKR contains Native Village Corporation (Kivalina) lands adjacent and within the ANILCA established Monument boundary. The southern coastal section contains Native Village Corporation (Kotzebue) lands adjacent and within the Monument boundary. The eastern interior central portion contains Native Village Corporation (Noatak) lands adjacent and within the Monument boundary. The southern coastal section contains Native Regional Corporation (Nana) lands within the Monument boundary. The north interior section of CAKR contains State of Alaska lands adjacent and within the Monument boundary. The southern interior section of CAKR is adjacent to several large parcels of Bureau of Land Management administered lands. Numerous privately owned allotments/parcels exist within the boundary, particularly along the coastal portion on the Monument.

Bering Land Bridge National Preserve shares its boundaries with a variety of different land owners. The north central coastal section of BELA contains Native Village Corporation (Kotzebue) lands within the ANILCA established Preserve boundary near Cape Espenburg. The northeast coastal section of BELA contains Native Village Corporation (Deering) lands and Native Regional Corporation (Nana) lands adjacent to the Preserve boundary. The west coastal and interior section of BELA contains Native Village Corporation (Shishmaref) lands adjacent to the Preserve boundary near Shishmaref Inlet. The western most coastal and interior section contains Native Regional Corporation (Bearing Straits) lands adjacent to and within the Preserve boundary. Aside from the coastal sections of the Preserve the majority of the Preserve is adjacent to Bureau of Land Management and State of Alaska administered lands. Numerous privately owned allotments/parcels exist within the boundary, particularly along the coastal/lagoon portions on the Preserve.

Kobuk Valley National Park shares its boundaries with a variety of different land owners. The southwest section, along the Kobuk River of KOVA, contains Native Village Corporation (Kiana) lands adjacent to the ANILCA established Park boundary. The southeast section, near the Kobuk River of KOVA, contains Native Village Corporation (Ambler) and Native Regional Corporation (Nana) lands within and adjacent to the Park boundary. The remaining sections along the west and east boundary of the Park are adjacent to Bureau of Land Management and State of Alaska administered lands. The entire northern boundary is shared with Noatak National Preserve. The entire southern boundary, along the Waring Mountains, is shared with the Selawik National Refuge (USFWS). Numerous privately owned allotments/parcels exist within the boundary, particularly along the Kobuk River of the Park.

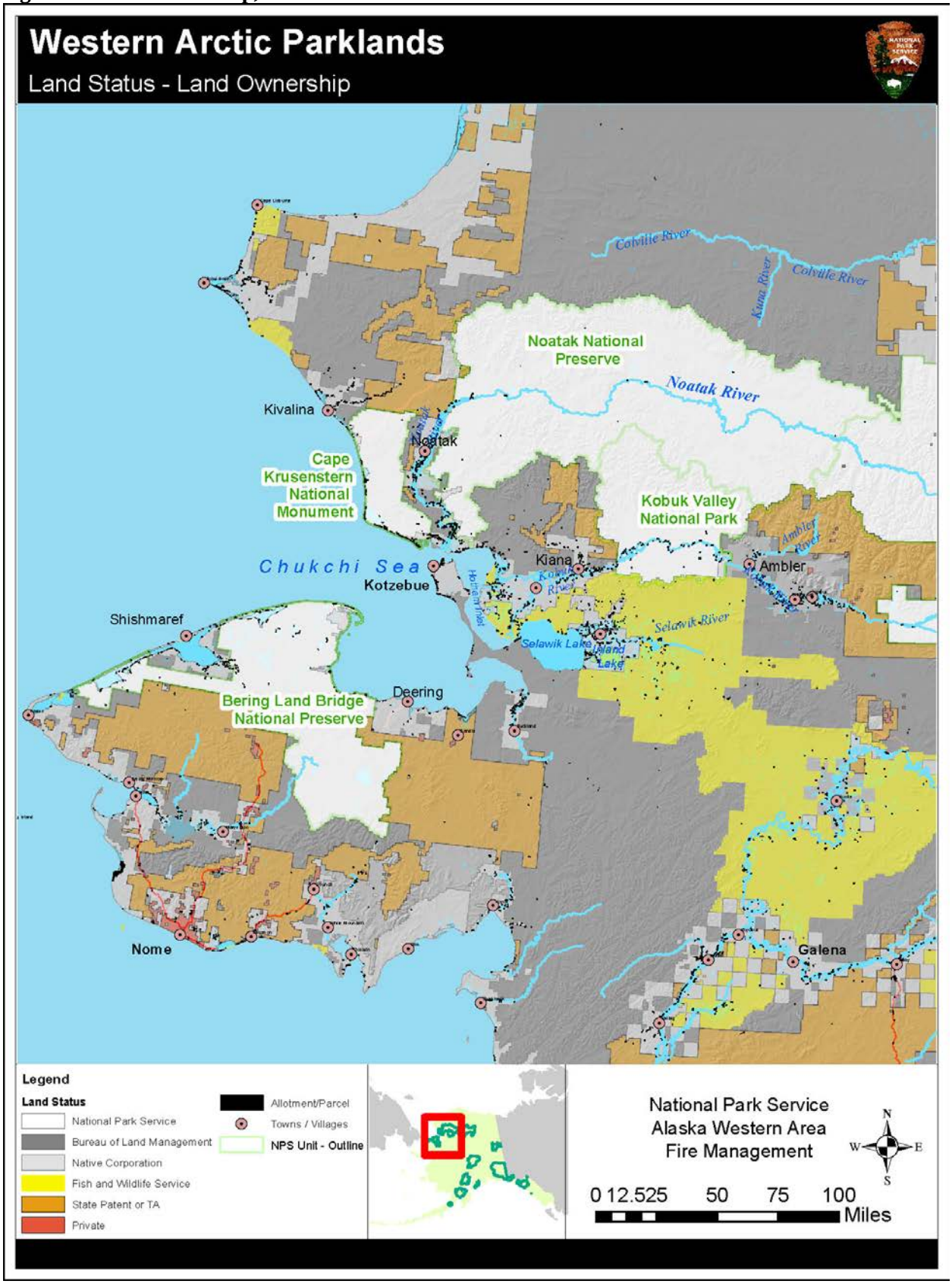
Noatak National Preserve shares its boundaries with a variety of different land owners. A small portion along the ANILCA established western boundary is adjacent to Native Regional Corporation (Arctic Slope) lands. The south western section, near the mouth of the Noatak River, contains Native Regional Corporation (Nana) and Native Village Corporation (Kotzebue) lands adjacent to and within the Preserve boundary. Additional Native Regional Corporation (Nana) and Native Village Corporation (Noatak) lands are adjacent to the Preserve along the west boundary. The majority, all of the northern

border and large sections of the south and southwest border, are shared with the Bureau of Land Management administered lands. Various section along the northwest, south central and south east are shared with State of Alaska administered lands. Much of the south central and eastern boundaries are shared with other NPS units, Kobuk Valley National Park and Gates of the Arctic National Park and Preserve. Numerous privately owned allotments/parcels exist within the boundary, particularly along the Noatak River near Noatak Village.

Numerous privately owned allotments exist within the Park/Preserve/Monument and are displayed on the map Land Ownership and Special Management Areas. (Figure 2: Land Ownership, Western Arctic Parklands).

Landownership patterns in and adjacent to NPS administered lands provide some challenges to managing natural processes across Western Arctic Parklands. Management direction differs for various landowners/land management agencies across Alaska thus an interagency planning effort was conducted to develop mutually understood procedures for developing response plans for any given area across landowners/jurisdictional agency boundaries. These specific planning and response procedures are identified in the Alaska Interagency Fire Management Plan, 2010.

Figure 2: Land Ownership, Western Arctic Parklands

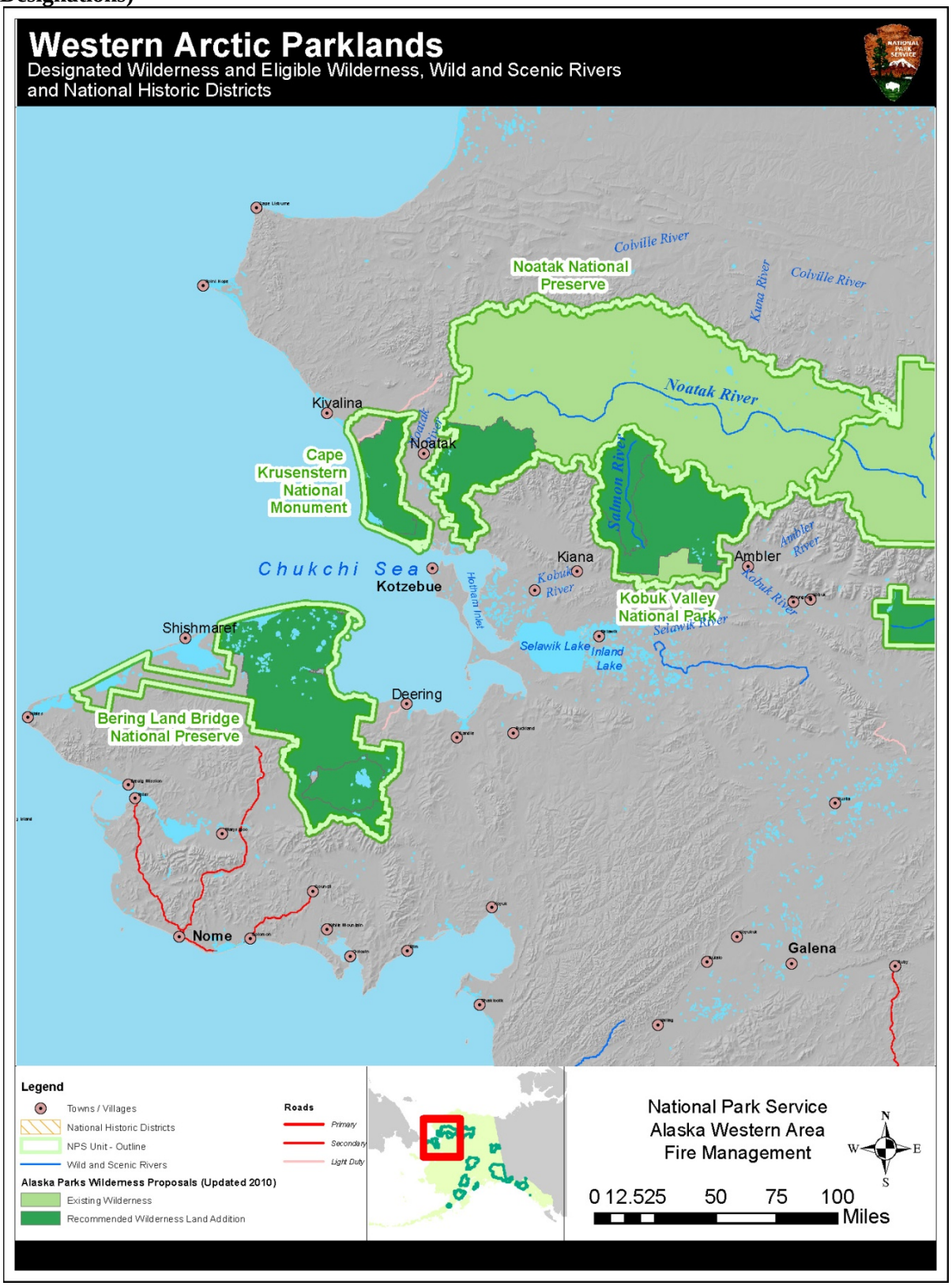


Wilderness- Western Arctic Parklands encompasses 11,759,235 acres. Within the Kobuk National Park and Noatak National Preserve there are 5,986, 146 acres in designated wilderness. An additional 5,181,901 acres are currently listed as eligible wilderness across the Western Arctic Parkland units. Approximately 95% of the Western Arctic Parklands are designated or eligible wilderness (11,168,047 acres). Therefore the vast majority fire management activities within its boundaries will conform to the basic principles of wilderness as described in Director's Order #41 and set for in ANILCA.

Wild and Scenic River- The Noatak River drains the largest mountain ringed river basin in America that is still virtually unaffected by human activities. This Wild and Scenic River designation originates in Gates of the Arctic National Park and Preserve and flows through the Noatak National Preserve to the end of this designation at the terminus of the Kelly River (Approximately 330 miles). The Noatak River is a premier wilderness river trip destination. The Salmon River, designated Wild and Scenic, entirely located in Kobuk Valley National Park originates in the Baird Mountains and flows to the Kobuk River (70 miles). Specific management considerations are consistent and integrated with the broader management standards of the Park Units that these rivers are located. These rivers are managed under the same provisions as Kobuk National Park and Noatak National Preserve. (NPS, KOVA and NOAT GMPs, 1986).

National Historic Landmarks – Two well established National Historic Landmarks (Archeological Districts) exist in Western Arctic Parks. Onion Portage site proper, within Kobuk Valley NP archeological district is the deeply stratified Onion Portage site proper, where archeologists excavated nine cultural complexes, ranging from the Akmak Complex (ca. 8,000-6,500 BC) to the Arctic Woodland Eskimo (ca. 1000-1700 AD). The stratigraphic sequence found at Onion Portage has been the model used by archeologists in establishing a cultural chronology for the region. Cape Krusenstern Archeological District, one of the reasons for the establishment of the Monument, encompasses a series of 114 marine beach ridges, formed at an average of perhaps 60 years each since the time of the highest post-glacial sea level. The district contains the cultural remains of peoples who have inhabited these beaches for 5,000 or more years. Adjacent to the ridges on unglaciated uplands in the Iguchuk Hills are surface deposits that extend the record backward to the time of the end of the Pleistocene. The beach ridges of Cape Krusenstern provide a broad, horizontal stratigraphy, which includes virtually all phases of cultural history known in northwest Alaska.

Figure 3: Special Management Areas (Wilderness & Preserve Boundaries, and Wild River Designations)



Subsistence **-** ANILCA permits some uses that would not be permitted in most other NPS areas, particularly and subsistence uses by local residents in all four areas. They provide residents with the opportunity to maintain a subsistence way of life as an integral part of a dynamic ecosystem. Thus special consideration should be given to these practices when considering appropriate fire management operations within the Park/Preserve or Monument.

Specific Park Unit Purpose Statements

CAKR – "protect the viability of subsistence resources"; "Subsistence uses by local residents shall be permitted in the monument in accordance with the provisions of Title VIII" (ANILCA).

KOVA – "protect the viability of subsistence resources". "Subsistence uses by local residents shall be permitted in the park in accordance with the provisions of title VIII" (ANILCA).

BELA – "to protect the viability of subsistence resources". "Continue reindeer grazing use" (ANILCA).

Sport Hunting- ANILCA permits some uses that would not be permitted in most other NPS areas, particularly sport hunting in the two preserves. They provide residents with the opportunity to maintain a subsistence way of life as an integral part of a dynamic ecosystem. Thus consideration should be given to these practices when considering appropriate fire management operations within the Park/Preserve.

1.2.2.2 Overview of physical and biotic characteristics of park

The four areas contain unaltered landscapes, vast populations of animals and plants in intact ecosystems, and archeological sites dating back to the first habitation of North America. As with other NPS-managed lands, Congress set aside the areas for their preservation and enjoyment short of the point of impairment. ANILCA permits some uses that would not be permitted in most other NPS areas, particularly sport hunting in the two preserves and subsistence uses by local residents in all four areas. They provide residents with the opportunity to maintain a subsistence way of life as an integral part of a dynamic ecosystem.

Physical

The national parks, preserves, and monuments of Western Arctic Parklands contain several very general components, including (a) the western most portion of Alaska's Brooks Range, (b) both hilly and low terrain on the northern Seward Peninsula, (c) broad lowlands draining major river systems approaching the coast of the Chukchi Sea, and (d) coastal lowlands and bluffs. Permafrost underlies much of the lowland terrain within Western Arctic Parklands, sometimes within 10 cm of the surface. Higher elevations and steeper slopes may or may not contain permafrost as frozen water by virtue of aspect (through summer insolation), grain size, drainage, and disturbance regime. (Sanzone 2006)

Specific Park Purpose Statements

NOAT – "Maintain the environmental integrity of the Noatak River and adjacent uplands to assure the continuation of geological and biological processes, unimpaired by adverse human activity"

KOVA – "Maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon, and other rivers, the boreal forest, and Great Kobuk Sand Dunes, in an undeveloped state"

BELA – "Protect and interpret examples of … ,volcanic lava flows, ash explosions, coastal formations, and other geologic processes"

Biotic

Vegetation

The most conspicuous feature of the vegetation in northwestern Alaska is treeline, or northward or coastward limit of conifer forests. The forest reaches its northwestern most limit in North America in the vicinity of the eastern border of Cape Krusenstern National Monument and the western edge of the Noatak National Preserve (Young 1974). Western and northwestern Alaska has long been recognized as having the richest array of vascular plants of any region in the circumpolar north (Hultén, 1937, 1968). Lichens and bryophytes are a conspicuous and ecologically important element in Alaska's arctic parks. Nonvascular plants are likely to represent 70% of ARCN's flora (Holt and Neitlich 2010). Table 1 indicates the percent of area within each park unit by vegetation types as defined in the ABR ARCN 2009 landcover map.

Table 1: Percent of Park Units by Vegetation Classes

Sorted by most common vegetation type for all WEAR Parks.

Vegetation ARCN Map 2009	% NOAT	% BELA	% CAKR	% KOVA	TOTAL WEAR
120: Dwarf Birch-Tussock Shrub	33.3	35.0	30.1	8.5	107.0
110: Dwarf Birch-Ericaceous-Willow Low Shrub	15.9	10.8	27.6	20.5	74.8
020: Sedge-Dryas Meadow	6.3	21.2	13.8	3.0	44.3
010: Partially Vegetated	15.3	4.3	4.6	6.1	30.3
150: Alder or Willow Tall Shrub	4.4	0.9	1.7	20.2	27.2
140: Willow Low Shrub	5.3	7.4	7.9	4.5	25.0
060: Dryas Dwarf Shrub	8.4	3.0	3.4	5.2	19.9
310: White Spruce Forest	1.3	0.0	0.4	18.1	19.8
400: Fresh Water	1.0	5.5	0.9	0.9	8.3
040: Sedge Fen	2.0	3.1	1.4	1.2	7.7
410: Coastal Water	0.0	3.1	4.2	0.0	7.2
100: Ericaceous Shrub Bog	1.0	4.6	1.4	0.1	7.1
030: Sedge Wet Meadow	2.5	0.0	0.0	2.0	4.5
320: Black Spruce Forest	0.0	0.0	0.0	4.0	4.0
070: Ericaceous Dwarf Shrub	2.2	0.0	0.0	1.3	3.5
130: Dwarf Birch-Willow Low Shrub	0.9	0.5	1.4	0.4	3.3
230: Spruce-Paper Birch Forest	0.0	0.0	0.0	1.9	1.9
210: Paper Birch Forest	0.1	0.0	0.0	0.8	0.9
090: Crowberry Dwarf Shrub	0.0	0.3	0.6	0.0	0.9
050: Brackish Sedge-Grass Wet Meadow	0.0	0.4	0.5	0.0	0.9
300: White Spruce-Lichen Woodland	0.1	0.0	0.0	0.4	0.6
200: Balsam Poplar Forest	0.0	0.0	0.0	0.5	0.6
220: White Spruce-Balsam Poplar Forest	0.0	0.0	0.0	0.3	0.3
015: Dunegrass Meadow	0.0	0.1	0.2	0.0	0.2

Specific Park Purpose Statements

NOAT – "Maintain the environmental integrity of the Noatak River and adjacent uplands to assure the continuation of geological and biological processes, unimpaired by adverse human activity"; "Protect habitat for… fish and wildlife, including but not limited to caribou, grizzly bears, Dall's sheep, moose, wolves, and for waterfowl, raptors, and other species of birds"

CAKR – "Protect habitat for seals and other marine mammals". "Protect habitat for … birds, other wildlife, and fish"

KOVA – "Protect habitat for … fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl"

BELA – "Protect and interpret examples of arctic plant communities…"; Protect habitat for internationally significant populations of migratory birds"; "Protect habitat for… fish and wildlife including, marine mammals, brown/grizzly bears, moose, and wolves"

Mammals and Birds

Western Arctic Parklands, accounting for four of the five Park Units that comprise the Alaska Arctic Inventory and Monitoring Network (ARCN). Inventory and Monitoring Program estimates that approximately 42 species of terrestrial mammals are believed to occur within the boundaries of ARCN, ranging in size from the tiny shrew (*Sorex yukonicus*) to brown bears (*Ursus arctos*) and moose (*Alces alces*). Most birds found in the ARCN are summer nesters or migrants, with only about a dozen species overwintering within the network. There is evidence supporting the presence of 177 bird species in ARCN, with individual parks containing between 114 and 132 species and as many as 12 to 26 species that have yet to be documented in one or more of the parks (NPSpecies 2004). (Sanzone 2006)

Specific Park Purpose Statements

NOAT – "Protect … populations of, fish and wildlife, including but not limited to caribou, grizzly bears, Dall's sheep, moose, wolves, and for waterfowl, raptors, and other species of birds"

CAKR – "Protect habitat for seals and other marine mammals". "Protect … populations of, birds, other wildlife, and fish"

KOVA – "Protect … populations of, fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl"; "Protect migration routes for the arctic caribou herd."

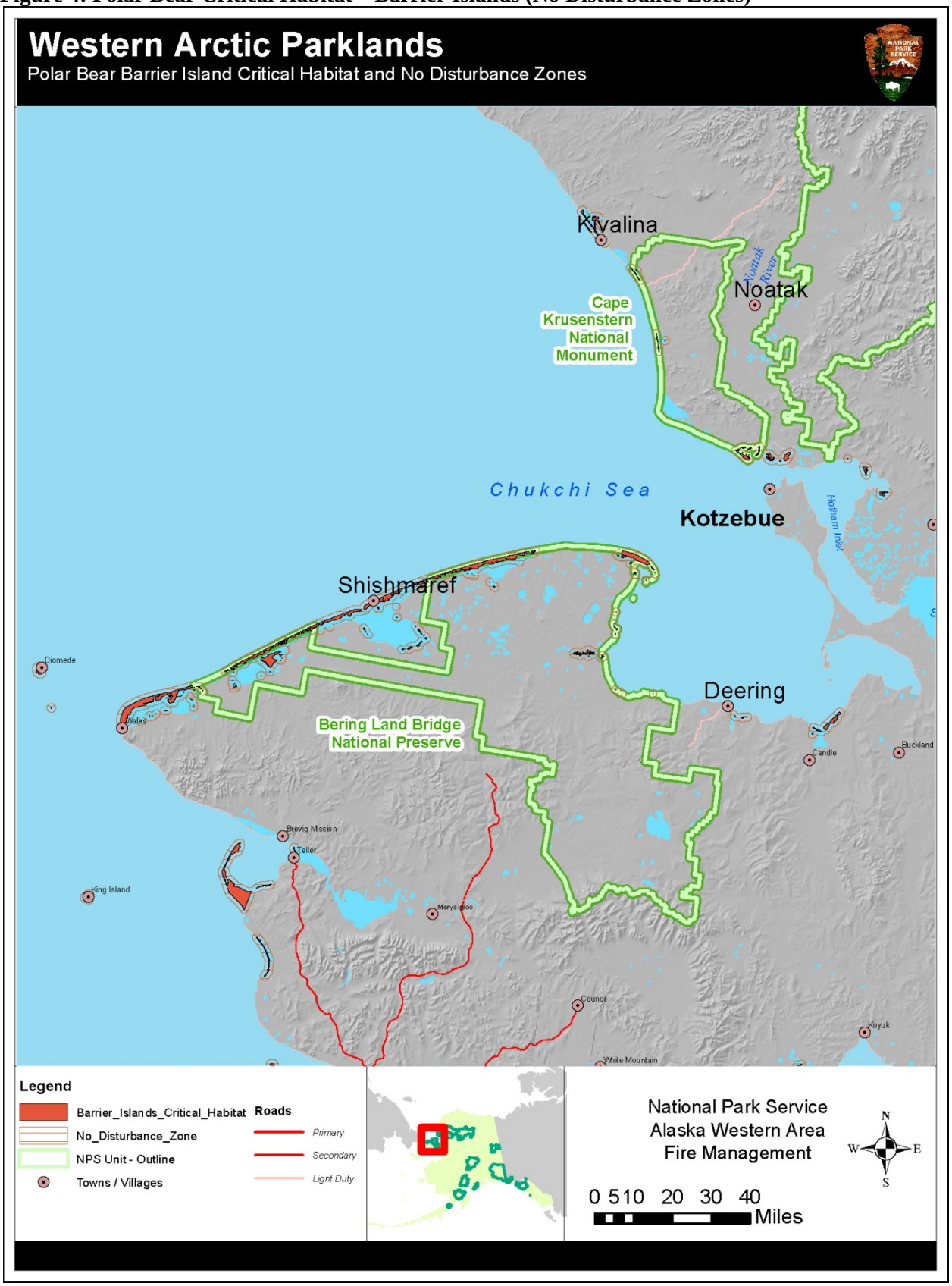
BELA – "Protect habitat for internationally significant populations of migratory birds"; "Protect … populations of fish and wildlife including, marine mammals, brown/grizzly bears, moose, and wolves."

Sensitive Natural Resources

Due to the immensity and remoteness of WEAR, knowledge of threatened, endangered, or candidate plant and animal species is minimal. One Threatened species, polar bear (*Ursus maritimus*) and one Candidate species, yellow-billed loon (*Gavia adamsii*) occur within the Western Arctic National Parklands.

Based on telemetry information polar bears are primarily located near the migratory extent of the pack ice. During the fire season the pack ice has typically receded north of the Western Arctic National Parklands thus the presence of polar bears in the area can be expected to be very infrequent. One of the Critical Habitat designated areas, Barrier Islands is interspersed throughout the CAKR and BELA coastline and are designated as "No Disturbance" zones 1 mile surrounding these Critical Habitat areas (See Figure 4).

Figure 4: Polar Bear Critical Habitat – Barrier Islands (No Disturbance Zones)



The impact of wildfire on polar bear habitat, in these areas, is expected to be minimal. However if fire suppression efforts within or in the vicinity of the Barrier Islands – No Disturbance Zones is necessary it may require the establishment extended fire camps. Though polar bears are unlikely in be in these areas, within CAKR and BELA, during the summer months the establishment of fire base camps will be minimized in these areas. Should it be necessary to locate a fire base camp in the No Disturbance zone, due to safety concerns, Section 7 consultation with USFWS will be initiated, as appropriate.

Yellow-billed loons are a migratory species with breeding habitat in Alaska, including within WEAR. Yellow-billed loons typically breed and rear young on lakes and ponds and have nests near shorelines. Wildfire often burns up to the transition to shoreline vegetation but does not burn the immediate shoreline vegetation. Therefore direct impacts to nesting yellow-billed loons is anticipated to be minimal. Disturbance of nesting/breeding yellow-billed loons, due to suppression actions, is possible. However disturbance impacts will be minimal since the majority of fires in WEAR will receive no suppression actions. Eighty-three percent of WEAR is designated in a Limited FMU and 12 percent is designated in a Modified FMU where few suppression actions are anticipated.

Two species of Eider, *Somateria fischeri* (Spectacled eider), and *Polysticta stelleri* (Steller's eider) are currently listed as threatened on the Federal Threatened and Endangered Species list. Although not scientifically documented by the NPS in any of the WEAR management units, the coastline of both Bering Land Bridge and Cape Krusenstern lay within the historic breeding range for these species. Further federally threatened and endangered species include the endangered *Balaena mysticeus* (Bowhead whale). According to the National Marine Fisheries Service, the range of these marine mammals and their occupation of distant offshore habitats leave these species non-threatened by fire and fire suppression activities. See Appendix D.3.a, Environmental Assessment for further information on these species.

Although not listed as threatened or endangered, there are a number of plant species that are listed on the Alaska Rare Plant List. Of current species included on the list, five are believed to occur in WEAR. These species are; *Oxytropis kobukensis* (Kobuk locoweed), *Oxytropis arctica* var. *barnebyana* (Barneby's locoweed), *Artemisia senjavinensis* (Bering Sea wormwood), *Douglasia beringensis* (Bering Sea douglasia), and *Rumex krausei* (Cape Krause sorrel). All of the species mentioned above occupy specific micro-sites in mostly rocky or sandy soils, gravel bars, scree slopes or rock outcrops. It is believed that fire in most years will not burn in these types of environments, thus posing little threat to the aforementioned species except under the most severe drought circumstances when fire behavior exceeds normal activity. Moreover, WEAR is home to 33 additional species included in the globally rare NP Species database. Designated Incident Commanders and Agency Administrators will make every effort to consult with appropriate resource advisors on the possible presence of any of these species and/or communities and appropriately adjust fire management strategy and tactics to minimize potential impacts. Further impacts and details on all the above species can be reviewed in the Environmental Assessment.

Ground disturbing suppression tactics pose a threat to fragile soil layers and to other ecosystem components. If ground disturbing suppression tactics are necessary the impact to sensitive natural resources will be mitigated through the use of minimum impact suppression tactics, as specified by NPS policy (see section 4.4.1).

Cultural

The four areas contain archeological sites dating back to the first habitation of North America. An example of the variety of archeological sites exemplified in Western Arctic Parklands includes National Historic Districts, and a wide array of historic, pre-historic and archeological sites. Sites range from early man migration to North America, village sites, historic seasonal camps to mining structures and artifacts dating to the Nome gold rush era.

National Register Eligible Sites

Three properties in the Western Arctic National Parklands are listed in the National Register of Historic Places. These are the Fairhaven Ditch (BELA), Onion Portage National Historic Landmark Archaeological District (KOVA), and Cape Krusenstern National Historic Landmark Archaeological District (CAKR). The Cape Krusenstern district includes several hundred archaeological sites, the majority of which are subsurface sites or surface sites lacking combustible structural remains. The Fairhaven Ditch is a historic property that includes a number of combustible surface structures, including three cabins and two ruins. Protection status of these eligible cabins and sites are determined using the guidelines described above. As the condition of these sites change, their fire protection status will be reassessed.

In addition to the National Register of Historic Places, data on historic properties are maintained in a number of NPS lists and databases. These include, but are not limited to, the Archeological Site Management Information System (ASMIS), Cultural Landscapes Inventory (CLI), Cultural Sites Inventory (CSI), and List of Classified Structures (LCS). Protection status of eligible cabins and sites within these inventories and the National Register are determined using the guidelines described above. As the condition of these sites change, their fire protection status will be reassessed.

Undetermined National Register Status Sites

According to the current WEAR cabin database (a database maintained by fire management to track protection requirements for historic and modern structures), there are 186 sites containing structural components. Twenty-eight of these are on National Park Service land. This number is currently being updated; the data is being compared with data from the List of Classified Structures (LCS), and the AHRS databases. Once the sites with structural elements are tallied, cultural resource staff will determine which known sites have not yet been evaluated using National Register criteria. This information along with information on wildland fire activity will be used to formulate a prioritized plan for systematic inventory and documentation of the poorly documented sites, with the sites most at risk from wildland fire as top priority.

Approximately 1% of the total area of WEAR has undergone systematic archaeological survey. The WEAR cultural resource staff is currently conducting an archaeological survey. As sites are identified, documented, and management strategies determined surface structural sites that may be adversely affected by wildland fire will be evaluated using National Register criteria. Cultural resource specialists, park management, and fire management will work together using the fire protection criteria to determine protection status for newly discovered sites.

Specific Park Purpose Statements

NOAT – “Protect archeological resources”

CAKR – "Protect and interpret a series of archeological sites depicting every known cultural period in arctic Alaska"; "Provide for scientific study of the process of human population of the area from the Asian Continent"; "Preserve and interpret evidence of prehistoric and historic Native cultures, in cooperation with Native Alaskans".
KOVA – "Protect and interpret, in cooperation with Native Alaskans, archeological sites associated with Native cultures".
BELA – "Provide for archeological and paleontological study, in cooperation with Native Alaskans, of the process of plant and animal migration between North America and the Asian Continent".

Fire Protection/Maintenance/Restoration

Generally describe types or categories of resources that require particular protection from fire, or that require fire for maintenance or restoration

Each of the General Management Plans (GMP) for units within WEAR were approved in 1986, and contain management actions intended to address potential issues and problems within WEAR. Fire management is treated only cursorily in the GMPs, all of which state in some form or another that "park units in northwest Alaska are to allow natural forest and tundra fires to fulfill their ecological role in vegetation succession." (KOVA GMP 1986:63) However, wildfire was also recognized as a threat to private property. Consequently, the National Park Service selected the limited fire management option identified in the Alaska Interagency Wildland Fire Management Plan (AIWFMP), in which only fires that threaten human life, significant cultural sites or private property are suppressed only to the degree necessary to provide protection. This policy follows interagency fire planning policy and direction, and complies with provisions in the Alaska Native Claims Settlement Act [ANCSA 21(e)] that afford native lands wildland fire protection services from the United States. Additionally, all GMPs allow for the use of prescribed fire as a tool to manage vegetation to protect property at risk and maintain fuel conditions. Additionally KOVA GMP includes using prescribed fire to restore areas of the Park to "natural conditions".

Each of the general management plans maintains a consistent view on fire and how it will be managed within the specified administrative unit. Below are some of the natural resource management objectives that relate to fire. Verbatim objectives have been referenced. However, general themes throughout all the GMPs pertaining to fire management have been paraphrased and not referenced.

GMP management objectives that relate to fire management for all Western Arctic Parklands include:

- Protect and interpret natural ecosystems and their individual components, based on an understanding of the role played by natural processes, including fire. (BELA 1986:6)
- Manage natural resources to perpetuate ecological processes and systems. (KOVA 1986:179, CAKR 1986:196)
- Emphasize the continuation of the natural process that have shaped the landscape and sustained the plant and animal populations found on NPS lands and waters. (NOAT 1986;75)
- Allow wildfire as a natural process while protecting private property, [ANSCA 21(e)] significant historic resources, and human life.
- Maintain clean air and unimpaired viewsheds.

- Protect significant cultural resources on parklands with methods that are compatible with the wilderness purposes of the area.
- Continue research to better understand fire behavior, effects, and fire history so that fires become more predictable and management goals and objectives can be safely and efficiently accomplished.
- Maintain natural features, environmental integrity, and the dynamics of natural processes operating within the park.

1.2.2.3 Role of fire in the park

Historic Role of Fire

Climate, terrain, and vegetation strongly influence the occurrence and extent of fires within WEAR. The subarctic boreal forests and low arctic tundra biomes are subject to periodic fires. Over the last 55 years, greater than 1,248,506 acres have burned within and around the WEAR park units. An annual average of 13,397 acres burn per year just on NPS lands, 97% of which are caused by lightening (data from 1956-2010). The frequency and extent of the fires is variable within the park units (Table 2). Fires can exert landscape-scale controls on vegetation structure and composition, permafrost dynamics, nutrient cycling, carbon loss/gain, primary productivity, and biodiversity (Racine et al. 2004).

Table 2. Fire statistics for fires that have burned in and around WEAR from 1956–2010

Data is shown for both 1) fires that occurred only within park boundaries ("In Park") and 2) fires that have burned in the park boundaries, although not all acres are contained within the administrative boundary of the units ("Affecting Park"). Most fire data provided in the table is based on NPS fire records from 1950 - 2010 fires (Fire-NPS Alaska 2013, AKRO GIS permanent data set). Area burned within park boundaries are based on fire perimeter data. Lightning strike data is from AICC ARCIMS web page.

Statistic	BELA	CAKR	KOVA	NOAT	Total WEAR
Number of Fires Affecting Parks (Fire-NPS Alaska 2013)	45	4	68	217	334
Number of Fires Started in Park (Fire-NPS Alaska 2013)	42	4	64	215	325
Total Acres Burned - Affecting Parks (Fire-NPS Alaska 2013)	292,387	4,277	425,243	597,090	1,318,997
Total NPS Acres Burned*	137,189	893	102,018	540,580	780,680
Average Area Burned/Year Affecting Park (1956-2013)	5,130	75	7,460	10,475	23,140
Average Area Burned/Year NPS acres in Parks (1956-2013)	2,407	16	1,790	9,484	13,696
Average Fire Size Affecting Park	6,497	1,069	6,254	2,752	3,949

Fire Cycle (years) - number of years estimated to burn entire park area (1956-2013)	1,157	41,253	979	693	859
Average number of lightning strikes/year (1986-2010)	50	12	138	412	
Park Acreage	2,785,901	660,043	1,751,646	6,568,645	11,766,236

Within Noatak NPr (NOAT) the lowlands of the Noatak Valley are subject to periodic large fires and frequent small fires from late May until early August. Fires commonly occur in shrub-tussock tundra, sedge/graminoid lowlands, and shrub thickets of dwarf birch/ericaceous, alder (*Alnus crispa*) or willow (*Salix spp*). Of all the parks in WEAR, Noatak has burned the most acreage and greatest number of fires over the last 55 years (Table 2). Recent studies indicate that over the past 2000 years in Noatak, the fire return interval has ranged from a median of 150 years down valley to 195 years up valley in the Noatak drainage (Hu et. al. 2010). However, Joly and others reported a fire cycle of 1,237 years for the preserve, based on fire perimeter records from 1950-2007. *Fire cycle* is defined as the length of time for an area equal to the entire area of interest to burn (McPherson et. al. 1990). More than 95% of Noatak's fires are caused by lightning. Thunderstorm development in the valley can result from synoptic widespread storms or localized air-mass storms controlled by local topography. Warm dry air masses within the Noatak Valley can encounter coastal low pressure systems from the west, leading to significant thunder cell development and lightning. When ignitions are accompanied by dry windy conditions, fires in the shrub-tussock tundra and low shrub birch/ericaceous can spread rapidly and burn thousands of acres in a few days.

Kobuk Valley NP (KOVA) is in the transition zone between the interior Alaska forests and northern and western tundra. Of the WEAR parks, KOVA has the greatest amount of forested lands, with a majority of the needleleaf forest mapped as white spruce (Table 1). Fires are most frequent in lower elevation forests south of the Baird Mountains within open and woodland spruce forests. Ninety two percent of starts occur between June and July. As is typical of boreal forest fires, the fires tend to have longer duration than tundra fires. No studies have been completed on the fire return intervals within KOVA. Fire cycles based on fire perimeters from 1950-2007 indicate that the fire cycle for Kobuk Valley is 840 years (Joly et. al. 2010).

Bering Land Bridge NPr (BELA) is located on the northern part of the Seward Peninsula. This area is a cold, wind-swept landmass jutting out into the Bering Sea. Vegetation is primarily tundra, with moist sedge-tussock shrub tundra communities at lower elevations and alpine Dryas-lichen tundra communities in the high mountains. Vegetation is primarily composed of sedge tussocks and varying densities of dwarf birch with scattered stringers of willows along riparian areas and moister upland sites. These vegetation communities are susceptible to fire, but low frequency of lightning (Dissing and Verbyla 2003) and/or higher precipitation near coastal areas reduce the number of fires within BELA. The majority of acres burned within the preserve occurred during 1977, in which several large fires burned within and around the Preserve. Over the past half century, fire suppression activity on the Seward Peninsula has affected the number of acres burned in the western half of BELA. Fire return intervals are not known for the preserve, however fire cycles based on fire perimeters from 1950-2007 indicate that the fire cycle for Bering Land Bridge is approximately 1,188 years (Joly et. al. 2010)

Cape Krusenstern National Monument (CAKR) is dominated by moist dwarf shrub-tussock tundra. The forest reaches its northwestern most limit in North America in the vicinity of the eastern border of Cape Krusenstern National Monument. The number of fires in CAKR is much lower than the other park units due to the wet maritime conditions and lack of ignition sources. Only four fires have been detected in CAKR over the past 50 years (see appendix S.2: Maps 5b: Fire History). Likewise, Joly and others found that the fire cycle for Cape Krusenstern was estimated at 53,349 years. No studies have been completed on the fire return intervals within CAKR.

Desired Role of Fire

Consistent with the GMP for the four Park units the desired role of fire in the Western Arctic Parklands is the following:

Wildfire

- Maintain the area's bio-diversity and natural process through the use of fire (including the naturally occurring spectrum of fire intensities and effects) while also ensuring the safety of life, property, and sensitive resources.
- Cost-effective management of fuel loads within the natural range of variation for the fire regimes and maintenance of Fire Regime Condition Class (FRCC) 1 within WEAR park units.

Prescribed Fire

- Maintain Fire Regime Condition Class (FRCC) 1 within WEAR park units to protect structures and private property at risk.
- KOVA – Restoration of Natural Conditions

1.3 Environmental Compliance

The Fire Management Plan for Western Arctic National Parklands (WEAR) complies fully with these directives.

The actions described within this plan also meet the requirements of the National Environmental Policy Act (NEPA), Section 106 of the National Historic Preservation Act (NHPA), Section 7 of the Endangered Species Act (ESA) and the Alaska National Interest Lands Conservation Act (ANILCA). Compliance with these acts will be demonstrated as follows:

- *The WEAR Fire Management Plan is accompanied by an Environmental Assessment (Appendix D.3.a), a substantive discussion of the effects upon Western Arctic Parklands natural and cultural resources by several alternative actions, including the proposed course of action that is explained throughout the FMP.*
- *The Environmental Assessment, in turn, is accompanied by an ANILCA 810(a) Summary Evaluation and Findings document (Appendix D.3.b), an assessment of the impacts of the proposed actions upon subsistence activities within WEAR.*
- *The Fire Management Plan, Environmental Assessment, and 810(a) Summary Evaluation and Findings will be submitted to National Park Service staff members at Western Arctic National Parklands and to the Alaska Regional Support Office for review of operational soundness and compliance with federal policy.*
- *The Fire Management Plan, Environmental Assessment, and 810(a) Summary Evaluation and Findings will be submitted for review to local communities, local native corporations,*

and to all state and federal agencies holding or administering lands adjacent to or in the proximity of the Parklands.

- *A Programmatic Agreement (pending) among Western Arctic National Parklands, Denali National Park, Lake Clark National Park and Preserve, Katmai National Park, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Office specifies the actions to be taken by all park units in conjunction with their Fire Management Plans for compliance with the National Historic Preservation Act.*
- *The State Historic Preservation Officer (SHPO) will review the Fire Management Plan and Environmental Assessment; in addition the SHPO will review all individual prescribed fire burn plans prior to their approval by the Superintendent.*
- *Notice of availability of the FMP and accompanying Environmental Assessment and 810(a) Summary will be made locally, with public comments accepted by the NPS for a period of thirty days thereafter.*

2.0 POLICY, LAND MANAGEMENT PLANNING & PARTNERSHIPS

2.1 Fire Policy

Federal Fire Policy

On May 2, 2008, the Wildland Fire Leadership Council issued a memorandum entitled *Modification of Federal Wildland Fire Policy Guidance.* This memorandum directed federal agencies to test and implement new guidelines for wildland fire management. The modifications are clearly described in the document and were field tested in a number of units in the 2008 fire season.

In 2009 the National Wildfire Coordinating Group (NWCG) issued a memorandum to the NWCG executive board (NWCG#001-2009, January 7, 2009) that;

1. Affirms the soundness of the *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)*,
2. Reiterates the policy changes stated in the May 2, 2008 WFLC memorandum entitled *Modification of Federal Wildland Fire Policy Guidance*,
3. States that the Wildland Fire Decision Support System (WFDSS) will replace existing analysis and decision processes, and
4. Confirms that the *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003)* will be replaced in 2009. This document, *Guidance for Implementation of Federal Wildland Fire Management Policy (February, 2009)*, is that replacement.

The current policy clearly states that wildland fire analysis will carefully consider the long-term benefits in relation to risks both in the short and long term:

"Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on ecological, social, and legal consequences of fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response to fire." (1995/2001 Federal Wildand Fire Management Policy)

NPS Policy

National Park Service *Management Policies 2006* *section 4.5 gives guidance regarding wildland fire management in National Park administered lands. Detailed NPS guidance in particular to fire management can be obtained from* Reference Manual 18 and Directors Orders 18 . The Management Policies 2006 also proclaim that Fire management or suppression activities conducted within wilderness, including the categories of designated, recommended, potential, proposed, and eligible areas, will be consistent with the "minimum requirement" concept identified in chapter 6 and Directors Orders #41: Wilderness Preservation and Management.

Reference Manual 18: Wildland Fire Management (RM 18) provides NPS field employees legal references, operating policies, standards, procedures, general information,

recommendations, and examples to assist them in carrying out Fire Management Policies and Director's Orders.

Director's Order # 18: Wildland Fire Management (DO-18) recognizes the need of the NPS to foster healthy and natural fire ecology within individual parks, through the development of fire management programs designed around resource management objectives. Tailoring the FMP to park resource management objectives while still following national guidelines is central to the development of individual fire management plans for each park unit. To this end, each unit of the NPS is directed to prepare a fire management plan that supports cultural and natural resource management objectives while emphasizing safety for park visitors, employees, and developed facilities.

Director's Order #41: Wilderness Preservation and Management (DO-41) states that all fire management activities conducted in Wilderness will conform to the basic purposes of wilderness and that ideally, "natural fire should be considered as a fundamental component of the wilderness environment." Emphasis is placed on the methods used to suppress all wildland fires should be those that minimize the impacts of the suppression action (MIST) and the fire itself, commensurate with effective control and the preservation of wilderness values. Additionally, Fire management plans must address the effects of fire management decisions on wilderness resources and character, air quality, smoke management, water quality, and other pertinent natural and cultural resource management objectives.

Alaska Policy

Alaska Wildland Fire Coordinating Group (AWFCG)

The mission of the Alaska Wildland Fire Coordinating Group, AWFCG, is to provide a forum that fosters cooperation, coordination, collaboration and communication for wildland fire management and related-activities in the State of Alaska. The AWFCG is the leadership focus for planning and implementing interagency fire management statewide. A comprehensive website contains all current AWFCG documents and educational materials through the Alaska Interagency Coordination Center (AICC).

Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement

The Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement, herein referred to as the Master Agreement, documents the commitment of all Parties (BIA, BLM, USFWS, NPS, USFS and the State of Alaska) involved and improves efficiency by facilitating coordination and exchange of personnel, equipment, supplies, services and funds among the parties to this agreement in sustaining wildland fire management activities. This includes prevention, preparedness, communication and education, fuels treatment and hazard mitigation, fire planning, response strategies, tactics and alternatives, suppression and post-fire rehabilitation and restoration.

Alaska Interagency Wildland Fire Management Plan

In 1984, the NPS cooperated with the Alaska Department of Fish and Game (ADF&G), BLM, DNR, USFS, USFWS, BIA, and Regional and Village Native Corporations to produce Interagency Fire Management Plans for the Kobuk and Seward/Koyukuk Planning Areas. These plans provided direction for fire management activity for WEAR until 1998. In 1998, under the Alaska Wildland Fire Coordinating Group, the common elements of the area-specific fire management plans were incorporated into a single reference document: the

Alaska Interagency Wildland Fire Management Plan. Copies of the 13 original area-specific plans and the AIWFMP can be found in various Federal and State of Alaska Fire Management Agency/Division offices including at the NPS regional office, Alaska Resource Library both located in Anchorage, Alaska and the BLM Alaska Fire Service office at Fort Wainwright, AK. Under the AIWFMP, fire protection needs were determined by the land manager/owner and reviewed annually. Lands are placed in Critical, Full, Modified, or Limited protection categories. The protection categories establish priorities for allocating fire-fighting resources with the Critical category being the highest priority and Limited the lowest. These categories are based on values to be protected, as well as the managing agency's resource management objectives, policies and mandates. These categories are discussed in detail in the AIWFMP.

Prior to 1980 the policy for fire in Alaska required the immediate suppression of all wildfires. This policy was costly, of questionable effectiveness, and had a negative effect on the diversity and productivity of the fire-dependent ecosystems in some regions of Alaska. In addition, during periods of high fire activity it was not possible to provide immediate or effective suppression on many fires because of the shortage of personnel, equipment, supplies or aircraft. It was soon recognized by all land agencies that an improved system was needed for establishing response priorities. Several progressions of fire management planning documents evolved over the years until finally, in 1998, the Alaska Interagency Wildland Fire Management Plan (AIWFMP) was signed into action as the official response plan.

In 2010, necessary updates were made to respond to public requests for more information regarding Alaskan fire management practices, clarify interagency guidelines, polices and operational directions for responses to wildland fires and to modernize terminology. "This plan affirms that fire firefighter and public safety is the first priority on all fire management activities for all agencies. It also reaffirms the concepts presented in the 1998 plan and previous Alaskan interagency fire planning efforts for a consistent, cost-effective, interagency approach to wildland fire management." (2010, AIWFMP) The updated 2010 AIWFMP is the interagency reference for wildfire operational information. It specifies direction for the response to a wildfire that is based on the management option designation and provides guidelines to Jurisdictional and protection agencies for decision support direction as the complexity of a wildfire increases.

Multi-Agency Coordinating Group

The Alaska Multi-Agency Coordinating (MAC) Group provides a forum to discuss actions to be taken to ensure that an adequate number of resources are available to meet anticipated needs and to allocate those resources most efficiently during periods of shortage. The Alaska MAC Group forum ensures coordinated: - Incident prioritization - Resource allocation and acquisition - State and federal disaster response or coordination - Political interfaces - Information provided to media and agencies involved - Anticipation of future needs - Identification and resolution of issues common to all parties. The MAC group convenes on an "as needed" basis or when Alaska Preparedness Level 4 in reached. (See the Alaska Preparedness Plan in the Alaska Interagency Mobilization Guide for further information.)

2.2 Park/Resource Management Planning

General Management – There is currently one resource management plan for Bering Land Bridge in the Western Arctic National Parklands. The RMPs for the remaining three NPS Units are incomplete for numerous reasons including changing requirements. Without an existing RMP, resource managers have had no alternative but to use the direction of the GMPs (1986) and

the specific park unit Foundation Statements to guide them in resource management decisions. See above sections: 1.2.2 Management Environment; 1.2.2.1 Land ownership, significant resources, mission and management; Fire Protection/Maintenance/Restoration

Foundation Statements

BELA - The purpose of Bering Land Bridge National Preserve is to protect and provide the opportunity to study and interpret the landscape which contains an invaluable record of floral, faunal, and human migration between Asia and North America and which supports an ongoing traditional subsistence culture. (NPS, Bering Land Bridge National Preserve Foundation Statement, 2009)

CAKR - The purpose of Cape Krusenstern National Monument is to preserve, study, and interpret a sequential archeological record of human migration and adaptation, and to protect arctic ecosystems and subsistence resources. (NPS, Cape Krusenstern National Monument DRAFT Foundation Statement, 2010)

KOVA - The purpose of Kobuk Valley National Park is to maintain the environmental integrity of boreal forest, montane, and riverine ecosystems. The park protects and interprets diverse resources including arctic sand dunes, archeological sites, and subsistence resources. (NPS, Kobuk Valley National Park DRAFT Foundation Statement, 2010)

NOAT - The purpose of Noatak National Preserve is to protect an intact 6.7-million-acre, mountain-ringed river basin ecosystem for outstanding scientific research and wilderness opportunities within an arctic-subarctic environment. (NPS, Noatak National Preserve Foundation Statement, 2009)

Alaska National Interest Lands Conservation Act (ANILCA) - Often called the most significant land conservation measure in the history of our nation, the statute protected over 100 million acres of federal lands in Alaska, doubling the size of the nations National Park and refuge system and tripling the amount of land designated as wilderness. With this acquisition also came a responsibility of preservation of various Alaskan ways of life, traditional use, natural processes, wildlife habitat, and unique natural character of vast undeveloped expanses. ANILCA

In 1980 the passage of the Alaska National Interest Lands Conservation Act (ANILCA), added these four Park Units to the NPS system in Alaska. Among the purposes for the establishment of the collective four Park units include:

- "To preserve unrivaled scenic and geological values associated with natural landscapes;
- To provide for the maintenance of sound populations of, and habitat for, wildlife species of inestimable value to the citizens of Alaska and the Nation, including those species dependent on vast relatively undeveloped areas;
- To preserve in their natural state extensive unaltered arctic tundra, boreal forest and coastal rainforest ecosystems;
- To protect the resources related to subsistence needs;
- To protect and preserve historic and archeological sites, rivers, and lands, and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing , fishing, and sport hunting within larges arctic and subarctic wildlands and on free flowing rivers;

- "To protect and interpret examples of arctic plant communities, volcanic lava flows, ash explosions, coastal formations, and other geologic processes;." (ANILCA, Section 202(2), BELA).
- "to protect habitat for and populations of, birds, and other wildlife, and fish resources;" (ANILCA, Section 202(3), CAKR).
- "To maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon, and other rivers, the boreal forest, and the Great Kobuk Sand Dunes, in an undeveloped state;" (ANILCA, Section 202(6), KOVA).
- "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;" (ANILCA, Section 202(1), NOAT).

This plan was created by the combined efforts or consultation of the following:

- NPS Alaska Region, Western Area Fire Management Program
- NPS Alaska Region, Western Arctic Parklands
- NPS Alaska Region Fire Management Program
- By reference all cooperating members of the Alaska Wildland Fire Coordinating Group.
- See Environment Assessment (2004) for additional NEPA compliance consultation (Appendix D.3.a).

During the planning process fire management related issues identified were:

1. Fire management operations in Wilderness.
2. The negative effect aerial fire retardant would have on the fisheries resources.
3. Landownership patterns within and adjacent to the NPS Unit Boundaries and impacts to maintaining "Natural Condition".
4. Protecting critical archeological resources that could be impacted by wildfire.
5. Minimizing potential impacts of fire operations activities with subsistence activities.

2.3 Partnerships

The National Park Service, Alaska Region, is a participant in all of the Interagency planning efforts that take place with regard to the management of wildland fire in Alaska. The AWFCG, the AIWFMP, Master Agreement and the interagency MAC group are all products of a cohesive interagency working group of which the NPS is cooperator. The effect of such interagency organizations is a professional, efficient and responsible way to manage fire over large landscapes.

3.0 PARK-WIDE & FIRE MANAGEMENT UNIT CHARCTERISTICS

3.1 Park-wide Fire Management Considerations

Under the AIWFMP, the NPS, other land management agencies, and private landowners are given the opportunity to evaluate their lands based on values to be protected and resource management objectives. Once fire protection needs are determined, the lands or properties are placed in Critical, Full, Modified, or Limited management option units. The fire management strategies selected vary from initial attack and sustained suppression efforts in the Critical and Full management areas to Surveillance in the limited management areas. Annual revalidation of these selections is required by the AIWFMP to ensure selected strategies remain consistent with changing values at risk and land management objectives.

Site designations were added as a management tool to the 2010 AIWFMP. Site designation provides the land manager the opportunity to acknowledge significance of a particular point within the landscape scale management option designation. Critical, Full, Avoid, and Non-sensitive were the categories created for assignment to these particular sites. Critical and full sites are afforded the same protection priority of their landscape scale counterparts. Avoid designation applies to sites where fire suppression activities should be avoided. At these sites the effects of suppression actions may likely be more detrimental than the effects of the naturally occurring fire. Non-sensitive sites are those acknowledged by the NPS; yet no protection, action, or consideration is warranted for the site.

In Alaska, primary responsibility for wildland fire protection is divided between the Alaska Department of Natural Resources (DNR), the US Forest Service (USFS), and the Bureau of Land Management Alaska Fire Service (BLM-AFS). The BLM-AFS carries the primary responsibility for suppression actions on lands within Western Arctic National Parklands. Part 620 Departmental Manual 2.4 states "BLM will maintain and operate the Department of the Interior wildland fire suppression organization in Alaska with the primary intention of providing cost-effective suppression services and minimize unnecessary duplication of suppression systems for Department of Interior agencies." …"BLM is authorized to provide safe, cost-effective emergency wildland fire suppression services in support of land, natural and cultural resource management plans on Department of Interior administered land…". Although BLM-AFS has primary responsibility for suppression, 620 Departmental Manual 2.4 states that "nothing herein relieves agency administrators in the Interior bureaus of the management responsibility and accountability of activities occurring on their respective lands." Section 2.4 goes on to state that "each bureau will continue to use its delegated authority for applications of wildland fire management activities such as planning, education, and prevention, use of prescribed fire, establishing emergency suppression strategies, and setting emergency suppression priorities for the wildland fire protection organization on respective bureau lands." Further information of the responsibilities of the Protection and Jurisdiction agencies is located in the Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and Departmental Manual 620, Chapter 2.

The NPS, as well as the US Fish and Wildlife Service (USFWS), the Bureau of Indian Affairs (BIA), and Alaska Native Regional Corporations and villages participate in wildland fire management training and provide suppression resources during periods of increased fire activity in WEAR, Alaska and the contiguous United States. Although the use of NPS personnel for initial attack and structure protection is not common, qualified NPS personnel may provide initial attack if they are the closest resources or if no other initial attack resources are available.

The utilization and implementation of the AIWFMP management options in WEAR provides the most efficient use of resources throughout the state. Areas of critical concern are prioritized to receive resources first while simultaneously allowing fire to fulfill its natural role in large undeveloped regions. By using this management strategy the NPS succeeds at its dual mission to protect life, property and valuable resources while simultaneously allowing natural ecological process to complete their natural cycles.

Fire Management Units – Common Elements

In accordance with DO-18, the Parklands have been sub-divided into four Fire Management Units (FMUs), each indexed to an appropriate AIWFMP category. It should be noted that the areas contained within individual Fire Management Units at WEAR are not contiguous (e.g.,

In Bering Land Bridge, the modified protection FMU includes acreage in both the far west, central and southeast sections of the preserve). Maps 2a and 2b in Appendix S.2 shows the general location of the Parkland's FMU boundaries within the park as well as the AIWFMP protection categories for adjacent lands.

FMU Common Management Constraints and Guidance

Management Constraints

The majority of Western Arctic Parklands is designated or eligible wilderness and sensitive resources that could be adversely affected by fire suppression activities exist throughout the Park Units. Only the Agency Administrator or delegated official can approve deviation from the restrictions described below.

- Firefighter and public safety will be the number one concern in all fire management activities.

- Heavy equipment (including bulldozers) will not be used without the approval of the Superintendent (or delegate), except in life-threatening situations.

- Retardant will not be used without the approval of the Superintendent (or delegate), except when fire imminently threatens human life. Any use of retardant will comply with standards identified in the Interagency Standard for Fire and Fire Aviation Operations (published annually). The use of water rather than retardant if preferable except under the most extreme circumstances. If used, retardant will not be applied within a 1 mile radius of waterways Waterways are defined in the Interagency Redbook as "Any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life." As is specified in the 2010 AIWFMP, retardant use in Park/Preserve will only be used upon authorization of Agency Administrator or designee.

- Base Camps – Prior to the set-up of any remote extended fire camp in the Park/Preserve, fire managers will make every attempt to notify Cultural and Natural resource staff. Fire staff will actively work with Cultural and Natural Resource staff to select an appropriate camp location. – This consultation will ensure campsite locations are chosen in order to minimize impacts to resources at risk. Section 7 consultation with USFWS will be conducted as necessary. The establishment of extended fire camps is essential and immediate responses to an emergency and/or immediate threat to life or property by wildland fire is necessary.

    - Base camps will be located at least 500 feet away from known archaeological sites as identified as "Cultural" site within the Known Site database. Once base camps are identified the protection agency will notify the jurisdictional agency of camp locations for consultation with Natural and Cultural Resources.
    - Provide camp location guidance to the Protection agency personnel to distribute to fireline personnel. Requires the development of fire base camp guidance to be easily and effectively delivered to fireline personnel.
    - Where possible, considerations for potential camp locations should include beachs, river bars or other disturbed grounds.

- Prior to demobilization, IC to identify any rehab needs to protection agency and protection agency notify the jurisdictional agency.
- In the polar bear Critical Habitat Barrier Island – No Disturbance Zone the establishment of fire base camps will be minimized. Should it be necessary to locate a fire base camp in the No Disturbance zone, due to safety concerns, Section 7 consultation with USFWS will be initiated, as appropriate (BELA and CAKR Only).

- Western Arctic Parklands employees involved in fire management activities will make every effort to understand wilderness policy, identify sensitive over flight areas, and coordinate with the Agency Administrator, Chief of Operations or delegate prior to flying when fire incidents take place in WEAR.

- The WEAR fire staff will make every reasonable effort to communicate to the public and NPS employees ongoing fire management efforts, fire situation, and socio-political and economic impacts of any fire management activities conducted within this FMU

Special Concerns

- Western Area fire staff involved in fire management activities in WEAR will make every effort to understand current sensitive issues in each of the four management areas. This includes but is not limited to; current political issues, subsistence seasons/areas; critical migration paths/timing, reindeer grazing allotment susceptibility, wilderness policy, private land issues and susceptible cultural resources. Park managers will reciprocate by providing timely and accurate information that will aid fire managers in determining appropriate responses to current fire situations without jeopardizing valuable park resources and park/community relations.

- The use of motorized equipment or mechanized transport that is generally prohibited by the Wilderness Act (helicopter landings, use of chainsaws, use of bulldozers, etc.) will not be permitted on lands that are designated as Wilderness or eligible for Wilderness prior to the preparation of a Minimum Requirement/Minimum Tool Analysis. Actions taken to suppress wildfires will use the minimum requirement concept, and will be conducted in such a way as to protect natural and cultural resources and to minimize the lasting impacts of the suppression actions.

Safety Considerations

Fire management unit boundaries have no effect on safety considerations in Western Arctic Parklands and therefore will be discussed in Section 4.1 of this Plan.

Operational Information

Specific operational information can be obtained from the Alaska Statewide Annual Operating Plan, which is located in Exhibit C of the Master Cooperative Wildland Fire Management and Stafford Act Response Agreement. The Annual Operating Plan (AOP) will be updated annually to reflect changes in organizational structure, policy, and legal mandates as it relates to all interagency cooperators. The AIWFMP 2010 is the reigning response plan for all lands in Alaska regardless of ownership. FMU options are

delineated and topics of intent, priority, objectives, operational guidance and general fire occurrence are defined and discussed.

Non-Federal Land Ownership

Certain lands within Western Arctic National Parklands were available for selection under the Alaska Native Claims Settlement Act (ANCSA 1981). Regional and village corporations were established and allowed to select large tracts of lands. Individuals eligible under ANCSA were allowed to select small tract allotments. The majority of the corporate lands and small-tract allotments that were selected within the boundaries of WEAR have been conveyed, providing fee title to the selecting entities. Conveyed and selected lands in Kobuk Valley National Park and Noatak National Preserve are concentrated along the river corridors. The majority of conveyed lands exist along the coastline and other large bodies of water in Bering Land Bridge and Cape Krusenstern. There are additional areas in Bering Land Bridge and Cape Krusenstern that are selected and scheduled to be conveyed by KIC and NANA. Other non-federal holdings within WEAR include small mining claims, state-owned submerged lands and tidelands, and small private tracts. Land status and ownership continually changes. The Western Area fire management and park staff relies upon the NPS GIS system for updated ownership information during fire management incidents.

Ownership of Adjacent Lands

The Alaska Fire Service – Bureau of Land Management Fire Management Program is responsible for the primary suppression response on the lands adjacent to WEAR. Lands adjacent to WEAR fall under the following categories of ownership:

- Bureau of Land Management
- State of Alaska (owned and selected lands)
- Gates of the Arctic National Park (NPS)
- Arctic Slope Regional Corporation
- N.A.N.A. Regional Corporation
- Bering Straight Regional Corporation
- Other Native-owned land
- Other Native-selected land

Historic Fire, Weather, Fire Season, Fuels and Fire Behavior

1. Historic Role of Fire in WEAR

Fires are infrequent occurrences in the coastal management units of WEAR. Although according to fire history records, during severe drought and active fire years; fires have burned in and around both Bering Land Bridge and Cape Krusenstern. However, the two more continental units (Noatak, Kobuk Valley) see more significant fire activity most years. Major portions of the Noatak and Kobuk Valley lie within the northernmost belt of interior Alaska, where fire has played a critical role in ecosystem sustainability.

Figure 4, below, shows the fire history of each WEAR unit for the years that data exists. As is evident, fire is a relatively infrequent occurrence in Cape Krusenstern, and Bering Land Bridge, with most years seeing no wildland fires at all. However, as years like 1977

indicate, fire is a significant ecological process and albeit infrequently, has the potential to impact large areas.

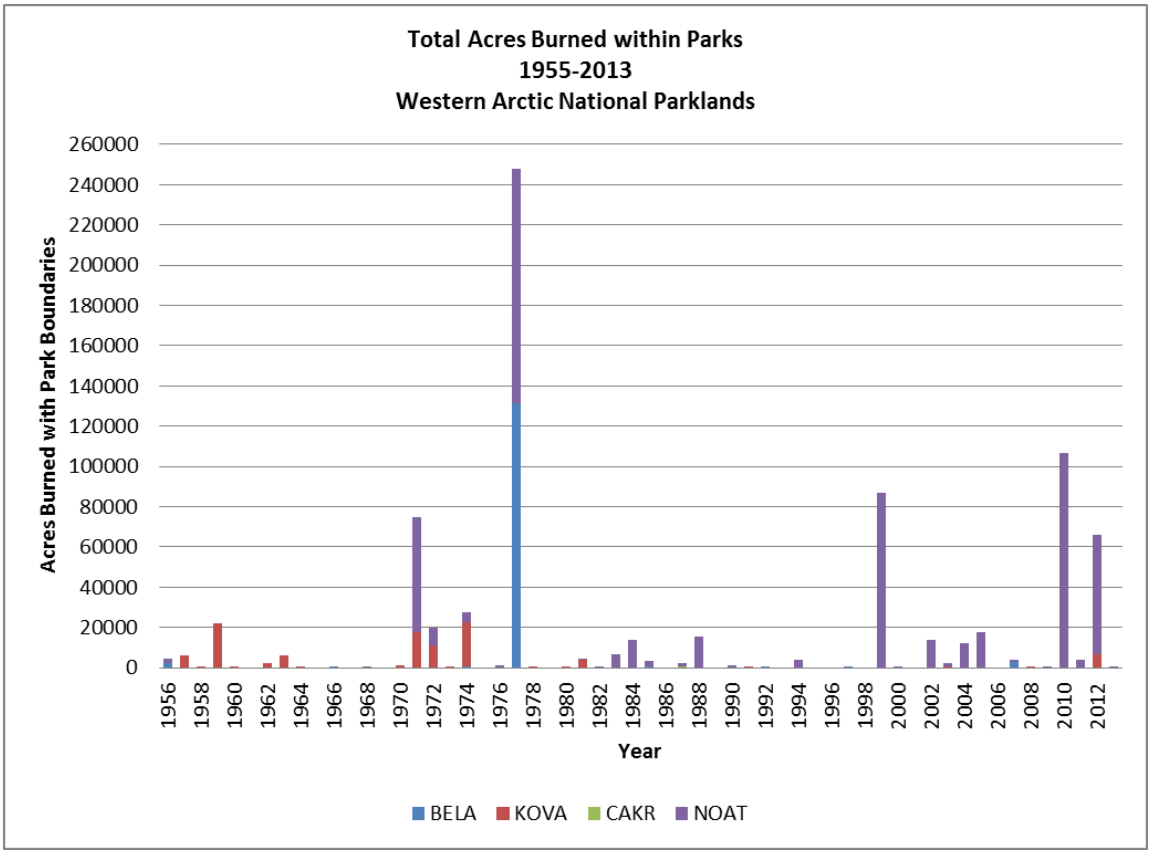


Figure 5: Acres Burned on NPS Lands in Western Arctic National Parklands Based on WFMI Fire Records From 2013.

2. Weather Analysis

Two major climate zones can be found within the Western Arctic Parklands. The Noatak National Preserve and the Kobuk Valley National Park lie within the continental climate while the Bering Land Bridge and Cape Krusenstern exist within the coastal climate zone.

The continental areas experience long cold winters and short warm summers. Winter temperatures reach –60F or lower and can endure for long periods of time, while summer months bring temperatures that are usually mild but have reached as high as 90 F. Freezing temperatures have been recorded every month of the year in these areas. Sunlight in the northern portion of Noatak reaches 24 hours/day in June and July and just slightly less in the southern half and the Kobuk Valley, thus providing no variation in burning conditions between day and night during the peak of fire season. Annual precipitation in these eastern more continental units averages approximately 20 inches, 50% of which is from snow pack. Thunderstorms provide the majority of the other half of the precipitation during the months of June and July. Due to the comparatively complex geography of the western Brooks Range and Warring Mountains prevailing winds are driven by topography in these interior management units.

The coastal climate areas in WEAR experience quite different weather than that of their eastern counterparts. With significant maritime influence these areas experience lower fluctuations in diurnal temperatures than are witnessed in more interior areas. Temperature, humidity and winds are largely dependent on whether the surrounding ocean waters are ice covered or ice-free. When offshore waters are frozen, the coastal climate's low temperatures range from 0 to –40F (not accounting for wind chill) and summer temperatures average in the mid 50F, with record highs reaching the mid 80s in June and July. Breakup usually occurs in late May or early June and freeze-up generally in mid to late October. Although maritime geographically, these coastal areas reflect their arctic influence, remaining relatively cool and dry compared to other coastal areas to the south. Snowfall accumulation averages between 50-60 inches annually. This snowfall however accounts for only a fraction of the 10 inches (or less) of precipitation this area receives every year. Cape Krusenstern and Bering Land Bridge both receive most of their annual moisture during the warmer and moister summer months.

The FAA, NPS, FWS, and BLM maintain Remote Automated Weather Stations (RAWS) at various sites in and around WEAR unit boundaries. The following locations have RAWS stations that may provide helpful weather information to the WEAR fire managers: Kotzebue (PAOT), Ambler (PAFM), Nome (PAOM), Selawik NWR (SWK), and Hoodoo Hill (HDO), Noatak River (NOA), Kiana (IAN), Quartz Creek (QRZ), Kavet Creek (KAV), Kelly River (KEL), Koyukuk NWR (KOY) and Haycock (HAY). Additional RAWS stations, part of the NPS ARCN I&M Program, are being installed. These new RAWS stations do not meet the NFDRS RAWS standards but will provide useful weather information aside from the NFDRS Fire Weather RAWS network. Data from all RAWS sites are available on the Internet through the Alaska Fire Service homepage (go to http://fire.ak.blm.gov/ ; next click Fire weather, then Weather Database). Information collected from the RAWS sites contributes to interagency efforts to monitor weather and generate fire weather indices. All RAWS records are archived at the Western Region Climatological Center.

3. Fire Season

The seasonal fire cycle in Northwest Alaska consists of distinct periods, or phases, of fire activity, each varying with changing weather patterns, seasonal variability, and the stage of vegetation development for the growing season.

The first phase begins in early May with the loss of snow cover and ends in mid June when green-up (the budding of trees and shrubs) begins. During the transition from 100% winter-cured fuels to green-up, human-caused fires may occur; these fires are usually relatively easy to suppress due to high relative humidity recovery at night, cool day and night temperatures, and typical close proximity to roads, airstrips, and/or navigable water. Spring fires that are not suppressed, however, often grow later in the season as fuels become drier.

The second phase is primarily lightning caused. Suppression of these fires is harder, because of their occurrence in remote areas where detection and access are more difficult and because more time typically passes between detection and initial attack. Fires occurring in the second half of June, the second period, usually do not develop the intensity of later summer fires. However, during hot, dry, and windy conditions, June wildland ignitions can result in extreme fire behavior.

The third phase begins in early July and runs through the first part of August. Fires in this phase also are primarily lightning caused. This is the period of maximum fire activity. The usual problems of accessibility and detection are compounded by increased rates of spread and higher fire intensities due to lower fuel moisture levels. Even with prompt initial attack, fires are often beyond immediate control by the time fire fighting forces arrive, and indirect attack is often the only viable suppression strategy.

The final phase occurs from early to late August, with few occasional starts into September on dry warm years. Hunters and fishermen usually cause ignitions during this period. These fires are generally easy to control, except during particularly dry autumn weather.

4. Fuel Characteristics and Fire Behavior

Fire behavior is essentially a function of fuel type, fuel loading, fuel moisture content, topography, and local weather conditions. WEAR exhibits several major fire behavior systems of vegetation that can be described as fuel types: grass/tundra, deciduous forest/shrublands, mixed forests, and conifers. A breakdown of these major fuel types follows. This breakdown facilitates a more representative depiction of fire behavior in each of the sub-types. The fuel types are described below.

a. Grass/Tundra

This fuel type consists of continuous graminoid cover. Within this fuel type low ericaceous shrubs, trees or tall shrubs may occur but do not appreciably affect fire behavior characterizes. Four subtypes, or vegetations structure types that exhibit separate fire behavior dynamics, are found in this system: matted grass, common after snowmelt in the spring; standing dead grass, common in late summer to early fall; tussock/tundra and shrub tundra. The live to dead ratio and wind speed in grasslands has a pronounced effect on fire spread.

Matted /Standing Dead Grass: Fire behavior in these two grass subtypes is relatively easy to suppress. These fuel type burns during the spring and fall. The burning period is shorter due to less solar radiation and high humidity recovery at night; a condition referred to as diurnal effect. The rate of spread can be high in this fuel type but there is limited smoldering and mop-up (post-suppression maintenance accomplished to ensure that all ground fire is extinguished) is relatively easy.

Tussock/Tundra: Fire behavior in the tussock/tundra type is substantially different than other grass models. Tussocks form an extensive layer of dead leaves at the base of the plant creating grassy knobs. The dense thatches of dead leaves that make up the tussock mound are small in diameter and loosely compacted. The fuel wets and dries very rapidly, burns quickly, and, because there is typically a substantial amount of fuel, the fires can be remarkably intense when burning under dry, windy conditions. This fuel situation presents a set of control problems unique to the fuel type, as extinguishing can be extremely difficult due to thick mats of dry mosses, lichens and other organic matter. Travel on the ground is also difficult in tussock tundra. Elevations above 3,000 feet form effective barriers to fire spread since they generally do not support enough vegetation to carry fire.

Birch/Ericaceous Shrub Tundra: Dwarf birch and ericaceous genera comprise this fuel type. These shrub species grow in mosaic like patterns with all varieties of

tundra communities. The shrub layer forms a continuous fuel bed that often burns early to mid summer with green leaves intact unlike the pure deciduous forest fuel type below. Dwarf birch particularly has an elevated resin content that leads to an increase in fire behavior intensity. Although common throughout Alaska, this fuel type is not clearly defined nor it's fire behavior well-documented in literature currently available.

b. Deciduous Forest/Shrublands

Pure Deciduous Forest: This fuel type is represented by pure stands of deciduous forest species including but not limited to aspen and/or birch with an understory of alder and/or willow,. Stages in leaf development (leafless, green-up, leaf fall) drastically effect fire behavior and fuels present in this system. Fires in this type usually occur in spring before leaf-out or in fall after leaves have fallen. During this time, leaf litter is the primary carrier of the fire and usually results in low to moderate fire intensities except under the most severe weather conditions. Fires can burn in this fuel type post green-up (leaf-on) but fire behavior is greatly reduced due to shading of fuel by the forest canopy thus increasing relative humidity, decreasing fuel temperatures and reducing surface windspeeds. Fires that do occur during the leaf-on stage carry in grasses, dry herbaceous, and various understory shrubs.

Shrublands

Alder/Willow Shrublands: This fuel type is represented by pure stands of deciduous shrub of alder and willow, but may also include deciduous forest types of balsam poplar, aspen or paper birch in early development. Stages in leaf development (leafless, green-up, leaf fall) drastically effect fire behavior and fuels present in this system. Fires in this type usually occur in spring before leaf-out or in fall after leaves have fallen. During this time, leaf litter is the primary carrier of the fire and usually results in low to moderate fire intensities except under the most severe weather conditions. Fires can burn in this fuel type post green-up (leaf-on) but fire behavior is greatly reduced due to shading of fuel by the canopy cover thus increasing relative humidity and decreasing fuel temperatures. Fires that do occur during the leaf-on stage carry in grasses, dry herbaceous, and various understory shrubs.

c. Mixed forests

Black, white spruce and/or tamarack with Aspen, willow, cottonwood, and/or birch, characterize the mixed forests fuel type. On any specific site, individual species can be present or absent from the mixture, however spruce must be present in order for the fuel to fall into this classification. Stand mixtures exhibit wide variability in age and stand structure. Two phases associated with the seasonal variation in the flammability of the hardwoods are recognized—the leafless stage occurring during the spring and fall, and the green stage during summer. Rate of spread in both fuel types is weighted according to the proportion of softwood and hardwood components (Canadian Forest Fire Behavior Prediction System). In areas where the proportion of hardwoods is greater than softwoods and when the deciduous overstory and understory are in leaf, fire spread is greatly reduced with maximum spread rates only 1/5 that of spring or fall fires under similar burning conditions. During spring and fall when the deciduous overstory and understory are leafless, the leaf litter can burn similar to the grass models because the diurnal effect shortens the burning period and there is little smoldering. In areas where the proportion of conifers is greater than hardwoods, the dryness of the organic matte will dictate the difficulty of

extinguishing fire. The rate of spread will be relatively slow in these areas unless there is a very large grass component and conditions are extremely dry.

d. Needleleaf Forest

Spruce-Lichen Woodland

This fuel type is characterized by open, white spruce. Stands occupy well-drained upland sites. Forest cover occurs as widely spaced individuals and dense clumps. Tree heights vary considerably, but bole branches that emanate from the trunk of the tree (both live and dead) uniformly extend to the forest floor and layer development is extensive. Woody surface fuel accumulation is usually very light and scattered, and shrub cover is exceedingly sparse. The ground surface is fully exposed to the sun and commonly covered by a nearly continuous mat of reindeer lichens, averaging 3-4 cm in depth.

The spruce-lichen woodland fuel type may support a high rate of spread, but may or may not support a continuous crown fire. Mop-up may be difficult if the organic mat is deep and dry. For the most part, fires occurring in this fuel type are relatively easy to control because they are primarily surface fires, which can be extinguished by firefighters on the ground.

Boreal Spruce. This fuel type is characterized by pure, moderately well stocked black spruce stands on poorly drained sites. Tree crowns occur near the ground and dead branches are typically draped with bearded lichens. The flaky nature of the bark on the lower portion of the trunk is pronounced. Low to moderate volumes of woody material is present on the ground. Labrador tea is often the major shrub component, and a carpet of feather mosses and/or ground-dwelling lichens dominates the forest floor. Sphagnum mosses may occasionally be present. A compacted organic layer commonly exceeds a depth of 20-30 cm below ground surface.

Stand replacement and crown fires (typically single and group tree torching) dominate the fire behavior of this fuel type. A crown fire may commence when the fire reaches a rate of spread of 10 chains (660 feet) per hour. Due to the low crown base height associated with this fuel type a flame height over 1 ft can initiate single and group tree torching (Scott and Reinhardt, 2001). Typically crowning occurs just behind the flaming front. Independent crown fires are rare. It is also common to have spotting by aerial firebrands in a crowning spruce fire. Wind is the crucial factor, with spotting frequently occurring between ½ to two miles ahead of the fire. The carrier fuel consists of the organic mat (primarily feathermoss and lichens at the top of the organic mat), which has a tremendous surface-to-volume ratio with immediate responses to changes in relative humidity, solar radiation, and wind. Without wind the rate of spread is relatively slow and predictable, while intensity is high in surface fuels. Mop-up will be difficult if the organic mat is dry in the lower duff layers.

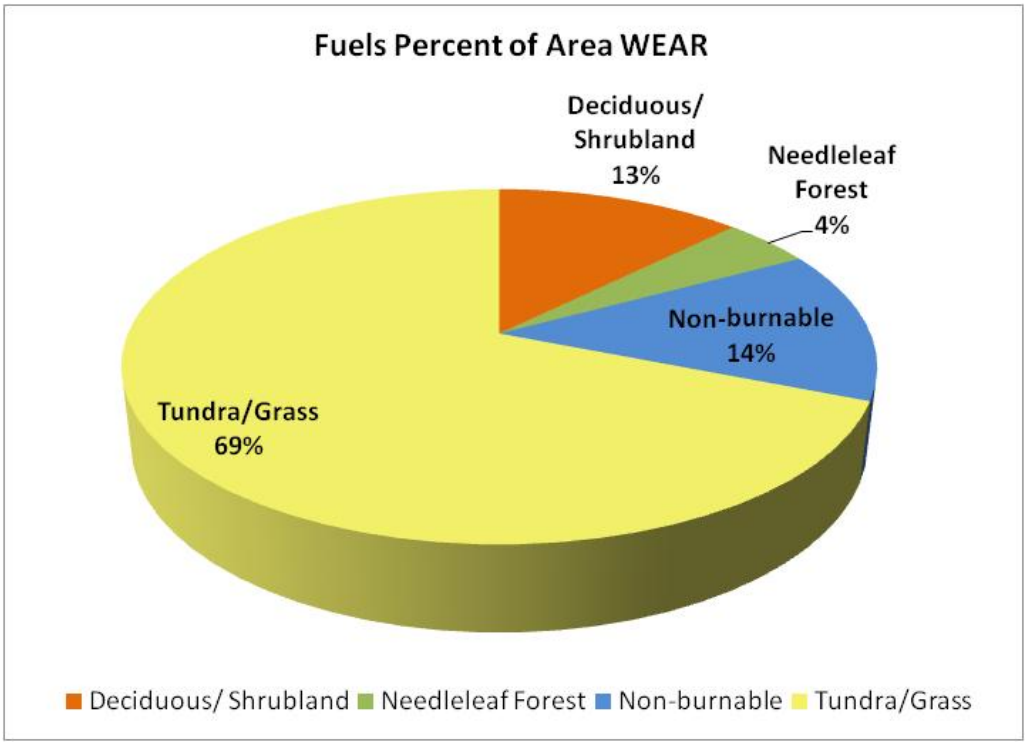


Figure 6: Generalized Landcover for WEAR.
Percent of fuel types across Western Arctic Parklands, based on the NPS ARCN 2009 Landcover map. Unburnable is defined as water, area barren of vegetation or sparse vegetation that cannot sustain continuous fire-growth. Deciduous/Shrublands include deciduous forests and willow or alder dominated shrublands. Needleleaf forest includes both pure needleleaf forests (spruce) and mixed spruce/deciduous forests.

5. Historical Alterations of Fuel Regimes

There is little information to be found regarding the historical alteration of the fuel regimes in WEAR. Although fire suppression has occurred since the establishment of the AIWFMP within WEAR, and continues on a relatively few fires, the overall effect of fire suppression appears to be negligible. The large-scale alterations to the fuel regimes in WEAR that have occurred are the result of fire, although climate change has likely changed fuel matrices in the form of increased tree/shrub and resulting encroachment on tundra. Human alterations have occurred on a relatively minute scale throughout the area.

The impact of aggressive suppression in Interior Alaska and WEAR is difficult to assess. Organized suppression has occurred in Alaska since 1939, when the Alaska Fire Control Service (predecessor to the AFS) was established. The effects of this activity are not clear, however, the reduction of total fire acreage has been unmistakable in some areas. A past study of the Tanana/Minchumina Planning Area has shown that annual burned acreage hovered around 900,000 acres between 1957 and 1981, down from the estimated 1.5 to 2.5 million acres prior to 1940. The Tanana/Minchumina Planning Area received greater fire suppression emphasis than the area encompassed by WEAR. Yet despite this reduction, large, high-intensity fires remain a frequent occurrence. Detection of interior fires remains difficult especially during periods of high fire activity and smoke concentration.

Control Problems

Control and suppression problems are dependent on fuel type, fuel loading, weather, and time of year. Alaska has four distinct periods of fire activity with different control and suppression problems associated with each.

1. Spring Green-up

Ignitions during spring green-up are usually wind-driven, surface fires that are relatively easy to control and extinguish. High winds can cause high rates of spread and control may be more difficult. These fires are mostly limited to fine fuels (i.e. grass) that are directly exposed to solar radiation, humidity, wind, and precipitation. This period is typically from early to mid June.

2. Transitional

Ignitions that occur during the transitional time are typically more difficult to control, as hand-constructed firebreaks are less effective. Water under pressure from fire pumps with hose lays and aerial support, such as a medium helicopter and bucket, may be required for effective action at the fire's head. This period is typically mid June to early July.

3. Cumulative Drought

Initial ignitions during the time of cumulative drought, as well as carryover fires from the previous period, are the most difficult types to control and extinguish, and may require indirect attack, aerial back firing, and/or the use of natural barriers. Direct attack is rarely possible because of the fire's intensity, and should only be attempted with the utmost caution. Suppression actions must be restricted to the flanks and back of the fire. Indirect attack in the form of aerial ignition, if available, may be effective depending on the fire's forward rate of spread. Fire extinguishing may be particularly difficult in the conifers and mixed forests due to the deep, dry organic matte present. This period is typically from early July to early August.

4. Diurnal Effect

This period is typically from early to late August when the days become shorter. Ignitions during this period of diurnal effect are easier to suppress because the reduced amount of daylight allows for the relative humidity to recover, resulting in increased moisture content in fuels. These fires are limited to fine fuels, such as grass, that are directly exposed to the drying effects of solar radiation. Smoldering and creeping fires from the previous periods may still be evident.

3.1.1 Fire Management Goals and Objectives

AIWFMP (State and Park-Wide Fire Management Options/Units)

Goals and objectives differ depending on the fire management option selected for each management area. Goals and Objectives in the AIWFMP are both broadly defined solely because all agencies across the State of Alaska needed to find common ground from which to operate. These goals, listed below are taken directly from the 2010 AIWFMP and provide a basis for which the protecting agency can operate.

Goals

- Emphasizing firefighter and public safety as the single, overriding priority.
- Defining criteria for prioritizing the allocation of resources in response to a wildland fire.

- Using ecologically, operationally and fiscally sound principles.
- Integrating fire management, mission objectives, land use, and natural resource goals.
- Maintaining a flexibility that allows agencies to adhere to their policies and respond to changes in objectives, fire conditions, land use patterns, resource information and technologies.
- Promoting cooperation, collaboration and partnerships for fire management between federal, state, and local governments, Alaska Native groups and other organizations

Objectives

- Protect human life.
- Prioritize areas for protection actions and allocation of available firefighting resources without compromising firefighter safety.
- Use a full range of fire management activities to achieve ecosystem sustainability including its interrelated ecological, economic, and social components. (fire suppression, monitoring, prescribed fire, thinning and other vegetation treatment projects, prevention and education programs, scientific studies, etc.)
- Use wildland fire to protect, maintain, and enhance natural and cultural resources and, as nearly as possible, enable fire to function in its ecological role and maintain the natural fire regime.
- Manage vegetation through various fuels treatment techniques to reduce and mitigate risks of damage from wildland fire.
- Balance the cost of suppression actions against the value of the resource warranting protection and consider firefighter and public safety, benefits, and resource objectives.
- Consider short and long-term cost effectiveness and efficiencies while maintaining responsiveness to jurisdictional agency objectives and within the scope of existing legal mandates, policies and regulations.
- Minimize adverse environmental impact of fire suppression activities.
- Maintain each jurisdictional agency's responsibility and authority for the selection and annual review of fire management options for the lands that they administer.
- Adhere to state and federal laws and regulations

NPS – Western Arctic National Parklands –Goals

Whenever safely possible, Western Arctic National Parklands will utilize the role of fire in the natural environment in the fulfillment of NPS natural resource management directives. Accordingly, WEAR will direct all fire management activities toward the accomplishment of the following goals

1. The protection of human life, property, and irreplaceable natural and cultural resources.
2. The preservation of fire in its natural role and as a natural process to the fullest extent possible.
3. The maintenance of dynamic natural processes occurring within the WEAR.
4. The use of selected wildfires for the accomplishment of resource management objectives and for the reduction of hazardous fuels.
5. The minimization of adverse effects of fire and/or fire suppression activities.
6. The coordination and scientific management of wildland fire based upon natural resource management program, park and NPS goals and objectives.

7. The education of employees and public about the scope and effect of wildland fire management.
8. The management of wildland fire incidents in accordance with accepted interagency standards and the achievement of maximum efficiency through interagency coordination and cooperation.
9. Ensure Natural and Cultural Resource concerns are addressed on wildfire incidents through training of appropriate WEAR personnel as Resource Advisors.
10. The presentation of timely and accurate fire situation, fire behavior and fire effects information to the WEAR Superintendent, park staff, regional fire management staff or Incident Management Team and to appropriate Alaska Fire Service personnel.
11. Support resource inventories, monitoring and research to better understand the current and potential impact of changing climate on park resources in relation to fire.

In managing and restoring the ecological benefits of fire on the landscape, managers must understand the differences between current conditions and desired conditions. Managers must also understand the practices and environmental factors that contributed to the current conditions. Information used to develop the desired conditions includes research data (where available), historic photos and written documents, and expert opinion. Desired conditions must be periodically evaluated to determine whether they are still realistic and wanted in light of a changing environment. For example, desired conditions may be based on our knowledge of past long-term climate conditions; however, future climate changes may preclude achieving these targets.

It is important to recognize that further work is needed at WEAR to better understand the interrelationships within natural systems. As this occurs, we may be able to refine these desired conditions – as part of adaptive management. This could be accomplished at the landscape or vegetation community scale and could be useful in developing ecological models and refining ecosystem priorities. Currently no Desired Conditions are developed for Western Arctic National Parklands. The following Interim Fire Management Desired Conditions are proposed by the Fire Program and will be evaluated and updated, as appropriate, in the Resource Stewardship Strategy planning process scheduled for 2014/2015 and the development of interdisciplinary Desired Condition Western Arctic National Parkland wide:

Interim Fire Management Desired Conditions

1. Vegetation will be managed according to enabling legislation, mandates and guiding documents for ecological integrity and natural processes, including wildfire.
    a. The number of acres burned per year per Park Unit are within the range of natural variability (1984-2010)
    b. The number of natural fire starts per year per Park Unit are within the range of natural variability (1956-2010)
    c. Total duration (days) of fire incidents annually per Park Unit are within the range of natural variability (1984-2010). The count of days from the first fire discovered to the final fire declared out date.
    d. Percent of wildfire burn severity, by severity class, remain within the natural range of variability (1983 to Current) (if burn severity remote sensed data is available).
2. In Bering Land Bridge National Preserve, within Reindeer herding areas, as established on January 1 1976, manage wildfire in accordance to ecological integrity while maintaining sound range management practices.

3.1.2 Wildland Fire Management Actions

Following March 31, 2010 the new guidance for the Implementation of Federal Wildland Fire Policy is in effect for future fire seasons. Decision support processes and analysis that help determine and document decisions regarding the management of individual ignitions will follow national direction. The policy for the National Park Service is to use the Wildland Fire Decision Support System (WFDSS) and analysis tools such as FARSITE, FlamMap, and FSPro.

Further regional guidance is located in the 2010 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2010 Alaska Statewide Annual Operating Plan.

The fire management program at Western Arctic National Parklands complies with the policies resulting from the Federal Wildland Fire Management Policy Review of 1995, as well as those established by the Alaska Interagency Wildland Fire Management Plan. All human-caused fires will be suppressed using the appropriate operational suppression response delineated in the AIWFMP.

Allowing for use of varied management applications regarding wildland fire and it's associated fuels will provide managers with every opportunity to obtain desirable results post treatment. Regarding unplanned ignitions, the Use of Wildland Fire will be both emphasized and utilized heavily in the Western Arctic Parklands particularly in the Limited Fire Management Option lands as directed in the GMP and DO 41. Use of Wildland Fire will also be considered in the other management options on a case by case basis at the discretion of the Agency Administrator. (See the Alaska Statewide Annual Operating Plan for updated direction)

Planned fuel treatment projects will take a less significant role by utilizing both mechanical and prescribed fire, often in tandem to protect valuable park resources. These tools can be implemented to provide increased protection to park resources regardless of the fire management option selection surrounding the resource. Additional prescribed fires may be utilized in the context of the objects as set for within there respect General Management Plans. Suppression actions will be used as a tool predominantly where Critical and Full management options prevail as directed and agreed upon in the 2010 AIWFMP and where appropriate to protect sensitive resources in the Limited management option.

No matter the tools selected to manage wildland fire and protect park resources, continual evaluation will be implemented to ensure fire and resource management goals and objectives are being met and wilderness values upheld. Monitoring and research findings will be reviewed and incorporated into future management decisions as outlined in Section 5.0 Adaptive Management Strategy as well as RM 18-Chapter 7-Fuels Management.

Fire Management Units

According to the AIWFMP, each FMU has specific, predetermined management strategies (or combinations thereof) that consist of the various management options described below (Table 3). For example, wildfire with resource benefit objectives will be the pre-planned response for ignitions detected within the WEAR Limited Protection FMU and in the Modified Protection FMU after the conversion date. These management strategies are summarized by FMU in Table 4.

Table 3: DO-18 Fire Management Strategies

Management Option	Intent	Policy
Prescribed Fire Prescribed Fire Plan → management-implemented ignition ***Wildfire (Use of Wildland Fire)*** Natural ignition → managed based on resource management objectives	• Ecosystem sustainability • Achieve Resource Management goals and objectives • Long-term protection of life, property, and/or fire sensitive resources. • Restoration of historic conditions. • Cost effectiveness.	• May only be implemented within FMUs designated for such use. • Context and circumstances of the fire dictate the appropriate response, based on the approved FMP. • Management strategy or prescribed fire plan should be based on resource management objectives.
Wildfire(Suppression) **Any ignition where there are no alternative appropriate responses→ suppression response**	• Immediate protection of life, property, and/or fire-sensitive resources. • Cost effectiveness.	• Suppression actions triggered automatically in certain FMUs. • Agency Administrator may select suppression actions in any FMU. • Context and circumstances of the fire dictate the appropriate response, based on the approved FMP • Suppression actions should comply with resource management objectives whenever possible. • Minimum Impact Suppression Tactics (MIST) will be used

Table 4: AIWFMP Management Options

PROTECTION CATEGORY	POLICY/RESPONSE	INTENT
CRITICAL	• Aggressive suppression of fires within or threatening designated areas. • Highest priority for available resources.	• Prioritization of suppression actions for wildland fires threatening human life, inhabited property, and/or other designated structures. • Complete protection of designated sites
FULL	• Aggressive suppression of fires within or threatening designated areas, depending upon availability of resources.	• Protection of uninhabited cultural and historical sites, private property, and high-value natural resources.
MODIFIED	• Fires in designated areas receive initial attack depending on availability of resources, unless land manager chooses otherwise and documents with WFDSS. • After designated **conversion date**, operational response to Modified protection zones is identical to that of Limited zones.	• Greater flexibility in selection of suppression strategies when chance of spread is high (e.g., indirect attack). • Reduced commitment of resources when risk is low. • Balancing of acres burned with suppression costs and with accomplishment of resource management objectives.
LIMITED	• Wildfires allowed to burn within predetermined areas. • Continued protection of human life and site-specific values. • Surveillance/Monitor.	• Reduction of long-term costs and risks through reduced frequency of large fires. • Reduction of immediate suppression costs. • Facilitation of bio-diversity and ecological health

Determination of WEAR Fire Management Units and their respective management strategies is based on the proximity of values at risk, the role of fire within the WEAR vegetative communities, and overall management objectives, as specified in DO-18. Variables such as fuel type, loading, and moisture level will be considered in the decision-making process for specific incidents, as well as in the writing of individual prescribed fire plans. Table 5 below summarizes the WEAR FMUs and rationale for FMU determination.

A statewide Multi-Agency Coordination (MAC) group will be convened when the Alaska Preparedness Level reaches Level 4 to establish priorities for suppression resource allocation and to determine if the need exists for a temporary change in the selected fire management option identified in the AIWFMP for a specific geographic area(s). Such temporary changes may be implemented during periods of unusual fire conditions (e.g., numerous or unusually large fires, predicted drying trends, problematic smoke dispersal, shortages of suppression resources, etc.). The duration and geographical extent of any such changes will be determined by the MAC group and will be reflected in WEAR FMU boundaries, which will be managed accordingly. The regional FMO represents the NPS on the MAC group.

Table 5: Integration of AIWFMP and DO-18 Policy at WEAR

WEAR Fire Management Units (Derived from AIWFMP Protection Categories)	**POSSIBLE RATIONALES for FMU Determination** *Approved Strategic Direction*	**APPLICABLE Management Strategies**
Critical	• Presence of permanent residences and valuable cultural resources, including National Historical Landmarks. *Protect human life and high-value resources by making this designation the highest priority for firefighting resource allocation.*	• Suppression Objectives • Prescribed Fire Use • Mechanical
Full	• Presence of private structures and of structures included on the National Register of Historical Places. • Proximity to Critical FMU. *Minimize damage to resources without compromising human safety. Contain fires with initial action forces. Manage fire for multiple objectives.*	• Suppression and/or Resource Benefit Objectives • Prescribed Fire Use • Mechanical
Modified	• Proximity to Critical and Full FMUs. • Presence of fire-dependent ecosystems. • Appropriate balance of cost and control. *Maintain flexibility to respond to fire conditions and tailor the initial action to those conditions. Allows for accomplishment of NPS objectives under suitable conditions while providing protection to identified sites.*	• Suppression and/or Resource Benefit Objectives • Prescribed Fire Use • Mechanical
Limited	• Presence of fire-dependent ecosystems. • Relative lack of significant fire-sensitive resources. *Allow fire to fulfill its natural ecological role. Environmental impacts from fire suppression activities may exceed damages incurred from fire effects or suppression costs may exceed value of resources to be protected.*	• Suppression and/or Resource Benefit Objectives • Prescribed Fire Use • Mechanical

Note: *Western Arctic Parklands to use fire for the benefit of the resource whenever possible. Under the new National Fire Policy direction, increased opportunities for the Use of Wildland Fire for resource benefit may become more available in Western Arctic Parklands. The Western Area FMO and Agency Administrator will assess every opportunity for managing fire for the benefit of the resources within the Park Units.*

3.2 Fire Management Unit Specific Characteristics

Determination of Fire Management Units within Western Arctic Parklands is a result of interagency agreements based on NPS management directives outlined in the GMP, RMP, foundation statement and NPS RM 18. These land management option selections are also in agreement with the broader AIWFMP. Predetermined responses are clearly defined by the AIWFMP and understood by all participating agencies within Alaska.

NPS selections were based upon laws, enabling legislation, mandates, and policies applicable to fire management within the NPS. Values and resources to be protected, fire behavior and ecology, and human use patterns were critical components to the selection process. If adjacent land manager/owners selected different options for their lands, attempts were made to negotiate an agreement on the selected option or determine reasonable boundaries if options differed. Every effort was made not to use administrative boundaries but to select option area boundaries that were identifiable from the air and were feasible considering operational and fire behavior concerns. (AIWFMP, 2010). These selections are revisited annually and updated when changes to land management objectives or values at risk dictate the necessity. Due to the aforementioned selective factors, 83% of the 11.6 million acres lands managed by WEAR fall in the Limited Fire Management Option (default wildfire with resource benefit objectives on NPS lands) [9,726,598 acres]. The balance of management option acreage is delineated 4% Full [523,545 acres] and 12% Modified [1,404,830 acres] 0% is identified as Critical. Most classified Full and Modified Options areas within NPS unit boundaries are the result of inholdings and other land owners' selections.

FMU Description

Due to the vast acreage covered by this fire management plan coupled with the geographically large and politically complex boundaries that define each management option, detailed written descriptions of each fire management option are not included. Instead a general description of where the fire management option occurs within the unit boundary will follow accompanied by a detailed map (see Appendix S.2: Maps 2a & 2b).

CRITICAL

Intent: In accordance with the AIWFMP, the highest priority for the aggressive suppression of ignitions occurs within Critical Protection zones and/or sites. To give the highest priority to suppression action on wildland fires that threaten human life, inhabited property, designated physical developments and to structural resources designated as National Historic Landmarks.

Goals:

1. Protect human life.
2. Prioritize areas for protection actions and allocation of available firefighting resources without compromising firefighter safety.
3. Protect area from wildland fire.
4. Provide for protection actions on fires that threaten human life, qualifying properties, or high-value resources with available firefighting resources and without compromising firefighter safety.

Prescribed fire and/or mechanical fuel reduction is appropriate in critical protection FMUs based upon land manager/owner's land and fire management objectives.

Physical Description: There are currently no areas within any of the four management units of the Western Arctic National Parklands that fall within the critical fire Management option. Future WEAR fire management reviews have the flexibility to grant critical protection status to any area within their jurisdiction that falls within the Critical protection criteria.

FULL

Intent: The primary objective in the Full Protection FMU is to protect valued resources (cultural and historical sites, private property, natural resource high-value areas) by minimizing the presence of uncontrolled fire. An appropriate suppression response will be implemented whenever possible to ignitions within this FMU. The Use of Wildland Fire may occur within this FMU if circumstances preclude initial attack within 24 hours of discovery or suppression response is not feasible. The Use of Wildland Fire may be implemented with Agency Administrator's approval with consultation from the Western Area FMO and Galena Zone FMO. The decision to manage wildfire with resource benefit objectives will be documented through the Wildland Fire Decision Support System strategic planning process. In all cases, fire management strategies for incidents within the Full Protection FMU and/or sites will be aimed primarily at the protection of structures and other valued resources. Mitigation of immediate threats will take precedence, but implementation of alternative strategies aimed at long-term fuels management and/or other management goals will also be allowed when deemed appropriate by the Agency Administrator.

Goals:

1. Prioritize areas for protection actions and allocation of available firefighting resources without compromising firefighter safety.
2. Minimize damage to the identified sites and areas from wildland fire.
3. Control all wildland fires at the smallest acreage reasonably possible with initial action forces.

Prescribed fire may also be implemented in this FMU, with the Superintendent's approval of a formal prescribed fire plan, for the purpose of preserving and/or restoring fire in its natural role, reducing hazardous fuel accumulations, or restoring historic conditions. Mechanical fuel reduction is appropriate based on land manager/owner's land and fire management objectives.

Physical Description:

1) BELA contains 216,748 acres of full protection land. This land is concentrated in the northwest corner of the Preserve around the Shishmaref Inlet (see map 2a: Appendix S.2).
2) CAKR possesses full protection areas of land in its southeast most corner and a small area along its eastern boundary. The full protection landmass covers 63,034 acres (see Map 2b: Appendix S.2).
3) KOVA contains no designated zone for full land protection status (see Map 2b: Appendix S.2).
4) NOAT has 244,651 acres of full protection designated along the western boundary of the Preserve near Noatak Village (see Map 2b: Appendix S.2).

Management Constraints:

- Establishment of helispots and helibases will be minimized.
- Minimize establishment of remote fuel caches, attempt to use pre-existing fuel caches.

LIMITED

Intent: To recognize areas where the exclusion of fire may be detrimental to the fire dependent ecosystem, the environmental impacts of fire suppression activities may have more negative impacts on the resources than the effects of the fire, or the cost of suppression may exceed the value of the resources to be protected. Due to the near absence of values at risk within this unit, most ignitions occurring within the Limited Protection FMU will be managed for the purpose of preserving fire in its natural role within the ecosystem and accomplishing fire and land management objectives. The Use of Wildland Fire is the default management action for wildfires in the Limited Protection FMU. The decision to manage wildfire with resource benefit objectives will be documented through the Wildland Fire Decision Support System strategic planning process.

Goals:

1. Use wildland fire to protect, maintain, and enhance natural and cultural resources and, as nearly as possible, enable fire to function in its ecological role and maintain the natural fire regime.
2. Weigh the costs and associated environmental impacts of the suppression actions against the values to be protected and consider firefighter and public safety, benefits and resource objectives.
3. Realize short and long term cost effectiveness and efficiencies.
4. Minimize the adverse effects of fire suppression efforts

Prescribed fire may also be implemented in this FMU, with the Superintendent's approval of a formal prescribed fire plan, for the purpose of preserving and/or restoring fire in its natural role, reducing hazardous fuel accumulations, or restoring historic conditions. Mechanical fuel reduction is appropriate based upon land manager/owner's land and fire management objectives.

Physical Description:
The Limited Protection FMU (approximately 9,725,208acres) includes all WEAR holdings (lands under NPS management) not contained within the Critical, Full or Modified FMUs.

Management Constraints:

- Establishment of helispots and helibases will be minimized.
- Minimize establishment of remote fuel caches, attempt to use pre-existing fuel caches.

MODIFIED

Intent: Provides an adaptable option management level between Full and Limited that allows the NPS to consider environmental conditions into their decision making process. The primary objective in the Modified Protection FMU is to achieve an appropriate balance between protection of life and property and cost effectiveness through the implementation of alternative suppression strategies. AFS will provide operational

control of initial attack for ignitions detected within the Modified Protection FMU, if adequate fire fighting resources are available and conversion has not occurred. However, minimizing acreage burned is less of a priority in Modified FMUs than it is in Critical or Full FMUs. Accordingly, Incident Managers will consider a wide range of suppression strategies within the Modified FMU, including containment by natural barrier or indirect use of retardant or handline. The Use of Wildland Fire is allowed within this FMU if circumstances preclude initial attack within 24 hours of discovery or suppression response is not feasible. The Use of Wildland Fire may be implemented with Agency Administrator's approval with consultation from the Western Area FMO and Galena Zone FMO. The decision to manage wildfire with resource benefit objectives will be documented through the Wildland Fire Decision Support System strategic planning process. Once the Modified Protection FMU has converted, management objectives are identical to those established for the Limited Protection FMU and the Use of Wildland Fire becomes the default management action.

Goals:

1. Use a range of fire management responses:
   Before the conversion date: Contain fires with initial action forces.
   After the conversion date: Use wildland fire to protect, maintain, and enhance natural and cultural resources and, as nearly as possible, allow fire to function in its ecological role and maintain the natural fire regime.
2. Weigh costs and associated environmental impacts of the suppression actions against the values to be protected.
3. Realize short and long-term cost effectiveness and efficiencies.
4. Moderate the adverse effects of fire suppression efforts.

Prescribed fire may be implemented in this FMU for the purpose of reducing hazardous fuel accumulations or restoring historical conditions, with the Superintendent's approval of a formal prescribed fire plan. Mechanical fuel reduction is appropriate based upon land manager/owner's land and fire management objectives.

Physical Description:

1) BELA contains three separate modified fire management option zones within the boundary of the preserve. These three units comprise all 804,464 acres of modified within the NPS jurisdiction and are located in the southeast, central and western most tip of the unit (see Map 2a: Appendix S.2).
2) CAKR contains no modified fire management zones within its boundaries.
3) KOVA encompasses 543,739 acres of modified fire management option status land. This land in concentrated along the Kobuk River subsistence corridor in the southern half of the park (see Map 2b: Appendix S.2).
4) NOAT contains a portion of modified in the southwest portion of the preserve (see Map 2b: Appendix S.2).

Management Constraints:

- Establishment of helispots and helibases will be minimized.
- Minimize establishment of remote fuel caches, attempt to use pre-existing fuel caches.

Fire Management Site Designations

AIWFMP

Critical, Full, Avoid and **Non-sensitive** site designations have been established to identify the appropriate actions to be taken within the landscape-scale management option areas. These site designations give protection agencies specific guidance for structures, cultural and paleontological sites, small areas of high resource value and threatened and endangered species nesting areas.

- ***Critical*** sites are to be protected from fire and receive the same priority as Critical Management Option areas.
- ***Full*** sites are to be protected from fire and receive the same priority as Full Management Option areas.
- ***Avoid*** sites are areas where fire suppression activities should be avoided and effects from suppression efforts minimized. Aircraft should be restricted from these areas.
- ***Non-sensitive*** sites have been located and identified by the jurisdictional agency and do not require any type of protection, suppression actions, or considerations (*see additional guidance below*)

When a structure is located during fire management activities and no designation has been recorded, the jurisdictional agency will be notified immediately and they will determine actions to be taken. (2010 AIWFMP)

NPS

Because the protection of every known site within WEAR unit boundaries is not feasible, criteria have been established to provide cultural resource specialists and park management with a consistent methodology for determining which key sites will be afforded special protections from wildland fire. Additional to the AIWFMP site designation criteria, cultural resource managers for Western Arctic Parklands have defined criteria for each of the categories and added a fifth. Non-Sensitive/Defensible Space, was added to the management strategy for site specific considerations within the Park Units. This designation provides managers with a more flexible option when considering the protection of potentially valuable resources. Within the designation, defensible space will be created either through a fuels management project ideally preceding the fire start, or during an incident before fire impacts the area, this may decrease the likelihood of damage from wildfire but firefighters will not be required to stay and perform suppression actions at the site. Fuels mitigation work will follow project standards and may be implemented by either NPS fire personnel from neighboring programs or Western Arctic Parklands maintenance personnel. These sites will receive the lowest priority for suppression resources from the protection agency.

The criteria, listed in the following sections and may be updated or improved upon should new information come to light. Please note that although this section focuses on cultural resources that are not currently occupied, the following protection categories apply to all buildings and structures located within the park boundary. It is for this reason that “year-round residence” or “trespass structures” are listed as criteria.

Archeological/Cultural/Historic Resources

If historic fire activity is any indication, one may presume that wildland fire has, at some point, affected many of the prehistoric sites within WEAR, and perhaps some of the

historic sites. Wildland fire effects on the types of materials commonly found in prehistoric sites will tend to be minor. Thus, the Fire Management Plan will have no immediate impact on the majority of archeological and non-structural historical resources within WEAR.

Known historic and prehistoric properties that have the potential to be impacted by wildland fire or wildland fire management activities, such as fire suppression activities, will be identified and assessed by qualified cultural resource personnel. Wildland fire management staff in coordination with park cultural resource staff will make every reasonable effort to protect historic properties from fire suppression activities that may adversely affect these properties. Each threatened site will be assigned a fire protection category (see below) so that the Western Area FMO will be able to identify those cultural resources that may warrant special attention in the event of a wildland fire. Each site will be assigned to one of the four fire protection categories using a variety of criteria, including National Register of Historic Places status and eligibility, WEAR management objectives, and site or structure integrity, among others. Assigning protection categories will expedite the planning of, and subsequent response to, wildland fire incidents. The cultural resource staff will continue to update the Western Area FMO on changes to integrity and condition of these resources that may change their protection status.

In addition, where wildland fire activity threatens cultural sites that have been designated Full or Critical protection status, the Western Area FMO will immediately contact the park Cultural Resource Specialist for consultation, particularly if ground disturbing activities are required for protection or fire suppression. The Western Area FMO will also contact the Cultural Resource Specialist if fire suppression activities for the protection of inholdings/allotments might affect sites on surrounding parklands.

Some sites, due to special circumstances, may not fall into an appropriate protection category. For example some sites, particularly archeological sites that are eligible for critical protection may be more susceptible to damage from fire suppression activities than from a fire burning the area. Park managers can lower or elevate the protection level of such sites as necessary. Final protection level designation requires consultation with the Western Area FMO, Cultural Resource Specialist, and approval by the Superintendent. The Cultural Resources specialist will ensure that changed protection status will be updated on the appropriate NPS GIS layer and communicated to Western Area FMO and Galena Zone FMO for correction on the Map Atlas. Western Arctic National Parklands will continue to work towards a geospatial database that contains all relevant sensitive feature information that help inform management decisions in regards to wildfire.

CRITICAL:
Definition: Fires immediately threatening this designation will receive highest priority for protection from wildland fires by immediate and continuing aggressive actions dependent upon the availability of suppression resources.
Objectives: Protect human life, inhabited property and designated physical developments without compromising fire fighter safety. Protection of the aforementioned elements is the primary objective, not control of the wildland fire.
Recommended criteria:

1. Any historic property designated as a National Historic Landmark.
2. Any cabin or building that has been specified as actively occupied on a resident use permit granted to the user by the NPS.

3. Any property that is essential to the WEAR management and resource operations; examples include: ranger stations, remote base camps, etc.

FULL:
Definition: Fires immediately threatening this designation will receive aggressive initial attack dependent upon the availability of suppression resources.
Objectives: Protect sites designated as Full management from the spread of wildland fires burning in a lower priority fire management option. Minimize damage from wildland fires to the resources identified for protection commensurate with values at risk.
Recommended criteria:
1. Any historic property designated, or determined eligible for, inclusion on the National Register that retains structural integrity (i.e., standing with a roof).
2. Any property that has received NPS funds for stabilization or rehabilitation, or is designated to receive funds in the future.
3. Administrative sites (i.e., public use cabins, facilities at actively used airstrips, etc.).
4. Cultural resources that are representative of historical themes established by the park unit and retain a high degree of structural integrity.

NON-SENSITIVE:
Definition: Fires immediately threatening this designation will be allowed to burn under the influence of natural forces within predetermined areas while continuing protection of human life.
Objectives: Within land manager policy constraints, accomplish land and resource management objectives through the use of wildland fire. Reduce overall suppression costs through minimum resource commitment without compromising firefighter safety. Typical suppression response is a confinement strategy.
Recommended criteria:
1. Trespass structures that do not meet any of the criteria listed above.
2. Cultural resources that are not eligible for the National Register.
3. Historic properties that lack significant structural integrity:
   a. Stand-alone log buildings/structures that consist of four courses of logs or less
   b. Stand-alone frame buildings with one or more collapsed wall(s)
   c. Stand-alone tent frames and other camp features (meat racks, fish wheels, etc.) that are less than 50% intact
   d. Stand-alone mining features (adit, penstock, flume, dam, etc.) that are less than 50% intact
   e. Multi-component properties in which the majority of the contributing structures are less than 50% intact
   f. Bridges, trestles, aerial tramways, or other transportation-related features that are less than 50% intact
   g. Machinery, vehicles, or other equipment that has degraded to the extent that function and/or interpretive value has been compromised

NON-SENSITIVE/DEFENSIBLE SPACE:
Definition: Fires immediately threatening this designation will be allowed to burn under the influence of natural forces within predetermined areas while continuing protection of human life. Defensible space will be built prior to any fire starts.
Objectives: Within land manager policy constraints, accomplish land and resource management objectives through the use of wildland fire. Allow protection of structural resources using minimum tool and ensuring firefighter safety.

Recommended criteria:

1. Cultural resources that are not eligible for the National Register, but that are representative of historical themes established by the park unit and have a decrease in structural integrity.
2. Cultural resources that are in the process of assessment for the National Register.
3. Historic properties that have a decrease in structural integrity:
   a. Stand-alone log buildings/structures with a collapsed roof
   b. Stand-alone frame buildings with a collapsed roof
   c. Stand-alone tent frames and other camp features (meat racks, fish wheels, sheds, outhouses, etc.) that are less than 75% intact
   d. Stand-alone mining features (adit, penstock, flume, dam, etc.) that are less than 75% intact
   e. Multi-component properties in which the majority of the contributing structures are less than 75% intact
   f. Bridges, trestles, aerial tramways, or other transportation-related features that are less than 75% intact

Note: See the 2005 "Alaska NPS Structure Protection Procedures" for the latest Guidance.

4.0 WILDLAND FIRE OPERATIONAL GUIDANCE

4.1 Safety

The foremost guiding principle of *Federal Wildland Fire Management Policy, January 2001* is that firefighter and public safety is the first priority in every fire management activity. The AIWFMP and this Fire Management Plan and the activities defined within reflect this commitment. The commitment to and accountability for safety is a joint responsibility of all firefighters, managers, and administrators. Individuals must be responsible for their own performance and accountability. Every supervisor, employee, and volunteer is responsible for following safe work practices and procedures, as well as identifying and reporting unsafe conditions. All firefighters, fireline supervisors, fire managers, and agency administrators have the responsibility to ensure compliance with established safe firefighting practices.

All actions defined in the Fire Management Plan will conform to safety policies defined in agency and departmental policy, including, but not limited to:

a. Interagency Standards for Fire and Fire Aviation Operations (Redbook)
b. NPS Director's Order 18 Wildland Fire
c. NPS Reference Manual 18, Chapter 3 - Standards for Operations and Safety"
d. DOI Departmental Manual 485 (appropriate sections)

4.1.1 Firefighter Safety

Fire management safety concerns at Western Arctic Parklands include threats posed by fire and smoke to visitors, local residents, employees and wildland firefighters. Due to the remote nature of the Park/Preserve/monument transportation of fire personnel by fixed and rotor-winged aircraft and boats represent additional safety concerns. Risks are reduced by following existing policies and procedures established for aircraft and boat travels and following firefighting operational safety procedures described below.

Transportation safety

Aviation Safety- As is the case in most of Alaska, air travel is the common mode of transportation in and around WEAR. Inherent risks are reduced by following existing Federal Aviation Administration safety policies and procedures and more specific Interagency Standards for Fire and Fire Aviation Safety as referenced in NPS Reference Manual 18.

The inherent remoteness of Western Arctic Parklands demands that safety be a priority to all personnel involved in fire operations and associated project work. Aviation operations become routine in Alaska and it is not unusual for personnel to become complacent. Access to most field camps and facilities within the Park/Preserve/Monument is by airplane and/or helicopter only and therefore routine low level fixed wing and helicopter aircraft are to be expected during the busy summer months.

Watercraft and ATV Safety- Watercraft and ATV's also provide routine transportation. Operation of any watercraft will be done by a qualified operator who has passed the agency Motorboat Operator Certification Course (MOCC) as outlined in DOI DM 485 Safety and Occupational Health Chapter 22: Watercraft Safety. Additionally any

personnel operating ATV's on NPS land will adhere to regulations clarified in NPS Reference Manual 50B Section 6: Motor vehicle Safety, specifically section 6.1 which addresses ATV safety in particular.

Weather- Weather patterns in this region of Alaska are exceptionally inhospitable and inclement weather should be expected. This includes fog and winds for days at a time and low ceilings among other things and special attention should be given to weather forecasts for the fire area. Grounding of aircraft is common and therefore additional clothing, supplies and food should be the standard for operations being conducted within Western Arctic Parklands.

Requirements for Fire Personnel

All personnel participating in fire management activities within Western Arctic Parklands will be required to comply with all National Firefighting standards and complete the following before an NWCG Red Card will be issued:

- Pass routine physical examination as required.
- Participate in Annual Firefighter refresher and safety training
- Succeed at completing the Work Capacity Test requirements
- Participate in routine physical fitness training (Primary FFT = Mandatory, Secondary FFT = highly encouraged) when appropriate.

After the completing of the aforementioned requirements, a Red Card will be issued providing current NWCG qualifications and training needs where appropriate. Annual participation is required in order to keep Red Card currencies. Additionally, qualified fire personnel operating on assignments in Alaska and nationally, will adhere at all times to the following safety guidelines

- Know and Follow the 10 Standard Fire Orders
- LCES (effectively use Lookouts, Communication, Escape routes, and Safety zones)
- Recognize the 18 Watch Out Situations
- Recognize the Common denominators of Tragedy Fires
- Follow the WORK/REST GUIDELINES as outlined in Chapter 7-*Safety* of the Interagency Redbook
- Follow the Risk Management Process (Incident Response Pocket Guide, page 1)

Refusing an Assignment

At no time will any employee be asked to perform duties outside of their current qualification status unless the task is being used for training purposes, in which case, a qualified trainer will oversee the operation. All firefighters have the right to a safe assignment. All employees have the right to turn down unsafe assignments; they also have the responsibility to identify alternative methods of accomplishing the mission. For more information on proper protocols, refer to the *Incident Response Pocket Guide* (IRPG) (NFES1077, PMS 461) under "How to Properly Refuse Risk." All personnel are authorized and obligated to exercise emergency authority to stop and prevent unsafe acts.

Standard Operating Procedures

Job Hazard Analysis (JHA): Requirements for completed Job Hazard Anaylsis are outlined in Chapter 7- *Safety and Risk Management* of the Interagency Standards for Fire and Fire Aviation Operations. It is the responsibly of the supervisor or line manager to ensure JHA's are reviewed and signed prior to any non-routine task or at the beginning of the fire season. (See Appendix G: Preparedness plan for further information pertaining to JHA's). For BLM Personnel Only – See Chapter 7- *Safety and Risk Management* of the Interagency Standards for Fire and Fire Aviation Operations for Risk Assessment Procedures.

After Action Review (AAR): An AAR is a learning tool intended for the evaluation of an incident or project in order to improve performance by sustaining strengths and correcting weaknesses. An AAR is performed as immediately after the event as possible by the personnel involved. An AAR should encourage input from participants that is focused on (1) what was planned, (2) what actually happened, (3) why it happened, and (4) what can be done next time. It is a tool a supervisor can use to get maximum benefit from the experience gained on any incident or project.

Serious Accident/Incident Review/CISM: Certain situations warrant investigations and review processes according to both National and NPS policy. Detailed guidance for the review and investigation requirements and protocols are outlined in NPS RM 18 Chapter 3, *Standards for Operations and Safety* and the 2010 Interagency Standards for Fire and Fire Aviation Operations Chapter 18, *Reviews, Investigations & Analysis.* In conjunction with serious accident/incident occurrences, Critical Incident Stress Management (CISM) may be appropriate. Responsibilities and protocols regarding the initiation of a CISM team is outlined in the Interagency Redbook.

4.1.2 Public Safety

Public safety concerns at Western Arctic Parklands include threats posed by fire and smoke to visitors, local residents, employees. Due to the remote nature of the Park/Preserve/Monument fixed and rotor-winged aircraft and watercraft represent additional safety concerns, especially under conditions of heavy smoke.

Visitor use will not be allowed near fire perimeters. An attempt will be made to inform all visitors of any known wildland fire activity within WEAR, and signs will be posted on nearby roads, villages and departure points if smoke produced during wildland and prescribed fire creates a safety concern. The Superintendent may initiate a temporary closure of the hazardous area if large or erratic fire behavior endangers visitor and employee safety to a significant degree. Closures may also apply to airspace.

Emergency Evacuation procedures

The Alaska Division of Emergency Services has developed standard procedures for the evacuation of personnel and/or public due to risks posed by fire and/or smoke. Either the WEAR Superintendent or the WEAR Agency Administrator may request the Alaska Division of Emergency Services (ADES) to implement evacuation procedures for WEAR or for adjacent communities. This could range from the evacuation of an individual adversely affected by smoke to community evacuation due to the threat of fire. Any fire

related evacuation effort will be coordinated with the protection organization FMO or Incident Commander.

Burn Restrictions and Bans

The Code of Federal Regulations, Title 36 – Parks, Forests and Public Property Chapter 1 (7-1-02), Section 2.13 (c) states; "During periods of high fire danger, the superintendent may close all or a portion of a park to the lighting or maintaining of a fire." Section (d) states: "The regulations contained in this section apply, regardless of land ownership, on all lands and waters within the park area that are under the legislative jurisdiction of the United States."

The Alaska Wildland Fire Coordinating Group (AWFCG) established procedures for implementing statewide or regional burn restrictions/bans at Preparedness Levels IV and V. Either fire protection organizations or land managers can recommend a burn restriction/ban based upon fire indices, risk factors, air quality, forecasted weather and the regional or statewide fire situation. If the AWFCG concurs, the recommendation is forwarded to the Deputy Director of Fire and Aviation (DNR) for implementation by the State Forester. The areas affected by the burn restriction/ban will be delineated using Alaska Department of Fish & Game (ADF&G) management units along with a text description of the area. If the NPS units or a portion of NPS units are included in the burn restriction/ban area the Superintendent has the option to implement a burn restriction/ban using the legislated authority described above. The NPS will support the regional or statewide burn restriction/ban, unless extenuating circumstances exist. Public Orders and new releases will announce the burn restriction/ban and will be posted on the AFS-BLM (http://fire.ak.blm.gov/) and DNR-DOF (http://www.dnr.state.ak.us/forestry/fire/) Internet websites. The NPS will prepare press releases as needed and will use NPS communication systems to inform NPS employees of the burn restriction/ban. A copy of the State of Alaska Burning Restrictions and Burn Ban Procedure, 1997 are on file in the Western Area and Regional Wildland Fire Management offices.

If burn ban proposals extend beyond NPS administered lands, at Preparedness Levels I, II, and III, local protection agency FMO after contacting local land managers or local land managers may recommend to the local protection agency FMO a burn restriction/ban. Follow Region-wide agreements for approval authority. Public Orders and press releases will be prepared by the protection organization. The Superintendent of affected NPS units will determine if the burn restriction/ban is appropriate. If it is appropriate, the Superintendent will implement the burn restriction/ban using his legislative authority.

Burn restrictions/bans will be rescinded after sufficient recovery of fire indices, improvement of air quality, reduction of risk factors and the regional/statewide fire situation. The burn restriction/ban may be rescinded for a portion of the affected geographic areas, if the exempted area can be clearly delineated and articulated to the general public. Press releases will be prepared by the protection agencies to announce the rescission of burn restrictions/bans. The Superintendent will rescind the NPS burn restriction/ban and announce the rescission through press releases if necessary and NPS communication channels.

4.2 Preparedness

Preparedness activities provide detailed procedures and standards for wildland fire operations, including pre-season and ongoing activities throughout the fire season. It also includes pre-planned procedures for initial response and incident management procedures.

Protection Planning

The NPS and BLM Alaska Fire Service – Galena Zone will review management option selections for Western Arctic Parklands annually as defined in the AIWFMP. Changes are submitted through the AWFCG procedures found at http://fire.ak.blm.gov/administration/awfcg.php.

The NPS is responsible for setting the strategic fire direction for the park/preserve and completing and/or reviewing other WFDSS pre-season entries.

Protection Area Boundaries

Each winter the Western Area FMO meets with WEAR staff members and fire management personnel from the AFS Galena Zone to re-evaluate the categorization and boundary locations of these units. Other land manager/owners will be consulted and concurrence will be sought for unit location or categorization changes that affect their lands. Final authority for the adjustment of FMUs and/or fire protection categories within the Parklands rests with the WEAR Superintendent.. Clear direction for the process and proper documentation procedures for these changes are given in the Alaska Statewide AOP.

Fire Protection and Suppression

The BLM Alaska Fire Service – Galena Zone will provide fire detection coverage for Western Arctic Parklands based on lighting activity levels, human use or at the request of the NPS. Upon discovery the Galena Zone will verify and document fire location, management option and cause of fire. Initial response will be implemented according to AIWFMP and the Jurisdictional FMO or designated NPS Duty Officer will be notified. BLM Alaska Fire Service will initiate a WFDSS entry as part of the notification process.

Prevention

A Step-Up Communications Plan has been developed by the NPS Alaska Regional Fire Education and Communications Specialist in collaboration with other agencies, regarding fire prevention. This plan provides access to detailed information on the current fire situation and emphasizes the likelihood of unwanted wildfires due to careless human acts. Details of this plan are described in detail in section.

Public Use Restrictions

See section 4.1.2 - *Public Safety* of this FMP regarding Burn Bans and fire area closures.

Prescribed Fire and Fuels Management

Mechanical fuels treatment and prescribed burning, or a combination of the two, may be used in the Park/Preserve/Monument to achieve resource management goals. The protection of National Historic Landmarks and classified structures listed on the National Register of Historic Places, or eligible for listing, could warrant these preventative measures. Fuel

reduction measures may also be used to protect other Critical and Full protection points that exist in the park that may not fall under the above categories. (ie NPS administrative buildings) Mechanical fuel reduction projects will strictly adhere to Fuels Management Plan Guidelines (Section 4.5- *Management of Planned Fuels Treatment*) and any plans for prescribed burning will constitute the development and approval of an official Prescribed Fire Burn Plan. (See Section 4.5.3- *Prescribed Fire Treatments*)

4.2.1 Coordination and Dispatching

The AIWFMP is the operational reference document for fire on all lands throughout Alaska, regardless of ownership. The AIWFMP works in unison with the Statewide AOP, the Master Cooperative Wildland Fire Management Agreement, local area AOP's and this Fire Management Plan for managing wildland fire in Western Arctic Parklands.
The purpose of the AIWFMP is to "Promote cooperative, consistent, cost-effective, interagency approach to wildland fire management." (Alaska Statewide AOP) The Alaska Wildland Fire Coordinating Group (AWFCG) is the interagency team that reviews and updates these governing documents regarding Wildland Fire Management in Alaska. The NPS Regional FMO represents National Park Service interests in the AWFCG.

The Alaska Interagency Coordination Center (AICC) serves as the geographic coordination center for Alaska. AICC provides statewide tactical resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildland fire management in Alaska.

BLM Alaska Fire Service – Galena Zone dispatch center in Galena provides fire dispatching services to the Western Arctic Parklands area. Galena Zone dispatch determines appropriate staffing levels in accordance with current and forecast fire weather, fire danger rating indices and/or current and expected wildfire workload.

4.2.2 Preparedness Activities

Alaska wildland fire preparedness activities include a wide range of readiness activities and program elements that are essential to dealing with unplanned ignitions and fuels treatments. AK preparedness levels are determined independently from the National Preparedness scale. Alaska preparedness levels are posted daily on the AICC website at the top of the Wildland Fire Situation Report. Definitions of each preparedness level are given and correlated with the appropriate management action and the assignment of responsibility.

A preparedness plan commonly requires annual updating and for that purpose will be attached in the Appendix G.

4.3 Management of Unplanned Ignitions

A. Preparing for Unplanned Ignitions.

Operational control of wildfire incidents within Western Arctic Parklands is the responsibility of BLM Alaska Fire Service – Galena Zone. The Alaska Statewide AOP contains all specifics regarding the response to, and management of, unplanned ignitions throughout Alaska. This includes initial response direction, WFDSS initiation, cooperation and requirements, FEMA reimbursable expenditures guidance, surveillance and monitoring protocols, and post fire activities (ie BAER). Relevant operational guidance regarding

unplanned ignitions is also found in the Statewide Master Agreement (clauses 24-33) regarding fire notification, closest forces concept, NPS independent actions, response to a wildfire, "special management considerations", delegations of authority, incident priorities and the preservation of evidence.

1. Objectives - Established goals and objectives for each management option guide pre-planned responses in each of the four management options within the Western Arctic Parklands. Rooted in founding documents for park purpose and management, these objectives are clearly described in section 3.1.1 of this plan as well as the 2010 AIWFMP.

2. Risk Assessment – A primary factor used to select the appropriate fire management option for a given areas within the Park/Preserve. Risks evaluated include nearby communities, private residences, private property, valuable natural and cultural fire- sensitive resources, and proximity to critical management units. The modified management option allows managers flexibility to incorporate Fire Weather Seasonal Tracking (FWST) information into their decision making process when choosing the appropriate conversion date and management response.

3. Implementation – Use of Wildland Fire at WEAR is the preplanned initial action in Limited and Modified (after conversion) protection categories identified in the AIWFMP. Use of Wildland Fire may occur in Modified (prior to conversion) and Full protection categories if suppression actions have not been initiated and the criteria for Use of Wildland Fire have been met (AIWFMP). The extent of the Use of Wildland Fire in WEAR may be altered based upon adjustments of the appropriate boundaries and management options for FMUs.

The FMU descriptions contained within this plan specify preplanned management actions, to be enacted automatically by Galena Zone dispatch in the absence of further guidance by the jurisdictional agency. The Superintendent with consultation from the Western Area FMO and the Galena Zone FMO may select a reduced or increased suppression response as determined by current fuel, weather, and fire management conditions and as dictated by NPS policy and the WEAR FMP. See Statewide AOP(Clause 29- Response to Wildfire)

Fire Effects Monitoring - Monitoring procedures at WEAR will follow guidelines established by the Regional Fire Ecologist, Western Area Fire Management FMO, and WEAR resource management staff, as well as the Alaska Fire Effects Task Group. Monitoring actions conducted at WEAR specifically in support of wildfire with resource benefit objectives will, whenever possible, include measurement of fuel moisture levels for forest floor duff layers (as represented by the Canadian Forest Fire Danger Rating System) as well as for traditional fine and heavy fuel models. (See Section 5.2 and Appendix F: Section 4.1 for a description of the WEAR short and long-term fire monitoring program.)

The Wildland Fire Decision Support System (WFDSS) process will be used to document decisions for all unplanned wildland fires. Implementation of Use of Wildland Fire actions will be initiated through the Wildland Fire Decision Support Process (WFDSS) through consultation with the Western Area FMO and Galena Zone FMO.

Regional guidance for the responsibility for completion of the WFDSS components is located in the 2010 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2010 Alaska Statewide Annual Operating Plan.

The initial WFDSS record documents the current and predicted situation, documents all appropriate administrative information, and aids managers by providing them with decision criteria to make the initial decision whether to manage the fire primarily for resource benefits or take aggressive suppression action to limit spread.

4. Staffing

A. Operations -- Galena Zone FMO in consultation with WEAR management and Western Area FMO will determine staffing requirements for wildfire incidents. Western Area FMO in consultation with WEAR management and Galena Zone FMO will determine monitoring requirements for wildfire incidents. All personnel involved with fire management activities will be appropriately qualified to meet National Wildfire Coordinating Group (NWCG) standards. Because of the remote nature, relative scarcity of structures or other sensitive values within portions of WEAR, wildfires with resource benefit objectives incidents may often be adequately managed through aerial surveillance every few days. Other incidents may demand the continuous presence of monitors or fire behavior analysts. Based upon the needs of the fire organization, WEAR needs and Agency objectives, the Superintendent and Western Area FMO will determine what WEAR staff will be available to assist with wildfire incidents. See Statewide AOP for further information (Clause 11-Interagency Dispatch, Clause 12-AICC, Clause 13-Interagency Resources)

B. Fire Effects Monitoring Staff – Following the monitoring procedures at WEAR established by the Regional Fire Ecologist, the Western Area Fire Management FMO with consultation from the Protection Agency FMO will determine staffing needs.

5. Information- The information and interpretation requirements of the WEAR fire management program are specifically addressed in Appendix H. The following objectives, however, pertain to unplanned ignitions:

- When extended incidents are likely to be visible to visitors, NPS personnel will prepare and distribute handouts explaining the WEAR fire management program, the nature of the specific incident, and the desirability of preserving the area's natural fire regime (As appropriate). This information will be available at visitor contact station(s) and available to park staff that may encounter park visitors.

- An attempt will be made to educate all WEAR employees about local fire ecology, the WEAR fire management objectives, and wildfire with resource benefit objectives incidents that are in progress.

- When wildfire with resource benefit objectives incidents occur near frequently used locations, interpreters or other NPS employees will make periodic visits to the location to answer questions.

Communication and education regarding wildfire in and around Western Arctic Parklands will follow protocols outlined in the Western Arctic Parklands Communication and Education Plan (Appendix H) and developed by the Regional Fire Communication and Education specialist.

6. Record Keeping- The following contents will be kept on file for each incident occurring within Western Arctic Parklands.

- WFDSS Report
- ICS 209
- WFMI Report
- Monitoring data, reports, and findings
- Revalidation and certification documents (if applicable)
- Funding codes and cost accounting
- Project Maps- generated by aerial surveillance and given to NPS to include in their GIS database, if NPS fire management staff is not present on fire.
- Aerial Photographs
- Any other pertinent information relating to the incident

B. Expected Fire Behavior

Fire behavior in WEAR can range from creeping subterranean fire in tundra to fast moving ground or canopy fire in surface fuels or spruce stands. For more detailed discussion refer to Fuel Characteristics and Fire Behavior (Section 3.1: Historic Fire, Weather, Fire Season, Fuels and Fire Behavior).

CFFDRS - The Canadian Forest Fire Danger Rating System (CFFDRS) is utilized to track fire danger throughout the state (Alexander and Cole, 2001). Specific analysis regarding CFFDRS and large fire occurrence and high fire growth days has not been thoroughly conducted for Western Arctic Parklands. The CFFDRS moisture components and indices commonly monitored further in the interior of the state are the Fine Fuel Moisture Code (FFMC), Duff Moisture Code (DMC), Drought Code (DC), Initial Spread Index (ISI) and the Buildup Index (BUI). The following Table illustrates the thresholds that can elicit extreme fire behavior or a high potential for growth.

Table 6: Canadian Forest Fire Danger Rating System

	FFMC	DMC	DC	ISI	BUI	FWI
Low	<74	0-30	15-150	0-2	0-30	0-5
Moderate	75-88	31-60	151-275	3-7	31-60	6-13
High	89-91	61-90	276-375	8-10	61-90	14-24
Very High	92-93	91-120	376-500	11-20	91-120	25-30
Extreme	>94	>120	>501	>121	>120	>31

C. Initial Response Procedure.

The FMU parameters described within this plan (and adjusted annually) comprise the only predetermined implementation procedures for unplanned ignitions at WEAR.

Initial responses to wildfires throughout Alaska are predetermined and clearly defined in the AIWFMP and statewide AOP. Fires can be categorized as Critical, Full, Modified, or Limited depending on the Fire Management Option selection given to the area the fire is

burning in. Responses to these ignitions are predetermined and range from aggressive initial attack (Critical) to periodic aerial surveillance (Limited).

Critical - Fires occurring in or immediately threatening this designation will receive highest priority for protection from wildland fires by immediate and continuing aggressive actions dependent upon the availability of suppression resources.

Full- Fires occurring within or immediately threatening this designation will receive aggressive initial attack dependent upon the availability of suppression resources.

Modified –Before the conversion date, fires will receive initial attack, dependent upon availability of suppression resources, unless otherwise directed by the land manager/owner(s) and documented in WFDSS. After the conversion date, the default action for all fires occurring within the Modified management option areas will be routine surveillance to ensure that identified values are protected and that adjacent higher priority management areas are not compromised. Critical and Full management areas are higher priorities for suppression resources than Modified management areas.

Limited - Wildland fires occurring within this designation will be allowed to burn under the influence of natural forces within predetermined areas while continuing protection of human life and site-specific values within the management option. Generally this designation receives the lowest priority for allocations of initial attack resources; however, surveillance may be a high priority.

The initial response on human-caused fires will be to apply the appropriate operational suppression response delineated in the AIWFMP. Therefore, in most cases, response to fires within a given fire management option is the same whether the ignition is natural or anthropogenic. The Agency Administrator, or delegate, may request a non-standard response to fires within Western Arctic Parklands. The Protection Agency FMO will be consulted on any non-standard response requests. Non-standard responses will be reviewed at the Interagency Fall Fire Review.

1. Information Needed To Set Initial Response Priorities.

Wildland fire management options selections are the basis for the selection of initial response priorities. The fire management option selections were based upon an evaluation of legal mandates, policies, regulations, resource management objectives, and local conditions. Local conditions include but are not limited to fire history, fire occurrence, environmental factors and identified values to be protected. The following item should be consulted prior to refining the initial response priorities.

a. Fire management unit the incident is located within.
b. Location/distance of the incident is other fire management units.
c. Location/distance of the incident in relation to values at risk (Fire Protection Points/Known Sites Database, Communities, adjacent landownership, Allotment, Archeological Database, proximity to sensitive water sources, etc.
d. Availability of resources.

2. Incident Documentation and Reporting

The Protection agency is responsible for all fire reporting commensurate with national standards and more specifically, as specified in the Alaska Interagency Mobilization Guide (AIMG) Chapter 20 Section 25.1.01.

Wildfire notifications with follow the procedures in the Alaska Statewide AOP. If NPS personnel, visitors, or local residents detect a new ignition they should notify the Galena Zone Dispatch as soon as possible. Information needed is: an accurate location of the fire (lat., long), approximate size, resources threatened, and any other pertinent information (nearby lakes or rivers, cardinal direction from these features, color of smoke, fuels (vegetation) present, size of column, etc…). Once Galena Zone Dispatch has this information then, contact the Western Area FMO responsible for the park wildland fire management program. If the appropriate Area FMO is not available contact the Regional FMO. If the Regional FMO is not available contact the Duty Officer identified on the Wildland Fire AKR Website (http://165.83.62.205/epr/fire/fire.htm/). The Area FMO or Regional FMO will contact the Superintendent if he has not been informed about the fire.

The Protection Agency and Jurisdictional Agency FMOs will work collaboratively to develop WFDSS documentation as required by National Fire Policy (Redbook) and the Alaska Statewide AOP.

The NPS is also responsible for completing and submitting a Wildland Fire Report Form and any additional fire reporting as required by RM 18 Chapter 11- Wildland Fire Reporting. The Western Area FMO will ensure accuracy of the report and will follow NPS Alaska Regional Fire Management procedures to have the WFMI Fire Reporting Module entered. A permanent hardcopy of the fire report is filed at the Alaska Western Area Fire Management Office in the Denali National Park and Preserve.

3. Criteria for Selecting the Initial Response

Primarily the initial response will follow the preplanned response as defined in the AIWFMP. The NPS has selected wildland fire management options based upon an evaluation of legal mandates, policies, regulations, resource management objectives, values at risk and local conditions. Local conditions include but are not limited to fire history, fire occurrence, and environmental factors. The NPS should revisit fire management option selections as part of their fire management program Adaptive Management Strategy procedures to ensure their selections remain consistent with current park management goals and objectives.

Additional criteria that could be evaluated for selecting the initial response for either validating the preplanned initial response or selecting a non-standard response.

- Current and expected weather,
- Proximity to sensitive resources,
- Current and expected mid to long term availability of suppression resources,
- Current and expected fire business load
- Air Quality advisories,

4. Response Times

Response times for fires occurring within Western Arctic Parklands will vary depending on the Fire Management Option selected for the area, availability of suppression resources, as appropriate, and with the current fire preparedness level across the state of Alaska. When Alaska Preparedness reaches Level 4 or 5, the Alaska Multi-Agency Coordinating group is assembled. The MAC group ensures:

- Incident prioritization ,
- Resource allocation and acquisition
- State and federal disaster response or coordination
- Political interfaces
- Information provided to media and agencies involved
- Anticipation of future needs
- Identification and resolution of issues common to all parties

  Response times will be greatly determined by the MAC group and fire activity across the entire state of Alaska.

NPS fire resources response times will vary based on location of the incident and the location and prioritization of NPS aviation resources. In general, all NPS lands are accessed through aviation resources. The NPS AWAFM Fire Exclusive Use Helicopter Contract module will be available seven days a week through the duration of the fire season. The NPS AWAFM Fire Exclusive Use Helicopter Contract module is typically located in Denali National Park and Preserve. Response times to Western Arctic Parklands is, for AWAFM resources, is typically between 12 and 36 hours to mobilize. Direct flight time from Denali National Park and Preserve to Kotzebue or Nome is approximately 4 hours.

5. Management Requirements and Restrictions

See Section 3.1 Park-wide Fire Management Considerations and 3.2 Fire Management Unit Specific Characteristics.

6. Non-Standard Response

The four fire management options address a high percentage of wildland fire situations that occur in Alaska. On rare occasions, however, situations arise where non-standard responses to the selected management options are prudent and justifiable. Non-standard responses procedures will follow those as described in the Alaska Statewide Master Agreement and AOP. Approval of non-standard responses reside with the Agency Administrator with consultation with the Protection Agency FMO prior to implementation. Examples of Non-Standard Responses are discussed in detail on pages 34/35 of the AIWFMP. All non-standard responses that occur will be reviewed at the annual fall fire review. See section above (3. Criteria for Selecting the Initial Response) for suggested factors to be evaluated prior to making a non standard response decision.

D. Transition to Extended Response and Large Fire

1. Criteria for Transition

Wildfire incidents in Alaska range from small (< 1 acres) to large (+50,000 acres) non-complex (few resources at risk) fires to the infrequent large complex urban interface fires.

The vast majority of the fires the Western Arctic Parklands are in the Type 4 complexity. As incidents progress, continual reassessment of the complexity level should be competed to validate that the organization remains appropriate, or the need exists for a higher level or lower Incident Management Organization. The Interagency Redbook, Chapter 11 contains guidance for the selection of the appropriate team organization determined through the completion of a complexity analysis and a Organizational Needs analysis if the fire reaches a Type 1, 2 or 3 complexity. See the Alaska Statewide Master Agreement and AOP for further guidance.

2. Implementation Plan Requirements and Responsibilities

WFDSS will be used to develop and document decisions and support extended response needs within Western Arctic Parklands. In the event higher complexity fires occur within the jurisdictional boundary of the NPS, the Jurisdictional Agency may utilize the virtual Decision Support Center and/or assemble a team of advisors (ie. Superintendent, Chief of Resources, Chief Ranger, etc…) who will assist in the development and review of the WFDSS process. See the Alaska Statewide Master Agreement and AOP for further guidance.

3. Delegation of Authority

Delegations of Authority will be cooperatively developed by the NPS and the BLM Alaska Fire Service – Galena Zone and will document procedures and criteria that specify direction, authority, and financial management guidelines to Incident Commanders of fires within Western Arctic Parklands for fires Type 3 and above (see Redbook and Annual Operating Plan 2011) (Master Agreement, 2011). Only after written authority is received may the Incident Management Team assume authority to manage suppression actions of the incident. (AIWFMP, 2011).

Communications throughout Western Arctic Parklands are a continual challenge. Recognizing this, the Incident Commander, through BLM Alaska Fire Service – Galena Zone, to the best of their ability, will notify the Agency Administrator or delegate of progress and activities occurring on the incident. Then, the NPS can disseminate correct and current information to local community members affected by the fire. See the Alaska Statewide Master Agreement for further guidance on communication guidance.

The Resource Advisor is responsible for anticipating the impacts of fire operations on natural and cultural resources and for communicating protection requirements for those resources to the Incident Commander. The Park should fill this position with a knowledgeable and qualified staff member to ensure the best possible protection of irreplaceable park resources. This position additionally ensures the IMTs compliance with the Resource and Fire Management Plans for Western Arctic Parklands, and provides counsel to the IC regarding sensitive issues within the park/preserve/monument. A complete list of position responsibilities and issues to be considered is available in the Resource Advisor's Guide for Wildland Fire (NWCG PMS 313, NFES 1831, Jan 2004 and the Interagency Redbook, Chapter 11, Page 11.

4.4 Burned Area Emergency Response

4.4.1 Minimum Impact Suppression Tactics (MIST)

It is the policy of the National Park Service that all fire management activities will be executed using minimum impact suppression guidelines. Accordingly, the following constraints apply to all fire management activity in Western Arctic National Parklands. These guidelines have been developed collectively by the jurisdictional land management agencies and recently updated in the Guidelines and Constraints section of the 2010 AIWFMP. Further direction specific to Western Arctic National Parklands and its associated resources is described in the NPS section below.

AIWFMP MIST- To the extent possible, minimum impact suppression tactics should be used.

- Firelines will be constructed in a manner that minimizes erosion and will follow natural contours wherever possible. Indirect attack will be used to the extent practical. A fireline rehabilitation plan for wildfire suppression activity damage, as approved by the jurisdictional agency(s), must be completed before the final demobilization occurs.

- The use of tracked or off-road vehicles (for example, bulldozers or all-terrain vehicles) requires written authorization by the jurisdictional agency(s) on a case-by case basis prior to use.

- Application of aerial fire retardant near lakes, wetlands, streams, rivers, and sources of human water consumption or areas adjacent to water sources should be avoided. A minimum of 300 feet is identified in the *Red Book*. Individual jurisdictional agencies may have more restricted retardant guidelines.

- Base camps, spike camps, helispots and other support areas should be located in natural clearings if possible. The construction of helispots should be minimized. Any opening created for support areas will be cut with an irregular perimeter. Such areas will be kept clean so as not to attract animals and will be cleaned up before departure of the last suppression personnel.

- Support areas such as camps, staging areas, and helibases will not be located on Native allotments. No resources will be removed from a Native allotment (e.g.firewood) without an approved agreement. The BIA or the local BIA service provider may prepare the agreement.

- Flight patterns and suppression activities will be restricted around areas designated Avoid. Examples include peregrine falcon nesting areas, threatened or endangered species, or sensitive sites identified by the jurisdictional agency.

- Suppression activities on or near non-structural cultural sites must be coordinated with the jurisdictional agency per 2010 AIWFMP.

- Jurisdictional agencies should be consulted concerning any operational restrictions in designated wilderness areas as directed in Guidelines and Constraints section of the 2010 AIWFMP.

NPS MIST

- Use water rather than retardant whenever possible; when retardant is necessary, use fugitives if available and avoid as much as possible the use of any retardant in or around lakes or marshes.
- Use cold-trailing or wet-lining techniques when feasible.
- Utilize foggers in mop-up; avoid "boring" or other scarring hydraulic actions.
- Dozers and other heavy equipment will be used only with the approval of the Superintendent (or delegate), except in life-threatening circumstances.
- Minimize the falling of trees and the cutting of shrubs; limb vegetation adjacent to fireline only as needed to prevent additional fire spread.
- Minimize the use of helispots/ helibases that require clearing.
- Emphasize appropriate Leave No Trace practices by personnel on the fireline and/or in spike camps, particularly with regard to human waste disposal, selection of durable campsites, and food storage in bear country.

Minimum impact suppression tactics and Leave No Trace ethics will be identified as an objective on all wildfire incidents occurring in WEAR.

4.4.2 Burned Area Emergency Response

Because the majority of land within Western Arctic National Parklands is categorized within the Limited Fire Management option, relatively limited suppression actions will be necessary and thus minimal adverse affects to the management area can be expected. In the event wildfires start in or threaten Full or Critical management areas, more aggressive suppression actions can be expected. In the event where suppression actions are required, MIST will be strongly emphasized. The need for emergency response for the stabilization and prevention of unacceptable degradation of natural and cultural resources resulting from the effects of the fire will be promptly determined by the Management Staff at WEAR and communicated by the agency administrator, or delegate, to the AFS- Galena FMO. Rehabilitation standards will be developed on a case by case basis in accordance to specific needs on incidents occurring within the Park/Preserve/Monument. Additionally see Section 3.1 Park-wide Fire Management Considerations and 3.2 FMU Specific Characteristics provide guidance regarding management constraints by FMU. These constraints will assist NPS in their mission to protect invaluable resources within the Park/Preserve/Monument.

4.4.3 Emergency Stabilization

Suppression activity damage repairs are the responsibility of the Incident Commander and are funded using the suppression account. Firelines may require rehabilitation in order to stabilize the burn area and to mitigate the effects of suppression activities. The Agency Administrator will ensure that the Incident Commander consults with natural resource managers as needed, regarding any specific rehabilitation needs. When possible, burned areas will be allowed to regenerate naturally. Due to the magnitude of NPS management units that could potentially be adversely affected by fire, rehabilitation needs will be determined on a

case by case basis by park resource management staff within an appropriate time frame for the necessary stabilization work to be completed. For Emergency Stabilization and Rehabilitation timeframes, priorities, policies and procedures to mitigate fire effects on federal lands, reference 620 DM 3, the *Interagency Burned Area Emergency Response Guidebook (Feb 2006)* and the *Interagency Burned Area Rehabilitation Guidebook (Oct 2006.)*

4.4.4 Burned Area Rehabilitation

Burned Area Rehabilitation (BAR) is a continuation of Emergency Stabilization efforts that occur immediately post fire. BAR efforts focus on repair or replacement of minor facilities as well as damage incurred to natural and cultural resources as a result of the fire. The BAR phase usually occurs within one to three years after the fire is extinguished. It is the responsibility of the Agency Administrator to ensure that BAR efforts are completed to the satisfaction. A Burned Area Emergency Response Plan (BAER Plan) may be appropriate if significant damages are incurred during a wildfire incident in Western Arctic National Parklands. At the request of the Agency Administrator, an interdisciplinary team (BAER Team) of specialists may be ordered to prepare a plan with specific rehabilitation guidelines to be carried out during or immediately following the containment of a wildfire. Appropriate use of funding is described in detail for BAR activities on federal and native lands are outlined in the following interagency departmental manuals. DOI 620 DM 3 and the Interagency Fire Business Management Handbook.

4.5 Management of Planned Fuels Treatments

Though Western Arctic National Parklands presently has no plans to use broadcast prescribed fire, it may be implemented in the future for the accomplishment of specific resource management goals. Because of the relatively undisturbed nature of WEAR landscapes, the Western Area FMO does not anticipate implementing landscape-scale burning for the purpose of restoring or preserving the area's ecosystems. WEAR park management may, however, use prescribed fire for the purposes of restoring historical conditions at selected sites or for reducing hazard fuel loads in the vicinity of resources requiring protection. See the NPS Alaska Region Programmatic Fire Hazard Fuels Management Plan, Environmental Assessment (2013) for further information.

4.5.1 Fuels Planning and Documentation

The fuels management program will implement fire management policies and help achieve resource management and fire management goals as defined in:

- Federal Wildland Fire Management Policy and Program Review
- Managing Impacts of Wildfires on Communities and the Environment (USDA, Oct 13, 2000)
- Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (USDOI/USDA)
- A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan.

a. Identify Participants

Any implementation of prescribed fire within WEAR will be predicated upon a planning session attended by the Western Area FMO, the Local Park Fire Coordinator, Superintendent or delegate and any other key players or interested parties. Topics covered in this meeting may include the determination of prescribed burn units, the establishment of prescribed fire objectives, the presence and protection of sensitive resources, the mitigation of smoke management problems, determination of prescriptions and/or burning windows, fire effects monitoring protocols and the impact of the proposed action on the full spectrum of WEAR uses, including wilderness values, and subsistence hunting and trapping.

Typical key members for fuels project decisions for Western Arctic National Parklands include:

- Superintendent(s)
- Western Area FMO or delegate
- Western Area AFMO
- Local Park Fire Coordinator
- Chief Ranger
- Chief of Cultural Resources
- Archeologists

b. Identify Candidate Projects

2015 BELA and KOVA shelter cabins. See the Five Year Treatment Plan, updated annually, for future candidate projects in outyears (Appendix E).

c. Project Prioritization Criteria

Consistent with the objective of maintain natural process to the greatest extent possible within the context of other Natural, Cultural, Subsistence and Adjacent Landowner Objective a current fuels treatment projects are focused on sensitive cultural and administrative sites. The Western Area Fire Management Staff working with the Local Park Fire Coordinator and Chief of Cultural Resources annually review and identify the site specific fire protection status for each site. If fire protection category changes are made to a site the list of changes are submitted to the Superintendents for approval. The sites that receive a Critical or Full Protection Category constitute the list of sites that may need fuel management treatments, based on natural fuel hazards at the site. As natural fuels conditions change at a site periodic visits to the site will be necessary to determine future fuels treatment needs.

TOP PRIORITY (CRITICAL FIRE MANAGEMENT OPTION IN THE ALASKA INTERAGENCY WILDLAND FIRE MANAGEMENT PLAN, AIWFMP)

1. The structure(s) is a primary domicile.
2. Structure(s) is designated as a National Historic Landmark.

SECOND PRIORITY (FULL FIRE MANAGEMENT OPTION IN THE AIWFMP)

1. The structure has been determined eligible for or is on the National Register of Historic Places, has structural integrity (e.g. intact roof and walls, a reasonable

probability for defense), is at potential risk from wildland fire and has been identified for or undergoing routine maintenance/restoration.
2. NPS administrative (e.g. patrol cabin) or public use structures – public funds expended to construct or maintain.
3. The use of the structure is provided for under NPS permit or an approved Mining Plan of Operations.

The following types of structures would not receive treatment under this Fuel Plan:

1. Trespass structures
2. Abandoned structures that are not eligible for inclusion on the National Register of Historic Places.
3. Structures without structural integrity or they have not been identified for or are undergoing routine maintenance/restoration. (It is difficult to put a sprinkler system on a structure without a roof.)

Additional Criteria, in order of priority but are not limited to, may be utilized to prioritize projects:

- Agency Administrator Priority
- Degree of Hazard (i.e. quantity of fuel adjacent to the site)
- Proximity to Values at Risk (i.e. Fire frequency and extent in the area of the site)
- Logical Project Sequence
- Fire Management Option selection
- Maintenance Cycle
- Logistical Feasibility
- Implementation requirements

d. Updating the Fuels Treatment Plan

Annual review of any fuels treatment plan will be incorporated with the review of this FMP and addressed at the Annual Fire Management Pre and Post Fire Season Adaptive Management Strategy Meetings. Any adjustments to Fuels Treatment plans will follow policy guidance as stated in Chapter 7-Fuels Management of RM18 and use the NPS Environmental Screening Form (ESF) to ensure new or updated projects remain in compliance with previously approved compliance documentation. If current projects specifications fall outside of previously approved compliance, a new compliance process will be initiated. Guidance for the appropriate action required may be obtained from park or regional compliance specialists and found in Director's Orders 12 .

4.5.2 General Fuels Management Implementation Procedures

See Appendix E – Multi-Year Fuels Treatment Plan for addition information.

a. Guidance

Prescribed fire planning and implementation will be in accordance with RM 18 Chapter 7, Fuels Management.

b. Annual Actions

Spring

- Five year treatment plan updated to reflect fuels treatment accomplishments from previous fiscal year.
- Fuels Treatment Plan, including Five year treatment plan, reviewed, updated and approved by Superintendent.
- Final submission National Fire Plan Operations & Reporting System (NFPORS) projects for next fiscal year.
- Compliance Review (PEPC) for current fiscal year projects.
- As appropriate, Prescribed Fire Burn Plans reviewed and completed.

Spring/Summer/Fall

- Implement approved/scheduled thinning, piling and/or pile burning projects.
- As necessary, field visits to potential future treatment sites, including cultural resources consultation.

Fall

- Fuel Treatment project reports completed.
- Submit into NFPORS projects for the next *three* fiscal years.
- After Action Review with Western Area Fire Staff, Park Unit Fire Coordinators and Superintendents regarding fuels treatment projects. (Note: This AAR is typically completed with the Post Fire Season Conference Call.)
- Notification of the coming fiscal year planned projects.

Winter

- Receive notification of receipt of NFPORS project funds and reprioritization of projects based on the receipt of funding.
- Update fire protection point status.
- Complete WFMI Fire Reports for completed Prescribed Fire Projects.

c. Implementation Standards

Activities proposed in the Fire Management Plan will be planned and implemented in accordance with Reference Manual 18, Chapter 7-Fuels Management, the Interagency Standards for Fire and Fire Aviation Operations and any applicable sections of the Alaska Statewide Master Agreement.

d. Planning & Reporting Requirements

Fuels- The Western Area FMO or delegate will be responsible for inputting proposed and completed projects for Western Arctic National Parklands into NFPORS. Project funds will be requested via NFPORS Treatments and Activities Module. NFPORS project requests will be uploaded into PDS by the FMPC by the date set in the current business rules of each year. The Western Area FMO will recommend and prioritize activities and treatments for funding based upon justification, effectiveness, collaboration, and probability of completion within the fiscal year.

Activity or treatment approval, along with line items, will be entered into the PDS Treatment Approval module by the FMO or delegate, no later than the date given in the current business rules. The RFMO will activate funding for treatment when funding is needed to initiate work and the probability of project completing is acceptable.

Rx Fire- The Western Area FMO will report the intent to conduct a prescribed fire by phone to the Regional Fire Management Office by 3:00 p.m. at least one day before a

prescribed fire (Notifications procedures are identified in the Burn Plan). The Western Area FMO or delegate will also notify the Galena zone dispatch, specific individuals/ organizations/agencies identified in the burn plan, and the appropriate reporting dispatch office following the notifications procedures as identified in the Burn Plan prior to the burn and again upon its completion. The appropriate reporting dispatch office will submit the information to the daily situation report.

The Western Area Fire Management Officer will ensure that each prescribed fire is documented with the following items:

- Approved prescribed fire plan.
- Compliance and planning documents.
- Map of project and surrounding area.
- Monitoring data (including weather, fire behavior, and fire effects observations).
- Smoke dispersal information.
- DI-1202

Escaped prescribed fires within the Park/Preserve/Monument will follow protocols outlined in the Statewide AOP, Clause 28- Escaped Prescribed Fires. A WFDSS report will be initiated and the fire will be declared a wildfire and treated as such.

Monitoring reports and documentation will follow protocols defined in the Regional NPS Monitoring Protocols. (Appendix F)

e. Monitoring

Prescribed fire and non-fire fuels treatments should be designed to meet the objectives of each project and therefore the components of monitoring should be developed based on the project objectives. The following guidance for monitoring prescribed fire and non-fire fuels treatment are described in RM-18 and provided below:

Prescribed Fire Monitoring Required, RM-18, Chapter 8, 4.4.2 (2008)
"Data collected to determine the immediate or short-term effects of a fire or fire management activity, at a level sufficient to evaluate whether stated management objectives were achieved." **Note:** Plots are not required in each specific project, but the monitoring program should include representative data for each key vegetation and fuel complex with specific objectives (monitoring type) in the park prescribed fire program.

Non-fire Treatment Monitoring Required, RM-18, Chapter 8, 4.4.3 (2008)
"Non-fire fuels treatments must be monitored for pre- and post-treatment conditions at a level sufficient to determine whether the objectives of the treatment were met."

Monitoring objectives and methods are required component of the Prescribed Fire Plan and Fuels Plans for all projects. Monitoring should be designed to meet the objectives of each project and therefore the components of monitoring should be developed based on the project objectives. Guidelines for monitoring prescribed fires and mechanical treatments within WEAR are provided in Section 5.2 Monitoring and protocols for monitoring are provided in Appendix F.

f. Historic Treatment Map

There have been two fuel mitigation projects in Western Arctic National Parklands. A map will be included in the future.

4.5.3 Prescribed Fire Treatments

a. Guidance

At present only site specific natural debris pile projects are planned to be treated using prescribed fire treatments in Western Arctic National Parklands. Future Prescribed fire use in the Park/Preserve/Monument may be considered when paired with mechanical fuel treatments to reduce fuels around critical fire sensitive resources within the boundary of the Park/Preserve/Monument. Any prescribed fire projects will adhere to Interagency Standards for Fire and Fire Aviation Operations Chapter 17, and the Interagency Prescribed Fire Implementation Procedures Reference Guide, as well as incorporate guidance from RM 18, Chapter 7-Fuels Treatments. Additionally, fire staff conducting the prescribed fire will adhere to all stipulations as outlined in the 2010 Statewide Master Agreement Clause 22- Prescribed Fire and Fuels Management

b. Treatment Review

NPS staff involved in fuels treatments will utilize an adaptive management process to plan, implement, and evaluate the fuels management program. See RM 18-Chapter 7-Fuels Management for specific guidance.

4.5.4 Non-Fire Fuel Treatments

There currently are approved non-fire fuels treatments projects for Western Arctic National Parklands. The use of mechanical fuel treatments is a viable option for concerns regarding fire-sensitive resources in the Park/Preserve/Monument.

a. Guidance

The planning and implementation of non-fire fuels management projects will be in accordance with Reference Manual 18, Chapter 7- Fuels Management and Chapter 8-Fire Ecology and Monitoring.

b. Planning

Planning efforts for Non-Fire fuels treatments will be in accordance with requirements described in RM 18 Chapter 7 Section 6 - Non-Fire fuels treatment. A non-fire treatment plan template is available in RM-18.

c. Treatment Review

Post treatment reviews will be an integral part of the continuation of fuels treatments. An AAR style approach will be taken regarding each project receiving treatment during the field season. Fire staff will provide monitoring data and analysis, digital photographs, and appropriate maps to Park Management and Regional Fire staff to aid in the evaluation process. Chapter 5.0 – Adaptive Management of this plan describes in detail the adaptive management process. See Section 4.5.2 Annual Action for Post Fire Season Review.

4.6 Prevention, Mitigation & Education

The effectiveness of prevention and mitigation efforts is highly dependent on the education of the appropriate audience. The NPS will make every effort to inform the public on all issues pertaining to wildland fires in Alaska and specifically, Western Arctic National Parklands. Emphasis will be placed on the responsible use of fire in an effort to minimize unwanted human

ignitions and the acceptance of lighting ignitions and their ecological role in the ecosystem in which people live. Interagency cooperation will be used, to the greatest reasonable extent, to ensure a unified prevention message is being sent to all Alaskan's.

4.6.1 Prevention/Mitigation

Western Arctic National Parklands, historically, has a varied number of fire starts and number of acres burns. However fire starts in this region of the state are a annual occurrence. When significant drying conditions exist and burning conditions are optimal for large fire growth the Western Area Fire Management officer will notify the Agency Administrator, or delegate, of the wildfire conditions. Management staff at Western Arctic National Parklands will utilize the Fire Communication and Education Plan guidelines for educating, local residents, visitors and park employees of the dangers of the present fuel conditions. See Appendix S.1 for fire history graphs.

4.6.2 Communications/Education

Mission: To pro-actively support the Alaska NPS Wildland Fire Management Program through a comprehensive communication and education program that emphasizes wildland fire management and the role of fire in ecosystems.

A. Program Capabilities

Currently the Regional Fire Communication & Education (RFC&E) specialist spearheads and provides guidance to all Park Area Fire Management and Public Information Programs.

1. Contact List

Contact the Western Arctic Parklands (WEAR) Fire Management Officer (FMO) for a list of the current fire staff. For current information about agency leadership and staff beyond fire management, local emergency responders, clinics, neighbors, local, regional, tribal officials, local schools, researchers, and community members, contact the WEAR headquarters or the Chief of Interpretation based in Kotzebue, AK. An Alaska media contact list is included in the appendix. WEAR specific target audiences are also listed in the WEAR fire communication plan located in Appendix M.

2. Materials

Western Area Fire Management Program maintains a cache of NPS and interagency fire brochures such as Wildland Fire in National Parks, Firewise Alaska, Smoke and Fire in Alaska, Safe Burn Barrels, and Safe Campfires. Contact the WEAR FMO for materials. Alaska interagency brochures can also be downloaded at http://fire.ak.blm.gov/administration/awfcg.php. General fire management print-on-demand documents are located at http://fire.ak.blm.gov/administration/awfcg.php. Information about wildland fire key messages and non-personal communication methods is in the WEAR fire communication plan, located in the appendix. WEAR also has a wildland fire education trunk which contains curriculum, books, and videos.

3. Press kit

This package is put together for the media, generally for a specific event/incident. It should include, at a minimum, a news release about the incident, fact sheets, incident maps, the park brochure or park newspaper, wildland fire brochures, and additional information reporters might need (a map with telephone and power outlets highlighted,

for instance, if they are actually at headquarters.) Since having a reporter at the park to cover an incident is a good chance to tell a broader story, a press kit is also a good vehicle to include recent news releases, story tips, materials on other park events and partnerships.

4. Online Resources

All parks at Western Arctic Parklands currently have an inactive current fire information webpage. Within 24 hours of a fire igniting at a unit, the park web manager will activate the current fire information page and the public will access it from the park's homepage. Fire staff or a PIO will write consistent and timely content for the page, and send the information to the park web manager for posting. Fire staff or a PIO will also upload current fire information, photos, and maps to NPS Fire News, an online portal for fire information. A link to Fire News is located on the park current fire information webpage. WEAR maintains Twitter accounts @BeringLandNPS, @NoatakNP, @KobukValley, and @CKrusensternNPS and the Alaska region maintains a Twitter account @AlaskaNPS. The Alaska region also has a Facebook account Alaska National Parks, in order to reach new virtual audiences and highlight all Alaska parks and programs. Other salient online resources include:

- http://www.nps.gov/noat
- http://www.nps.gov/kova
- http://www.nps.gov/cakr
- http://www.nps.gov/bela
- http://www.nps.gov/akso
- http://www.nps.gov/fire/
- http://fire.ak.blm.gov/
- http://www.nifc.gov/

B. Communications Step-Up Plan

In many Alaskan towns and villages, residents are more familiar with wildland fire than with NPS employees. Some AK NPS employees are not familiar with wildland fire and park staffs may not have experienced wildland fire events during their tenure in Alaska. Furthermore, Information Officers may be unfamiliar with Alaska wildland fire behavior and management and may require some assistance from AK NPS Fire Management staff. It is of utmost importance to keep these factors in mind while assessing the need for an Information Officer.

A wildland fire ignites on National Park Service land and AK NPS Fire Management and protection organizations initiate the appropriate response based upon the Alaska Interagency Wildland Fire Management Plan and NPS policy. During this process, AK NPS Fire Management and park staff must anticipate fire and smoke events and distribute information to internal and external audiences before the events impact them. Consider Information Officer assistance when:

Sizing Up the Fire

- Fire threatens structures
- Many large or small fires throughout the area
- Fire or smoke visible from town
- Fire moves towards a town or village
- Smoke impacts health or transportation in town, village or throughout the area

- Fire triggers media interest

Evaluating AK NPS Fire Management

- Fire Management staff anticipate not being able to, or cannot accomplish all outreach tasks.
- Internal and external communication methods such as local NPS Fire News updates (via Lotus Notes) and national NPS Fire News (located on the internet at http://data2.itc.nps.gov/fire/public/pub_firenews.cfm) no longer fulfill the needs of the incident.
- AK NPS Fire Management staff receives more calls or comments of concern regarding the management of the fire than they can sufficiently handle.

Evaluating AK NPS Employees

- NPS staff receives more calls or comments of concern regarding management of the fire than they can sufficiently handle.
- NPS staff cannot adequately respond to the number of information requests from local residents, visitors, and other park staff.
- NPS staff cannot fulfill fire related outreach needs.
- NPS staff voice concern about wildland fire management.
- A number of NPS employees or in particular, key staff members, are unfamiliar with AK wildland fire management and wildland fire in the boreal ecosystem.

Evaluating the Community

- Community vocalizes concern about the management of the fire.
- An incident of this nature has not recently occurred in this area.
- Community (at large) is unfamiliar with wildland fire and smoke thus reacts to it in either a negative or positive manner.
- Fire management activities or smoke impacts the community for more than a few days.
- Incident affects the economic viability of the community.
- Community has negative opinions about the NPS or government.
- Similar incidents occurred in the area and community members were affected in a negative way and still harbor and vocalize those emotions.
- Health impacts occur and/or evacuations are planned for or initiated.
- Incident directly affects the community. Such as…
  - Threat or perceived threat to personal property or welfare
  - Impacts planned events or historical happenings
  - Creates resource management issues
  - Their quality of life
  - Effects on their value systems
- Incident will impact the common thread that holds this community together. Such as…
  - Hunting grounds, berry picking opportunities, recreational areas, natural beauty of the surrounding areas

During a fire incident that warrants an Information Officer, things AK NPS Fire Management, Information Officer and park unit must do in order to be successful…

- Listen to internal and external audiences.
- Make personnel available to answer questions.

- Actively seek out leaders in the community such as Village Councils, Tribal Council, Community Elders to communicate with.
- Always try to make sure the community hears it from NPS or involved agency first.
- Evaluate the most effective means of communicating to town or village residents and residents in the surrounding areas, for example, local radio station, local newspaper, Alaska Rural Communication System.
- Involve community members when giving out information.
- Continually assess community information needs.
- Work closely with all affected agencies (other land managers and protection organizations).

An Information Officer can be informally requested or resource ordered. Situations that may warrant an informal request include:

- AK NPS Regional Fire Communication and Education Specialist is available because this person is considered a local NPS resource.
- AK NPS employee where incident occurs is available and the workload does not warrant a full time IOF.

Situations that may warrant a resource order include:

- FMO must look for assistance outside of park/preserve experiencing fire incident
- Workload demands a full time IOF be present.
- Size or complexity of the incident exceeds the experience, training or capabilities of the local IOF.
- Size of the information staff needed exceeds the capabilities of the local IOF.
- When local conditions (political or social) indicate that a non-local IOF may have more success in delivering pertinent fire related messages.

If and when it is determined that an Information Officer is needed, there are several potential candidates to choose from. A suggested prioritization of available Information Officers is listed here:

1. AK NPS Regional Fire Communication and Education Specialist
2. AK NPS employee where incident occurs
3. AK NPS employees
4. AK agency employees and/or residents
5. NPS or other agency employees

The AK NPS Fire Management Officer has the discretion to select an IOF1, 2, 3, or trainee for the fire incident. The size and complexity of the fire incident often foretells what type of Information Officer is needed.

Once the IOF arrives, encourage him/her to seek out support from local NPS employees, other local agency employees and community members. AK NPS Fire Management staff should continue to provide information about the fire to the best of their ability and as needed by the Information Officer in order to fulfill the information needs of the community, visitors, and park/preserve staff. AK NPS employees should be strongly encouraged to participate in information activities as they are initiated by the Information Officer.

- Western Area Fire Management Officer, Fire Management Staff, and Regional Fire Communications and Education Specialist will work together to effectively inform

and educate National Park Service employees and the public about the fire management program, the role of fire in the environment and the Firewise prevention concepts.

- The Regional Fire Communications and Education Specialist will work with Fire Management Staff, Interpreters, Education Specialists, Prevention Specialists and other interested parties, to feature the fire management plan, the role of fire in the environment and Firewise concepts in park brochures, exhibits, bulletin boards, interpretive presentations and off-site programs.

- The Regional Fire Communications and Education Specialist will create a specific outreach/public information plan for WEAR.

- During ongoing fires, the fire management staff will be responsible for fire information dissemination. The fire management staff will communicate orally and in writing the current fire situation to NPS employees, interagency partners and the media. Press releases and articles will be written by the either the Regional Fire Communications and Education Specialist or the Public Information Officer and released to local, and when necessary, national media. If an Incident Management Team is deployed to manage a fire that affects WEAR, NPS information personnel will interact with and support the team's Public Information Officer.

- When fires are visible and likely to continue, the Fire Information Officer may choose to establish a fire information center near the incident. All requests for incident information will be channeled to the center. Accurate and timely information will be compiled, organized and disseminated to the public and news media.

4.7 Air Quality/Smoke Management

4.7.1 Air quality issues

All fire management actions at Western Arctic National Parklands will be conducted in full compliance with local, state, and interstate air pollution control regulations as required by the Clean Air Act, 42 U.S.C. 7418. The Alaska Department of Environmental Conservation issues open burning permits. The National Park Service has been an active participant with the Alaska Department of Environmental Conservation in the development of the Alaska Smoke Management Plan. The optimal goal of a smoke management plan and program is to protect public health and the environment while allowing for reasonable resource management (e.g. Use of Wildland Fire and Prescribed Fire). Addressing smoke management concerns is a critical component of a Prescribed Burn Plan and the Wildland Fire Decision Support System.

Wildfire smoke could impact local towns and villages in the surrounding area. Appropriate air quality advisories will be issued to effected communities in accordance with interagency Smoke Education Communication Strategy policy.

Regional Haze Program

No class one Airsheds exist in Western Arctic Parklands or this portion of the state.

It is recognized that fire and its associated smoke is a part of the natural condition in Alaska and complexities such as differentiating transport of smoke and dust from Russia, China, Canada and other Northern European countries need to be quantified. A copy of the current Regional Haze Program is available from the Alaska DEC.

EPA Tile 18, Chapter 50: Air Quality Control Section 50.030: State Air quality Control Plan is the current compliance document in effect in the state of Alaska.

4.7.2 Smoke Management Program

Smoke assessments are the responsibility of both the Jurisdictional and Protecting agencies. The need for air resources advisors is increasing and additional technical expertise for addressing air quality and health related issues may be available through the Alaska Department Environmental Conservation (ADEC). The ADEC is the regulatory agency responsible for air quality and smoke management in Alaska and is represented on the AWFCG.

The AWFCG approved Smoke Effects Mitigation and Public Health Protection Protocols strive to explain the inevitable presence of smoke during the Alaska fire season. The protocols give detailed guidance to the agencies relevant to information dissemination to the public and other agencies about forecast and current smoke management concerns.

Current smoke information and forecast, regulations, advisories, and educational materials are available at the ADEC website. The ADEC also issues open burning permits. These permits are required prior to the use of any pre-planned ignitions

The Alaska Enhanced Smoke Management Plan for Planned Fire (ESMP) was developed by ADEC in coordination with the AWFCG Air Quality and Smoke Management Committee of which the NPS is an active participant. The optimal goal of a smoke management plan and program is to protect public health and the environment while allowing for reasonable resource management (e.g. The use of Wildland Fire and Prescribed Fire). Addressing smoke management concerns is a critical component of a Prescribed Burn Plan and wildland fire planning efforts and decision support systems (WFDSS). The ESMP and its appendices are available online.

All fire management actions at Western Arctic National Parklands will be conducted in full compliance with local, state, and interstate air pollution control regulations as required by the Clean Air Act, 42 U.S.C. 7418.

4.8 Data & Records Management

Immense investments of time, effort and finances go into obtaining fire information needed for federal reporting purposes, thus it is imperative that the data be preserved, safeguarded and permanently archived accordingly. NPS reference manual 18 clearly states the data's many purposes in the dialogue below.

"Information collected is important data used in long-range wildland fire planning, operational decisions, general information reporting, and programmatic performance analysis. It is imperative that the park collect, record, and input wildland fire data accurately and promptly and store

permanent records accordingly. The data contained in the wildland fire reporting system is frequently requested and used to fulfill a number of queries from interested members of the public, lawmakers, and researchers – all who rely on the accuracy of the reports." (NPS,RM 18)

All reporting will annually established NPS Fire Business Rules. Further guidance pertaining to fire reporting and associated details are available in Chapter11 of RM 18. Copies will be provided to Western Arctic Parkland NPS managers as requested.

Fire/Fuels/Budget Submission and Reporting

WFMI Fire Reports

The NPS Wildland Fire Report is the standard format for submission of fire data into the Department of Interior Wildland Fire Management System (WFMI). The NPS Alaska Western Area Fire Management Officer will take the initial information, verify all information contained in the report is correct, and complete a hardcopy Wildland Fire Report. An electronic Fire Report is provided to the Regional Fire GIS Specialist for review and inclusion into the nationally DOI maintained WFMI Database. The Alaska Western Area FMO will also ensure prescribed fires, false alarms and support actions are entered into the WFMI Database through the process described above. BLM Alaska Fire Service will maintain the original Protection Agency fire reports in their office in Fairbanks, Alaska. Final NPS Fire reports reside at the offices of Alaska Western Area Fire Management in Denali Park, Alaska.

WFDSS Decision Document

Wildland Fires Decision Support System processes and analysis that help determine and document decisions regarding the management of individual ignitions will follow national direction. The Current national policy for the National Park Service as well as all agencies in the State of Alaska is to use the Wildland Fire Decision Support System (WFDSS) and analysis tools such as FARSITE, FlamMap, and FSPro. A hardcopy fire report filed at the offices of Alaska Western Area Fire Management in Denali Park, Alaska.

NFPORS Reporting

Fires with resource benefit objectives, prescribed fire, fuels treatments and fuels activities will be entered in the National Fire Plan Operations and Reporting System (NFPORS) also have a hardcopy fire report filed at the offices of Alaska Western Area Fire Management in Denali Park, Alaska. Reporting timeliness will remain in compliance with standards specified in Chapter 11 of RM 18 and NPS Fire Business Rules.

Fuels Project Planning and Report

The Alaska Western Area Assistant Fire Management Officer will ensure fuels project planning and final report preparation, content and format will follow RM 18, Chapter 7 specifications.

Readiness Review Documentation

Complete Readiness Reviews (Checklists) Annually - internally completed by Area program overhead with oversight by Western Area FMO. Area completed checklists (with annotations/findings that Regional Office can work from support-wise) to be posted on AK Regional shared network "Wanshare" for given year. Alaska Regional FMO will archive locally at ARO. Western Area will archive documentation at Denali Park, Alaska. Readiness reviews should be completed before June 15 - preferably sooner.

Program Review Documentation

Area Program Reviews - To be completed every 3 years. The Program Review is intended to be completed by Alaska Regional Office, Alaska Eastern Area Fire Management Program, and potential Interagency personnel. Program review documentation, findings and recommendations will be posted on AK Regional shared network "Wanshare". Alaska Regional FMO will archive locally at ARO. Western Area will archive at Denali Park, Alaska.

Budget Submission/Reporting

Line Item requests (Additional staffing, fire facilities (construction/improvements, etc) are identified by the Park Unit and Alaska Western Area Fire Management Officer and submitted to the AK Regional Fire Management Officer. Fuels Management (potentially including) related project funding is primarily identified in the five year fuels plan and requested through the NFPORS planning process annually. See annually established NPS Fire Business Rules (NPS Wildland Fire and Aviation Financial Management Guide).

Compliance Submission/Reporting

Alaska Western Area Fire Management Officer, or delegate annually submits project compliance documentation through the Western Arctic National Parklands People Environment Public Comment (PEPC) system. Timelines are established annually by the WEAR compliance specialist. Typically PEPC submission must be complete by March.

Research Permit and Reporting System

When research permits are required the Alaska Western Area Fire Management Officer will be the lead to ensure that the electronic Research Permit and Reporting System procedures and reporting requirements are submitted.

AWAFM Annual Report

Annual reports, though not required, of the Alaska Western Area Fire Management Program should be created to provide a legacy of activities completed by the program. Annual reports have been completed periodically through FY 2005. As funds are made available and program priorities allow AWAFM annual reports will be completed.

Geographic Information Systems

Point locations of fires affecting Western Arctic National Parklands will be available as a GIS dataset stored in the NPS Alaska Region's GIS Permanent Data Set. The Regional Fire GIS Specialist is responsible for updating this layer on an annual basis. Final fire perimeter polygons will be housed in the interagency statewide polygon fire history layer (maintained by the BLM Alaska Fire Service) as well as any NPS agency specific polygon fire history datasets. The Regional Fire GIS Specialist is responsible for insuring that final fire perimeters are incorporated into these datasets and for insuring that current versions of these datasets are available through the Alaska Region's GIS Permanent Data Set.

NPS/USGS Burn Severity

For fire's greater than 500 acres in size, a burn severity assessment will be completed following the protocols of the NPS/USGS Burn Severity Mapping Project and/or the Monitoring Trends in Burn Severity Project. These projects map the burn severity of wildland fires using pre- and post-fire Landsat satellite imagery. If conditions allow, both an

Initial Assessment and Extended Assessment will be completed for each fire. Once the assessments are completed, burn severity data will be available for download from the NPS/USGS Burn Severity Mapping Project website (http://burnseverity.cr.usgs.gov/) and/or the Monitoring Trends in Burn Severity Project website (http://www.mtbs.gov/). In addition, the burn severity data and associated Landsat satellite imagery will be available through the NPS Alaska Region GIS Permanent Data Set. The Regional Fire GIS Specialist is responsible for requesting burn severity assessments for Alaska NPS fires and for incorporating burn severity GIS data deliverables into the NPS Alaska Region GIS Permanent Data Set.

Table 7: Reporting Requirements and Responsibility

Action	Responsible Party	Annual Deadline
Annual FMP Review	Area FMO or Delegate	June 1
Incident Reporting (Final Final Report)	Area FMO and BLM AFS- Galena Zone (Protection Agency)	October 31
WFMI Reporting	Area FMO or Delegate and AK Regional GIS Specialist	October 31
WFDSS Decision Document	Superintendent or Delegate	Redbook
NFPORS	Area FMO or Delegate and FPMA	NPS Fire Business Rules
Fuels Treatment Plans	Area AFMO or Delegate	RM-18, Chapter 7
Readiness Review	Area AFMO or Delegate	June 15
Program Review	AK Regional FMO	Tri-Annually
Budget Submissions	AK Regional FMO	NPS Fire Business Rules
Compliance Submission	Area AFMO or Delegate	Approx. March
Research Permit and Reporting System	Area FMO or Delegate and Principle Investigator	TBA
Annual Report	Area Fire Program Management Assistant (FPMA)	TBA
Program Accomplishments	Area FMO or Delegate	NPS Fall Fire Review (October)

- *Reference the Interagency Incident Business Management Guide*

4.9 Organizational & Budgetary Parameters

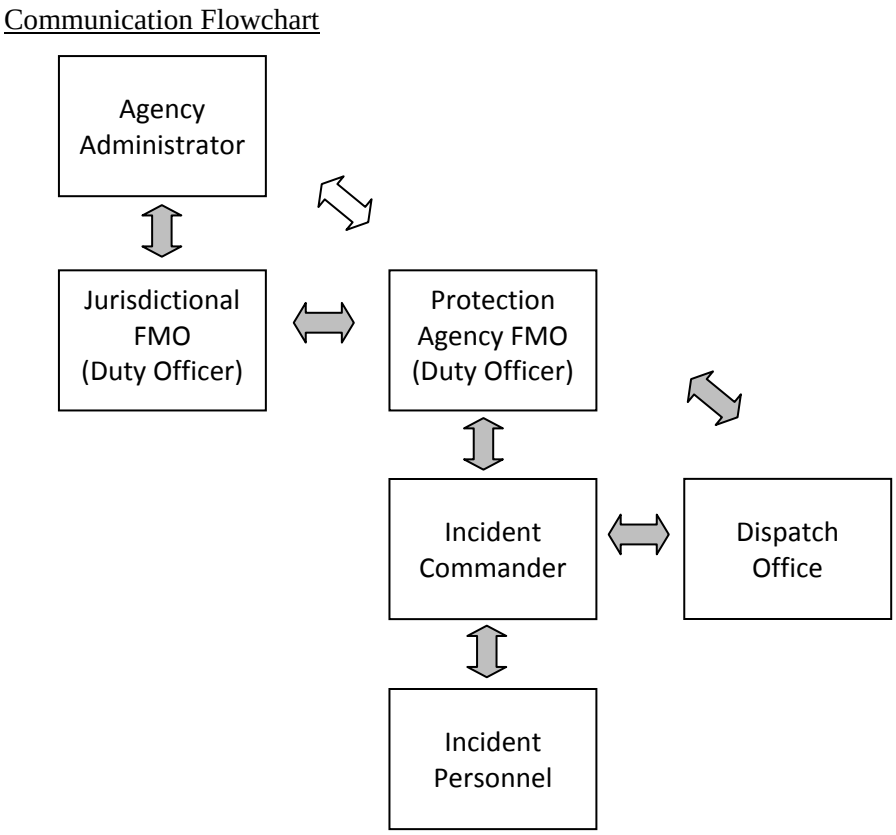
Alaska Interagency Cooperation and Organizational Structure

To ensure safe and efficient operations, a basic understanding of the cooperative relationship between the NPS fire management program and the other land management agencies in Alaska is imperative for all personnel. Departmental Manual 620 Chapter 2 describes the consolidation of wildfire suppression services for all Department of Interior Lands in Alaska under the Bureau of Land Management. The 2010 AIWFMP, 2011 Alaska Statewide Master Agreement and its associated AOP as well as the 2011 Alaska Interagency Mobilization Guide work together to describe the consolidation and coordination of wildfire suppression services for all lands in Alaska.

According to aforementioned documents, the BLM Alaska Fire Service -- Galena Zone provides suppression services and maintains operational control for implementing wildfire

suppression tactics on Western Arctic National Parklands administered lands. It is the duty of the Western Arctic staff together with the NPS Western Area Fire Management Officer to ensure that all suppression services contribute to the achievement of the management goals of the Park/Preserve/Monument as well as that of the National Park Service. See Figure 6 below regarding Western Arctic National Parklands, Alaska Western Area Fire Management and Protection Agency for coordination on Incidents.

Figure 7: Western Arctic Parklands and BLM AFS Galena Zone Coordination



NPS General Organizational Structure

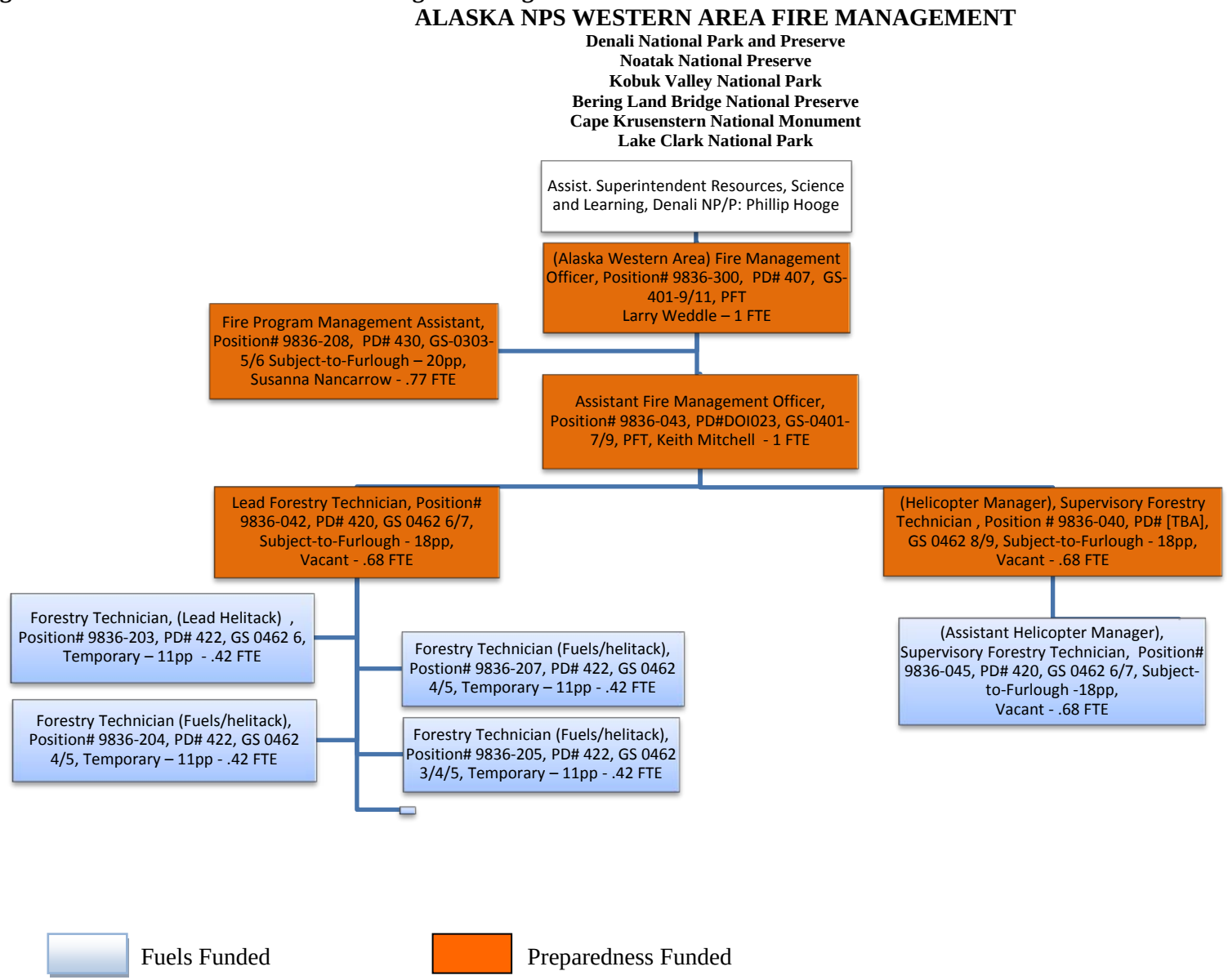
The Western Arctic National Parklands are a Park Unit where the administration of fire management is provided by the Alaska Western Area Fire Management program duty stationed in Denali National Park and Preserve. The Western Area Fire Management officer coordinates and implements the WEAR Fire Management Program. The Western Area Fire Program also provides fire planning and support to Denali, and Lake Clark. This is a shared position between all parks and no single park maintains ownership or priority over another. In all fire management related activities with the perspective Park Units that Alaska Western Area Fire Management administers fire management for the Western Area FMO reports to the Superintendent. In most cases a previously identified Fire Coordinator for each Park Unit will act as a liaison between said unit and the Alaska Western Area Fire Program.

The NPS develops the strategic objectives and direction on how a wildfire will be managed and communicates the objectives and direction to the Protection Agency. The AWAFM Duty Officer, typically the Fire Management Officer, serves as the liaison for wildfire suppression services between the Superintendent and the Protection Agency Fire Management Officer.

Necessary fire related project work, fire research and additional monitoring mandated by NPS policy will be coordinated from the NPS Alaska Western Area Fire Management Office as warranted.

Unless otherwise delegated, the Park Superintendant is the Agency Administrator for their Park Unit. The Agency Administrator retains responsibility for ensuring that Fire Management within Western Arctic National Parklands is managed in accordance with current governing land management documents. (General and Resource Management Plans, Wilderness Management Plan, Subsistence Management Plan, etc…)
The Agency Administrator, unless delegated otherwise, acts as the key communication link between Western Arctic National Parklands and the Alaska Western Area Fire Management Office regarding fire management issues and concerns.

Figure 8: Alaska Western Area Fire Management Organization



Duty Officer

An NPS duty officer is assigned at all times during the summer season when fire potential exists. The duty officer for Western Arctic National Parklands is routinely the Western Area FMO. FMO. When the FMO cannot fulfill the role of the duty officer, the Assistant FMO or previously established, with an approved delegation of authority, Western Area lead fire management staff will be assigned in the order listed below.

1. Assistant Fire Management Officer
2. Helicopter Manager
3. AK NPS Regional FMO
4. Assistant Helicopter Manager
5. Supervisory Forestry Technician

The order of contact is communicated to the Protection Agency dispatch offices annually and updated with current contact information. The Fire Program Management Assistant is included in the contact list to assist as necessary, though not in the duty officer role.

The FMO may assign the duty officer position to any fire management position, including detailed support positions, as necessary in his/her absence to balance meeting the needs of the each park unit's fire program without compromising safety provided an approved delegation of authority exists from the Superintendent (ie. The Duty Officer serves as the liaison between the Western Arctic Parkland Superintendent and the appropriate Protection Agency (ie. BLM Alaska Fire Service, Galena Zone) on all wildland fires in the Western Arctic National Parklands.).

The duty officer oversees and documents fire operations in the Park/Preserve/Monument and does not function in any ICS role during their role as duty officer. The primary role of the NPS duty officer is to ensure compliance of NPS policy on incidents within the Park/Preserve/Monument. They also serve as a vital communication link between park management and the Protecting Agency. See Section 4.3 Management of Unplanned Ignitions for specific procedures/activities the Duty officer will follow once notified of a fire within the Western Arctic Parklands.

Similarly, the protecting agency will also have a duty officer assigned. More duty officer functions can be found in Ch 3 of the *Interagency Redbook*. Primary responsibilities of the BLM Alaska Fire Service – Galena Zone are to coordinate and prioritize suppression actions and resource allocation to meet the strategic objectives as identified by the Jurisdictional Agencies.

Cooperation with Alaska Fire Service

In order to ensure safe and efficient operations, a basic understanding of the cooperative relationship between the WEAR fire management program and the BLM-Alaska Fire Service (AFS) is imperative for all personnel. As specified in the Alaska Interagency Wildland Fire Management Plan and the 2010 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2010 Alaska Statewide Annual Operating Plan the Alaska Fire Service is responsible for providing fire suppression services on all wildland fires occurring within WEAR. The management and staff of Western Arctic Parklands, in turn, will ensure that all suppression services contribute to the achievement of the management goals of the Park/Preserve/Monument

and the National Park Service, and to the greatest extent possible support suppression efforts as required.

Additional Resources

Western Arctic may use personnel to assist in information collection above and beyond the information provided by the AFS. These personnel may work directly for the NPS Western Area Fire Management Officer or, when an Incident Commander is assigned, directly for the IC. The NPS Western Area Fire Management Officer and the Protection Agency FMO will work together to determine the chain of command for these individuals and the dispersal of the information.

Agency Administrator

An Agency Administrator or Representative will be designated for each incident at any Western Arctic Park, Preserve or Monument. The Agency Administrator Representative will function as the direct representative of the WEAR Superintendent and as such will be responsible for the identification and accomplishment of WEAR and NPS resource management goals and suppression constraints. The Agency Administrator will prepare, in consultation with the Western Area FMO and Protection FMO, and sign key decision-making and validation documents (e.g. Wildland Fire Decision Support System). The Agency Administrator may also request that additional personnel be ordered to assist specifically with the accomplishment of WEAR and/or NPS goals (e.g., resource advisors, monitors, fire behavior analysts, etc.).

Incident Command Structure

For incidents at WEAR, resource advisors will report to the Planning Section Chief or Incident Commander as per NWCG specifications for Incident Command structure. Other personnel requested specifically to assist with the accomplishment of agency or WEAR resource management goals (e.g. monitors, fire behavior analysts, fire-use module personnel, etc.) will report to the Galena Zone FMO. Exceptions could occur if mutually agreed upon between the Western Area FMO and the Galena Zone FMO. If resources are placed under the supervision of the Western Area FMO these personnel will be briefed on contingent procedures and alternative chain of command for situations in which the Western Area FMO departs the incident or is out of regular contact. Depending upon the complexity of the incident these individuals may be assigned to the appropriate Incident Command element.

In summary, NPS personnel may participate in fire management operations within the Parklands in two distinct ways:

1. NPS employees may serve directly with operational forces (or other branches of command), under the supervision of the IC provided by AFS or ordered through the interagency mobilization system. For instance, a WEAR employee assigned to assist smokejumpers during line construction on a small wildland fire would report directly to a jumper-in-charge dispatched from Fairbanks.
2. NPS employees may work to help ensure the achievement of WEAR management goals under the supervision of the Western Area Fire Management Officer (or the Planning Section Chief or Incident Commander, in the case of NPS personnel serving as resource advisors). For example, an NPS employee working as a

monitor in support of the WFDSS validation process might report to the Western Area FMO (If mutually agreed upon by the Protection and Jurisdictional FMO; a WEAR staff member advising an incident command team on the presence of sensitive resources would report to the Planning Section Chief or Incident Commander.

WEAR employees dispatched directly by the NPS may occasionally serve as interim Incident Commanders, as qualified, on WEAR incidents. These rare instances will be in consultation with the protection FMO. In most cases, however, operations will be conducted from the outset by the AFS, with WEAR managers focusing on the identification and achievement of resource management goals, the conduction of monitoring efforts when necessary and ensuring compliance with AIWFMP by suppression forces.

Fire Management Responsibilities for WEAR Personnel

In light of the interagency nature of fire management at WEAR as well as the shared nature of the Western Area FMO and fire crew, fire management responsibilities for individual employees are best explained in two steps. All personnel at WEAR have predetermined responsibilities within the fire management program; these fixed responsibilities are shown in Table 8 below. For specific incidents, however, any one of several appropriate personnel will fill specific functions. These incident specific functions, their organizational structure, and lists of personnel who may perform them are shown in Figure 8.

Relation of Fire Management Program to WEAR Organization

The Western Area Fire Management officer coordinates the WEAR Fire Management Program. Although administratively based in Denali National Park, the Area FMO also provides fire planning and support to WEAR, and Lake Clark. This is a shared position between all parks and no single park maintains ownership or priority over another. The Western Area FMO should be considered park fire staff in each of the units he/she is responsible for. General duties for the Western Area Fire Staff are as follows.

Area Fire Management Officer – Oversight of all aspects of the fire programs for the area parklands, coordination of fire management strategies between the Area Parklands, Superintendent and the Protection Organization, coordinate and prepare wildland fire decision documents, keep Area parkland Superintendents informed and engaged in the fire organization.

Assistant Fire Management Officer (Wildland Fire Operations Specialist) – Supervises the daily operations of the area fire program. Assists the Area FMO in oversight and coordination responsibilities. In the absence of the Area FMO will assume all responsibilities of the Area FMO in an acting capacity. Assists as directed in all aspects of the area fire program.

Fire Program Management Assistant – Provide administrative and budgetary expertise to the fire program. Assists in the administrative duties in planning and reporting for the program and works to minimize the administrative burden on the rest of the area fire program staff.

Helicopter Manager – Provides leadership to the aviation portion of the area fire program. Leads, manages and administers the Fire Exclusive Use helicopter contract for the area fire program. Assists in the staffing of the NPS National Contract Helicopter, based at Great Smokey National Park, between January through May. The helicopter manager will assume the AFMO responsibilities in the absence of the AFMO. Assists as directed in all aspects of the area fire program.

Assistant Helicopter Manager – Assists the Helicopter Manager is all duties as stated above. Assists the Supervisory Forestry Technician with hazard fuels projects. In the absence of the Helicopter Manager assumes the Helicopter Managers responsibilities. In the absence of the Supervisory Forestry Technician assumes the supervision of the five person fuels/Helitack/ engine crew. Assists as directed in all aspects of the area fire program.

Supervisory Forestry Technician – Hires and supervises the five person fuels/Helitack/engine crew. Responsible for hazard fuels project planning and implementation. Oversees the readiness of the Type 6 engine. Assists as directed in all aspects of the area fire program.

Lead Helitack (Forestry Technician) – Qualified helicopter crewmember that assists with all aspects of the fuels program and works with the fire crew. Assists as directed in all aspects of the area fire program as qualified.

Forestry Technician (Fuels/Helitack) – Qualified or trainee helicopter crewmember that assists with the implementation of hazard fuels, fire ecology, Comm/Ed and Wildland Fire programs. Assists as directed in all aspects of the area fire program as qualified.

Table 8: Predetermined Fire Management Responsibilities

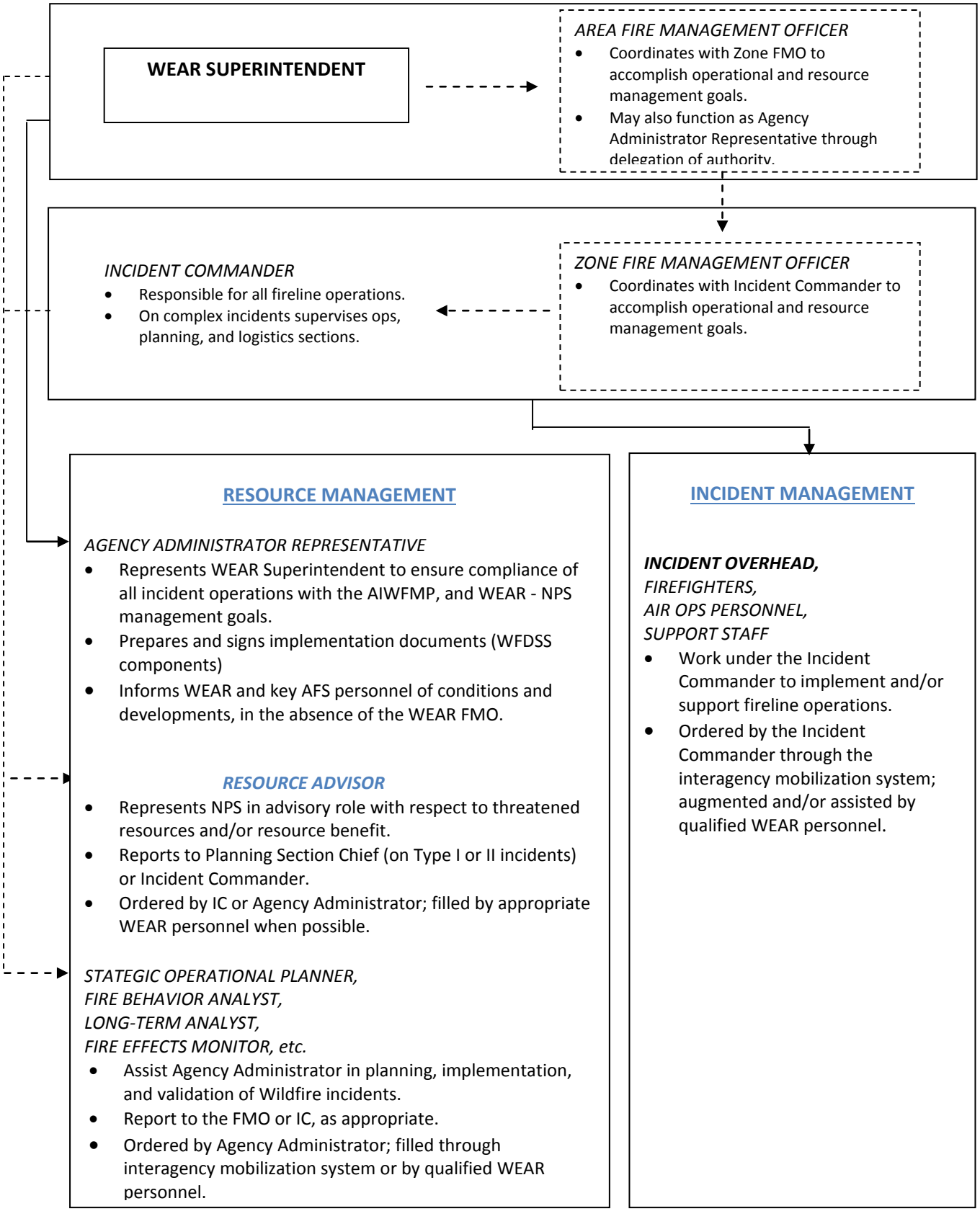
Position:	**Superintendent**
Fire management role:	The Superintendent of Western Arctic National Parklands is responsible for the planning and direction of all activities and programs and as such is ultimately responsible for any wildland fire operation at WEAR. The Superintendent may, however, choose to delegate any or all fire management responsibilities to appropriate personnel (e.g., Fire Management Officer, etc.).
Specific responsibilities:	• In conjunction with the protection organization FMO approves Limited Delegation of Authority and provides briefing and evaluation of Incident Management Teams. • Serves as Agency Administrator unless delegated. • Approves Non-Standard responses. • Approves prescribed fire plans. • Approves mechanical hazard fuel reduction plans. • Approves use of retardant and/or heavy equipment in non life-threatening wildland fire situations. • Participates in all official fire reviews. • Participates in NWCG functions as qualified.
Position:	**Area Fire Management Officer**
Fire management role:	The Western Area FMO oversees and coordinates the WEAR fire management program. Responsibilities listed below may be delegated to appropriate personnel (including, typically, the Chief of Resources, area fire staff, and the Eastern Area FMO).
Specific responsibilities:	• Works with Zone FMOs who will communicate intent with the Incident Commander and protection organization personnel. • May serve as Agency Administrator Representative for WEAR incidents when feasible. • Ensures that WEAR Superintendent/staff and key AFS personnel are informed of pertinent fire conditions and/or situations. • Works with WEAR staff, adjacent land owners and AFS zone managers to determine and adjust boundaries and strategies for WEAR FMUs. • Prepares Prescribed Fire Plans. • Prepares Mechanical Fuel Reduction Plans. • Represents Region and WEAR on NPS or interagency task groups/committees and in agency and interagency training. • Ensures the education of WEAR staff on fire management issues. • Participates in all official fire reviews. • Prepares and maintains fire records and reports. • Prepares funding proposals and manages the WEAR fire accounts. • Manages the WEAR fire cache and coordinates acquisition of supplies. • Ensures qualifications of staff. • Serves as liaison with regional office staff. • Ensures Federal Fire Policy is followed. • Participates in NWCG functions as qualified. • Coordinates with Regional FMO to ensure that WEAR fire management needs are identified and accounted for in budget preparation/allocation and are considered in regional fire management program.

Position	Division Chiefs and Supervisors
Fire Management Role:	The Division Chiefs and Supervisors provide their assistance and assistance of qualified employees as needed in the event of a large fire incident in WEAR or adjacent areas. This may include serving as resource advisors (natural, cultural, subsistence, etc). They also need to recognize and assist with national and regional fire response efforts when circumstance dictate and provide assistance with the preparing fire management related environmental compliance documents. These leaders also provide support to employees interested in maintaining or obtaining fire management qualifications.
Specific Responsibilities:	• Make qualified employees available for local, regional and national incidents. • Provide additional surveillance if needed on local /WEAR incidents • Assist with communication to local communities during incidents • Backfill local positions assigned to fire incidents • Work as Firefighter or other NWCG position as qualified. • Provide employee training needed to keep qualifications current or for the advancement of qualifications.
Position	**Local Park Fire Coordinator**
Fire management role:	The Local Park Fire Coordinator (LPFC) acts as the liaison between the Western Area FMO and the local park superintendent and staff. A close and open working relationship with the park superintendent is mandatory for this position. The WEAR LPFC functions as the conduit between Western Area FMO, Zone FMO, Superintendent and other key players of fire management program particularly if the Western Area FMO is not available. In the absence of on scene fire management staff, the LPFC may supervise WEAR fire operations as qualified.
Specific responsibilities:	• Provides guidance to the Western Area FMO in fire management issues pertaining to WEAR. • Advises WEAR Superintendent on approval of prescribed fire and mechanical reduction plans. • Advises Agency Administrator on Use of Wildland Fire for resource benefit. • Advises Agency Administrator and Incident Commander/overhead team of location and sensitivity of significant resources during wildland fire incidents. • Participates in all official fire reviews. • Assists with the development of fire management objectives. • Participates in NWCG functions as qualified.
Position	**Regional Communication and Education Specialist**
Fire management role:	The Regional Fire Communication and Education Specialist is responsible for informing and educating media, visitors, park staff and residents within and around WEAR about all fire management goals, objectives, and actions.
Specific responsibilities:	• Develops and coordinates on-going programs for educating the park staff and public about the area's fire ecology and the WEAR fire management program. • Develops and coordinates a plan for disseminating information during large or complex incidents. • Informs public of current fire situation. • Participates in NWCG functions as qualified.

	• Coordinates with AFS on prevention efforts. • Coordinates with AFS on information distribution.
Position	**Regional Fire Ecologist**
Fire management role:	The Regional Fire Ecologist is responsible for coordinating fire effects monitoring and fire related research within WEAR with other agencies.
Specific responsibilities:	• Coordinates all fire monitoring activities. • Develops fire research program for WEAR. • Coordinates with other agencies on research/monitoring. • Member of the Fire Effects Task Group. • Provides ecological expertise on vegetation communities and fire effects. • Represents WEAR and Alaska region on NPS and interagency fire ecology/effects taskgroups/committees.
Position	**Western Area Fire Staff**
Fire management role:	Western area fire staff is based in Denali Park and work at WEAR to help plan and implement fire management activities within WEAR administrative units. This fire management staff is shared between WEAR, LACL, and DENA.
Specific responsibilities:	• May serve as Agency Administrator or Acting Western Area FMO in the absence of the Western Area FMO, as qualified. • Serves as helicopter manager and/or crewmember during fire management and other resource management activities. • Serves as crew boss, etc. as qualified. • Supervises and assists with gathering and processing of data for use in long duration and incident-specific fire management planning. • Plans and implements hazard fuel reduction projects. • Assists with planning and supervision of prescribed fires. • Supervises and/or performs various resource management projects throughout WEAR • Participates in NWCG functions as qualified. • Represent WEAR and NPS on NPS and interagency fire related task group/committees
Position	**Other WEAR Employees**
Fire management role:	Any WEAR employee may be assigned to assist with fire management activities as environmental and/or cultural specialists, logistical advisors, firefighters, support personnel, law enforcement officers, etc., depending on qualifications, skills, and regular duties.
Specific responsibilities:	• Advising Western Area FMO or Agency Administrator during planning of fire management activities. • Gathering and processing of data for use in long-term and incident-specific fire management planning • Reports ignitions (specific Lat./Long) in WEAR. • Law enforcement. • Participate in NWCG functions as qualified.
Position	**Regional Fire Management Officer**

Fire Management role:	**Supports the Area Fire Management Officers for the NPS Alaska Region.**
Specific responsibilities:	• Makes final determinations on behalf of the NPS on fire management planning, strategy and tactics in the event the Western Area FMO, Local Park Fire Coordinator, or Superintendent are not available. • May sign the Fire Decision Document if Superintend or designee is not available • Represents the Regional Director and Superintendents through Delegation of Authority on the Alaska Wildland Fire Coordination Group and the Alaska Multi-Agency Coordination Group. • Ensures that WEAR and Alaska fire management needs and perspectives are addressed in regional, national and interagency policies, programs and procedures.

Figure 9: Incident-Specific Fire Management Functions at WEAR



General Budget Process

Suppression
Suppression costs for operations occurring within the Park/Preserve/Monument are the responsibility of the Alaska Fire Service as explained in Exhibit D of the Master Agreement. Further, the Alaska Statewide Master Agreement explains use and reimbursement of fire interagency resources within Alaska under clauses 34-37 and in Exhibit D: Reimbursable Billings and Payment.

Fuels Management
All requests for national fuels funding must be made by deadline established in the applicable version of the NPS Fire and Aviation Financial Management Guide (Fire Business Rules). Typically the deadline is approx. February 1st of the preceding year in order to be considered. Requests for fuels base funding will be submitted through the Regional FMO and requires a brief justification. Separate requests must be submitted for individual activities/projects in NFPORS. All requests must follow the procedures and deadlines as established NPS Fire and Aviation Financial Management Guide. Sporadically there is yearend funding available between August and September, but competition for these funds are high.

Cost Accountability and Budget Tracking
All fire management activities occurring within Western Arctic National Parklands will meet fiscal accountability and tracking requirements as outlined in the, Interagency Fire Business Management Handbook Standards and Alaska Statewide Master Agreement. The recently implemented Wildland Fire Decision Support System (WFDSS) uses the USFS fire cost estimation model, Stratified Cost Index (SCI) to help predict incident costs. This tool assists fire managers by ensuring decisions made on the incident will meet strategic objectives.

Interagency Agreements

1. Alaska Interagency Wildland Fire Management Plan
2. 2010 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement
    a. 2010 Alaska Statewide Annual Operating Plan

5.0 ADAPTIVE MANAGEMENT STRATEGY

Adaptive management has been embraced by Interior Department Bureau's and is being mandated throughout NPS Fire Management programs. Adaptive management ensures projects are well thought out, professionally planned, skillfully implemented, and appropriately monitored. The project data is then analyzed and ***communicated*** to all stakeholders involved in the project. Annual evaluations will ensure information learned from the project including data analysis, will be used to modify plans and objectives for the betterment of future projects in the Park/Preserve.

Western Arctic Parkland managers will collaborate with fire staff to ensure adaptive management strategies are implemented on all fires and fire related projects throughout the Park/Preserve. This process begins with policy direction and incorporates the most current information to make knowledge-based management decisions about how best to maintain fire-related natural resource components and processes. These decisions are periodically evaluated against monitoring results, new research and other relevant information. Recommendations and changes are integrated into the

planning and execution phases to help guide the fire management program.

Fire management program goals and objectives are described in sections 3.1.1. and 5.1 of the Fire Management Plan. Cumulatively, these goals and objectives emphasize the desire to understand the effects of fire management actions by monitoring and evaluating the effects of fire and fuels management activities on park natural and cultural resources. To accomplish this task, specific, measurable objectives are needed as a point of reference to determine if the resource conditions resulting from fire management actions are meeting park goals for maintaining natural conditions. To answer the question, "What would the resource look like if we achieve our goals?" desired conditions are needed to describe resource goals more specifically and to serve as a standard by which to measure fire management program success.

As the monitoring results become available, they are used to determine if management objectives are achieved and to determine if management activities need to be adjusted. Also at this time, an assessment of whether the management objectives are still desired is warranted in light of ongoing monitoring results and any new information made available. In this adaptive way, we can be sure that the monitoring program will adequately assess the success of the fire management program.

Annual planning and evaluation meetings will be coordinated by the Western Area Fire Management Officer for parks that had fires or projects implemented during the summer season. Parks with current planning efforts for fire related projects may also be required to participate. The complexity of the incident or project that occurred or is planned will determine the required level of adaptive management necessary. Appropriate adaptive management may range from an organized conference call for small simple fires, to a face-to-face meeting for larger more complex fires or projects. As complexity warrants, regional staff members may be called upon to participate and provide valuable input regarding fires or fire related projects in the applicable park units. These positions include but are not limited to; Fire Ecologist, Communication and Education Specialist, GIS Specialist.

The need for FMP updates may be initiated by the FMO or park management and will be addressed at the Adaptive Management Strategy Meeting.

For details regarding all aspects of adaptive management, please visit the DOI Adaptive Management Initiative Website, RM 18-Chapter 7, Section 3.4 and Chapter 8-Fire Ecology & Monitoring Section 3.1.

5.1 Fire Management Objectives

Consistent with the GMP for the four Park units the paramount objective for fire management in Western Arctic National Parklands is the following:

Wildfire – Maintain the area's bio-diversity and natural process through the use of fire (including the naturally occurring spectrum of fire intensities and effects) while also ensuring the safety of life, property, and sensitive resources. Maintenance of Condition Class 1 within WEAR park units.

Fuel Management – Maintain Condition Class 1 within WEAR park units to protect structures and private property at risk. Cost-effective maintenance of fuel loads within the natural range of variation for the fire regimes. Restoration of Natural Conditions (KOVA).

Fire management objectives are further described in section 3.1.1. The following interim fire management desired conditions effectively represent measurable fire management objectives for Western Arctic National Parklands.

Interim Fire Management Desired Conditions

1. Vegetation will be managed according to enabling legislation, mandates and guiding documents for ecological integrity and natural processes, including wildfire.
    a. The number of acres burned per year per Park Unit are within the range of natural variability (1984-2010)
    b. The number of natural fire starts per year per Park Unit are within the range of natural variability (1956-2010)
    c. Total duration (days) of fire incidents annually per Park Unit are within the range of natural variability (1984-2010). The count of days from the first fire discovered to the final fire declared out date.
    d. Percent of wildfire burn severity, by severity class, remain within the natural range of variability (1983 to Current) (if burn severity remote sensed data is available).
2. In Bering Land Bridge National Preserve, within Reindeer herding areas, as established on January 1 1976, manage wildfire in accordance to ecological integrity while maintaining sound range management practices.

Future Needs – Analysis of the natural range of variability from the historical records per park unit has yet to be completed. Once the analysis is completed a baseline will be established to measure success in meeting Western Arctic National Parklands fire management objectives.

Due to the accelerated climate effects in the Arctic Region and the potential impact warming temperatures may have on natural fire regimes future development or refinement of fire management objectives is anticipated.

5.2 Monitoring

Within the NPS Wildland Fire Management Reference Manual 18 it states that: “Fuels management activities and treatments must be monitored in order to assess treatment effectiveness and to determine whether management objectives were met. Moreover, monitoring is the basis of a successful adaptive management program” (RM-18, Ch. 7, section 3.4, USDI NPS 2008). The Alaska NPS fire ecology program is designed to determine whether fire and resource management objectives are being met, as well as to document any unexpected consequences of fire management activities. Fire and non-fire fuels treatment monitoring is an important part of adaptive management.

Guidelines for monitoring wildland fires, prescribed fires and mechanical treatments within WEAR were developed in consultation with the Interagency Alaska Fire Effects Task Group (FETG), NPS Fire Monitoring Handbook (FMH 2001), and the NPS Alaska Regional Fire Ecologist. These guidelines provide recommendations for minimum variables to monitor fire or treatment effects within a framework of three monitoring intensities (Level 1 – 3) and are shown in Table 9. Brief descriptions of the three monitoring levels are provided below:

Level 1, Surveillance Monitoring - This level provides a basic overview of the baseline data that is required to be collected for all wildland or prescribed fires, some variables are required for mechanical treatments. Information at this level includes such items as RAWS weather data, general description of the fire environment (i.e. topography and fuel types), and fire location or perimeter. Information collected at this level precludes the necessity for on the ground

measurements and can be done from remote sensing or an aerial platform. This data is necessary to satisfactorily complete a Wildland Fire Report.

Level 2, Moderate Intensity Monitoring **-** This level of monitoring documents fire behavior observations (not addressed in this document), fuels, and general effects of wildland fires, prescribed fires or mechanical treatments on vegetation. Information at this level includes characteristics of the fire, such as rate of spread, fire behavior, and burn severity, as well as current weather conditions. Fuel conditions would be assessed by determining the fuels array, composition, and dominant vegetation within the burn area, in addition to using vegetation and fuels maps to predict potential fire spread. Information to assess pre and post fire or treatment effects would include duff depth and moisture measurements, photo points, vegetation cover, and tree parameters. This level of monitoring is recommended for the use of wildland fire and prescribed fires, but is dependent on the objectives of the burn and the resources of concern. Some of the variables monitored at this level would require on the ground measurements of specific sites.

Level 3, Comprehensive Monitoring (Short or Long-term Fire Effects) – This level would be used to monitor the effects of prescribed or wildland fires in greater depth, it may also be used for mechanical treatments. Level 3 monitoring requires collecting information on fuel reduction, vegetative changes, and soil parameter changes. This level of monitoring may also include wildlife utilization techniques. The number of variables monitored increases and the techniques are more rigorous. Information collected at this level is based upon management objectives and the resources of concern. Variables monitored at this level would require the establishment of ground based plots.

Table 9: Monitoring Level Requirements and Recommendations for Fire Management Activities

Management Activity	***Minimum Required*** **Monitoring Levels**	***Recommend*** **Monitoring Levels**
Wildfire	Levels 1 *Burn Severity	Levels 1, 2, 3, *Burn Severity
Prescribed Fire	Levels 1, 2, 3, *Burn Severity	Levels 1, 2, 3, *Burn Severity
Non-Fire Treatments	Level 1	Levels 1, 2, 3

*Burn Severity should be requested for all fires > 500 acres on NPS lands (RM 18, Chapter 8, 4.3)

Fire and mechanical treatment monitoring should be designed to meet the objectives of each project and therefore the components of monitoring should be developed based on the project objectives. Suggested monitoring variables for Level 1 through 3 are provided in Table 10 below. Measurement of Level 1 variables is the recommended minimum for all wildland fires. The implementation of variables at Level 2 and Level 3 would depend on the objectives of the fire/treatment and the resources of concern, and would remain up to the discretion of the FMO, resource management staff, and fire ecologist. The difference between Level 2 and Level 3 monitoring will often be the nature of data gathered for the same variable (qualitative vs. quantitative) or the number of plots, which may determine the statistical significance of findings.

Table 10: Recommended Monitoring Variables for the Three Major Fire Management Activities

R = Required, O = Optional, and N/A = Not Applicable

Monitoring Level	Monitoring Variable	Wildland Fire	Prescribed Fire	Mechanical Treatment
1	Perimeter (> 100 acre fire) or Point Location	R	R	R
1	Fuel types	R	R	R
1	Site description	R	R	R
1	Weather (RAWS)	R	R	O
1	Fire Danger Indices	R	R	N/A
1	FRCC	R	R	R
1	Burn severity maps (> 500 acres)	R	R	N/A
2	Photos of burn or treatment area	O	O	O
2	Photo Points	O	R	O
2	Fire behavior	O	R	N/A
2	Smoke	O	R	N/A
2	Duff/fuel bed depths	O	O	O
2	Duff moisture	O	O	O
3	Duff consumption (pins)	O	O	N/A
2	Burn severity assessment	O	O	N/A
2	Vegetation class (pre & post)	O	O	O
2	Vegetation cover/ composition (Level 2 - quantitative)	O	O	O
2	Tree density by species and size class	O	O	O
2	Tree canopy cover	O	O	O
3	Tree heights, diameters	O	O	O
3	Tree damage (insect and disease)	O	O	O
3	Ladder fuel heights	O	O	O
3	Active layer depth	O	O	O
3	Soil parameters	O	O	O
3	Tree ring disks/cores	O	O	O
3	Shrub or species specific densities	O	O	O
3	Coarse woody debris (Brown's transects)	O	O	O
3	Herbivory	O	O	O

Wildfire Monitoring

The minimum required monitoring for wildfires on AK NPS lands includes the data necessary to fill out DOI required Wildland Fire Management Information (WFMI) fire reporting documentation (http://www.nifc.blm.gov/nsdu/fire_reporting/NPS/doc/NpsUserGuides.html). This includes documentation of information such as the fire origin, fire start and end dates, fuels, weather, final fire size (acres), and suppression actions. Currently, remotely sensed burn severity data using dNBR is required for all wildfires and prescribed fires exceeding 500 acres on National Park Service lands (RM-18, USDI NPS 2008 Chapter 8). A description of burn severity mapping and monitoring is provided in the Fire & Fuels Monitoring Plan in

Appendix F. Fire effects plots may be established if Fire Management, Resource Management or other needs are identified for specific fires. The AK Regional NPS Fire and Fuels Monitoring Protocol is recommended for monitoring wildfire effects (Appendix F).

Prescribed Fire Monitoring

All prescribed fires that are implemented in WEAR are required to have a monitoring plan that addresses the objectives of the prescribed fire. Not all prescribed fires need to be monitored, if representative fuel types are being monitored with similar prescription and fuels. All prescribed fires >500 acres are required to have a burn severity assessment map. The AK Regional NPS Fire and Fuels Monitoring Protocol is recommended for monitoring prescribed fire effects (Appendix F).

Non-Fire Fuels Treatment Monitoring

Mechanically treating fuels has recently become an important part of reducing fuel densities and reducing overall threats associated with wildland fires. A fuels treatment plan should be prepared for each project and include the following components. This plan includes a description or purpose of the project in an executive summary. A detailed description of the fuels to be treated is discussed. The area is identified with a project map listing the goals and objectives of the project. Project costs are calculated and summarized in the plan. The plan addresses the protection of sensitive features, safety of the personnel and the public, interagency coordination, public involvement, a monitoring plan, and post project rehabilitation issues. The main body of the plan addresses the statement of work to be done and specifications for treatments. These specifications address plant species by diameter and percent of stand for treatment. The monitoring section of the plan contains information on documenting and collecting photo point information and addresses other techniques or methods used to monitor the effectiveness of mechanically treating the vegetation.

Minimum Recommendations for Non-Fire Treatment Monitoring

- Describe treatment objectives and methods
- Document location, size, and data of treatment
- Photo points or video documentation

5.3 Evaluation

In the fall following each fire season an interagency review of the fire plan implementation and fire suppression operations is held with Protection Agency personnel and Jurisdictional Agency personnel. All involved parties are given the opportunity to identify plan implementation problems and operational concerns. The NPS will evaluate how the Protection Agencies responded to fires in the selected fire management options. Special considerations will be given to non-standard responses and opportunities will be available for each agency to comment. Consideration of fire management option selection is reevaluated annually and if deemed appropriate will follow the revision process and timeline specified in the AIWFMP. At minimum the Regional FMO and the Regional Fire Ecologist will be present to give voice to park units not already represented by and NPS Area FMOs.

All wildland fire occurring within Western Arctic National Parklands will be reviewed in accordance with Reference Manual 18, Chapter 17- Wildland Fire and Program Reviews and the Interagency Redbook-Chapter 18-Reviews and Investigations. If fires occur and the complexity necessitates a specific incident review, the Western Area FMO, WEAR Fire Coordinator and the

Regional FMO will coordinate with the Western Arctic National Park management personnel to schedule a separate review for the incident.

Park specific standards and procedures for the evaluation of monitoring and research data from wildfire, prescribed fire and non-fire fuels treatments is discussed in section 5.0- Adaptive Management Strategy, of this FMP.

5.4 Fire Research

Implementation of this fire management plan is not contingent upon the completion of research. A limited body of scientific information exists regarding effects of fire and fire regimes for the Western Arctic National Parklands. Information regarding primary and secondary fire effects in most ecosystems of WEAR is incomplete. A summary of fire research and monitoring are provided in Appendix F Fire and Fuels Monitoring Plan, topics and references are listed below. As new information becomes available fire-related resource management objectives can be refined in an adaptive management style.

Long-term fire effects on vegetation and permafrost after tundra fires

Racine, C., R. Jandt, C. Meyers, and J. Dennis. 2004. Tundra fire and vegetation change along a hillslope on the Seward Peninsula, Alaska, U.S.A. Arctic, Antarctic, and Alpine Research 36 (1): 1-10.

Racine, C., Allen, J.L., and Dennis, J.G. 2006. Long-term monitoring of vegetation change following tundra fires in Noatak National Preserve, Alaska. Technical Report: NPS/AKRARCN/NRTR-2006/02. Arctic Network Inventory & Monitoring Program, National Park Service, Alaska Region. Fairbanks, AK. http://science.nature.nps.gov/im/units/arcn/documents/documents/NPS_ARCN_NRTR-2006-02-LongTermMonitoringVegetationChangeFollowingTundraFiresNoatakNPAlaska.pdf

Racine, C., Barnes, J., Jandt, R., and Dennis, J. 2010. Long-term Monitoring of 1977 Tundra Fires in the Northwest Alaska Parks. Alaska Park Science, Volume 9, Issue 1: 24-25. http://www.nps.gov/akso/AKParkScience/2010Vol9-1/Long-Term-Monitoring-of-1977-Tundra-Fires-Racine.pdf

Reconstructing fire regimes and vegetation over the past 6,000 years in tundra ecosystems

Hu, F.S., Higuera, P., Barnes, J.L., Rupp, T.S., Chipman, M., and Duffy, P.A. 2010. Reconstructing fire regimes in tundra ecosystems to inform a management-oriented ecosystem model. Final Report, JFSP Project Number 06-3-1-23, CESU Agreement J979106K153/001, April 2010. https://www.firescience.gov/projects/06-3-1-23/project/06-3-1-23_hu_et_al_finalreport_jfsp_06-3-1-23.pdf

Future Fire Regime and Climate Modeling

Springsteen, A, and Rupp, T.S. 2009. Summary report for Alaska National Parks: Projected vegetation and fire regime response to future climate change in Alaska. CESU Final Report, NPS. (Contact: Jennifer Barnes, Regional Fire Ecologist, NPS AKRO, for copy of report)

Assessing Remote Sensed Burn Severity Maps – Boreal and Tundra Fires NPS

Allen, J.L. and Sorbel, B. 2008. Assessing the differenced Normalized Burn Ratio's ability to map burn severity in the boreal forest and tundra ecosystems of Alaska's national parks. International Journal of Wildland Fire. 17: 463-475.

Sorbel, B. and Allen, J. 2005. Space-based burn severity mapping in Alaska's National Parks. Alaska Park Science. Vol 4(1): 4-11 (Link to article: http://www.nps.gov/akso/AKParkScience/Vol4-Issue1.html)

Fire and Caribou

Several research studies have been completed to assess the impacts of fire on lichen and caribou winter grazing habitat in Northwest Alaska. Listed below are some recent references for published papers.

Holt, E.A, McCune, B. and Neitlich, P. 2008. Grazing and fire impacts on macrolichens communities of the Seward Peninsula, Alaska, U.S.A. The Bryologist 11(1): 68-83.

Joly, K., F.S. Chapin, and D.R. Klein. 2010. Winter habitat selection by caribou in relation to lichen abundance, wildfires, grazing, and landscape characteristics in northwest Alaska. Ecoscience 17 (3): 321-333.

Joly, K., T.S. Rupp, R.R. Jandt, and F.S. Chapin. 2010. Fire in the range of the Western Arctic Caribou Herd. Alaska Park Science 8 (2): 85-91.

Fire Research Needs

Opportunities will be taken to coordinate and work with NPS staff, Fire Management Staff, and Arctic Network Inventory and Monitoring Program to identify and encourage fire related research within the park. As research needs are identified, funding will be sought so studies may be undertaken. Fire research has limited funding within the NPS. If it is determined, however, that significant information is needed concerning the effects of fire, park managers may submit proposals through the NPS Fire Research Funding call. Opportunities exist for making requests for research funding through the Joint Fire Science Program. Other opportunities exist under the (CESU) Cooperative Ecosystem Study Units (CESU 2004) and National Park Service requests (Fee Demonstration Program, Project Management Information System (PMIS), and Natural Resource Challenge). The following list are fire research and monitoring needs currently identified for Western Arctic National Parklands:

- Determine fire effects (vegetation) at WEAR through the establishment of vegetation and/or soils plots in past burned areas or during on-going fires.
  - Document and assess long term effects of fire on wildlife habitat.
  - Document and assess effects of fire on permafrost and erosion.
- Assess the risk of fire and fire behavior in relation to climate change.
- Determine historic fire regime in BELA, KOVA and CAKR, utilizing dendrochronology or lake core methods. Map and determine pre-1940 fire history.

Appendix A: References Cited

Alaska Interagency Coordination Center. 2011. Alaska Interagency Mobilization Guide. 193 pp.

Alaska Interagency Fire Management Council. 1984. Alaska Interagency Fire Management Plan, Kobuk Planning Area.

Alaska Interagency Fire Management Council. 1984. Alaska Interagency Fire Management Plan, Koyukuk/Seward Planning Area.

Alaska Wildland Fire Coordinating Group. 1998. Alaska Interagency Wildland Fire Management Plan.

M.E. Alexander & F.V. Cole, Spring/Summer 2001 issue of Flreline, Vol. 12, No. 4, Pages 2-3, published by USDI Bureau of Land Management, Alaska Fire Service, Fort Wainwri ght. Alaska.

Anderson, Hal E. Aids to Determining Fuel Models.

ANILCA Reference

Burgan, Robert E. and Rothermel, Richard C. Behave: Behavior Prediction and Fuel Modeling System. U.S. Forest Service. General Tech Report INT-167. 1984.

Higuera, P.E. Barnes, J.L., Chipman, M., Urban, M. and Hu, F.S. 2011. Tundra fire history over the past 6000 years in the Noatak National Preserve, northwestern Alaska. Submitted to Alaska Park Science- Nov 2010.

Holt, E. A. and P. N. Neitlich. 2010. Lichen inventory synthesis: Western Arctic National Parklands and Arctic Network, Alaska. Natural Resource Technical Report NPS/AKR/ARCN/NRTR—2010/385. National Park Service, Fort Collins, Colorado.

Hu, F.S., Higuera, P., Barnes, J.L., Rupp, T.S., Chipman, M., and Duffy, P.A. 2010. Reconstructing fire regimes in tundra ecosystems to inform a management-oriented ecosystem model. Final Report, JFSP Project Number 06-3-1-23, CESU Agreement J979106K153/001, April 2010. https://www.firescience.gov/projects/06-3-1-23/project/06-3-1-23_hu_et_al_finalreport_jfsp_06-3-1-23.pdf

Hulten, E. 1937. Outline of the History of Arctic and Boreal Biota During the Quaternary Period. Bokforlags Aktiebolaget Thule, Stockholm.

Hulten, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA.

Joly, K., T. S. Rupp, R. R. Jandt, and F. S. Chapin. 2010. Fire in the range of the Western Arctic Caribou Herd. Alaska Park Science 8 (2):85-91.

McPherson, G.; Wade, E.; Phillips, C. B. 1990. Glossary of wildland fire management terms. Bethesda, MD: Society of American Foresters.

National Park Service. 1986. General Management Plan, Bering Land Bridge National Preserve.

National Park Service. 1986. General Management Plan, Cape Krusenstern National Monument.

National Park Service. 1986. General Management Plan, Kobuk Valley National Park.

National Park Service. 1986. General Management Plan, Noatak National Preserve.

National Park Service. 1994. Resource Management Plan, Bering Land Bridge National Preserve.

National Park Service. 1999. Director's Order No. 41: Wilderness Preservation and Management.

National Park Service. 1999. Reference Manual No. 18: Fire Management.

National Park Service. 2000. Gates of the Arctic National Park and Preserve Fire Management Plan.
National Park Service. 2000. Yukon-Charley Rivers National Preserve Fire Management Plan.

National Park Service. 2001. Management Policies: Chapter 6, Wilderness Preservation and Management.

National Park Service. 2008. Director's Order No. 18: Fire Management.

National Park Service. 2008. NPS-18 Guideline: Wildland Fire Management.

National Park Service. 2009. Foundation Statement, Bering Land Bridge National Preserve. 34 pp.

National Park Service. 2009. Foundation Statement, Noatak National Preserve. 29 pp.

National Park Service. 2010. DRAFT Foundation Statement, Cape Krusenstern National Monument. 29 pp.

National Park Service. 2010. DRAFT Foundation Statement, Kobuk Valley National Park. 31 pp.

National Park Service. 2013. Programmatic Fire Hazard Fuels Management Plan, Environmental Assessment, Alaska Region. 240 pp.

National Wildland Fire Coordinating Group. 1993. Prescribed Fire Complexity Rating System Guide.

National Wildland Fire Coordinating Group. 1996. Wildland Fire Qualification Guide.

Neitlich, P. N., and L. M. Hasselbach. 1998. Lichen Inventory and Status Assessment for Gates of the Arctic National Park, Alaska. NPS General Technical Report, Fairbanks, Alaska.

NPFlora. 1989. Checklist of Flora and Fauna in Collections of National Park Units in Alaska. U.S. Department of Interior, National Park Service, Alaska Regional Office, Anchorage, Alaska.

NPSpecies: The National Park Service Biodiversity Database. Secure online version <https://science1.nature.nps.gov/npspecies/> (accessed September 2004).

Sanzone, D. M., S. D. Miller, and S. B. Young. 2006. *Monitoring Ecological Change in the Arctic Parklands: Vital Signs Monitoring Plan for the Arctic Network Phase 2 Report.* Arctic network Inventory and Monitoring Program, National Park Service.

Scott, J.H., Reinhardt, E.D., 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. USDA Forest Service Research Paper RMRS-RP-29.

Taylor, S.W.; Pike, R.G.; Alexander, M.E. 1997. Field guide to the Canadian Forest Fire Behavior Prediction (FBP) System. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Spec. Rep. 11. 60p.

Young, S. B. 1974. The Environment of the Noatak River Basin, Alaska: Results of the Center for Northern Studies Biological Survey of the Noatak River Valley, 1973. Contributions from the Center for Northern Studies. Center for Northern Studies, Fairbanks, AK.

U.S. Departments of Agriculture and Interior. 1999. Wildland and Prescribed Fire Management Policy, Implementation Procedures Reference Guide.

U.S. Departments of Agriculture, Interior, Department of Commerce, U.S. Environmental Protection Agency, Federal Emergency Management Agency, National Association of State Foresters. 2001. Review and Update of the 1995 Federal Wildland Fire Management Policy.

U.S. Department of Interior. 1998. Departmental Manual, Part 620, Chapter 2: General Policies and Procedures—Alaska.

U.S. Forest Service, Department of Agriculture. 1999. Ogden, Utah. Fire Effects Information System.

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Appendix B: Definitions

Agency Administrator: An incident-specific position filled by any qualified WEAR staff member as designated by the Superintendent. The Agency Administrator represents the WEAR Superintendent and works with the incident command team to ensure the compliance of wildland fire operations with WEAR and NPS resource management policy and AIWFMP.

Appropriate Management Response (AMR): Any wildland fire action selected and developed through either the implementation of the AIWFMP, initial decision-making process (i.e. WFIP stage I) or a WFSA. AMRs may be directed toward suppression or resource benefit, depending on predetermined parameters and incident-specific conditions.

BEHAVE: A system of interactive computer programs used for formulating fuel models based and predicting fire behavior.

Condition Class 1: Fire regimes are within an historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.

Director's Order 18 (DO-18): A comprehensive statement of National Park Service wildland fire management policy.

Extended Attack: Any wildland fire suppression action lasting beyond one operational period.

Fire Cycle: Length of time for an area equal to the entire area of interest to burn; size of the area of interest must be clearly specified. For example the length of time it would require to burn a specified area (i.e. park area), given the amount of area that has burned in the past.

Fire Management Officer (FMO): A permanent position with responsibility for the planning and coordination of fire management programs on NPS lands in western Alaska. A Western Area FMO based administratively in Denali provides fire management direction for WEAR as well as LACL, and DENA.

Fire Return Interval: The number of years between two successive fires documented in a designated area (i.e., the interval between two successive fire occurrences). The size of the area must be clearly specified. Unit of measurement is years.

Fuel Loading: Amount of live and dead organic matter present at a particular site.

Fuel Model: A mathematically simulated fuel complex based on representative descriptors; used to estimate rate of spread and other fire behavior indices.

Initial Action: The actions taken by the first resources to arrive at a wildfire. Initial Action may include the full spectrum of responses from monitoring to aggressive containment.

Initial Attack: Initial action focused on aggressive containment of the fire perimeter.

Maximum Manageable Area (MMA): A geographical parameter established during the WFIP process and indicating the size that a fire use incident may grow to before triggering a WFSA.

Operational Period: The period of time scheduled for execution of a given set of tactical actions as specified in the Incident Action Plan. Operational Periods can be of various lengths, although usually not over 24 hours.

Prescribed Fire: Planned implementation of fire within a predetermined area and under predetermined conditions, for the accomplishment of resource management objectives and/or hazard fuel mitigation.

Reference Manual 18 (RM-18): A detailed set of guidelines for the operational implementation of the wildland fire management policies specified in DO-18. RM-18 consists of a continuously evolving on-line document.

Response to Wildland Fire: The mobilization of the necessary services and responders to a fire based on ecological, social, and legal consequences, the circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected.

Suppression: All the work of extinguishing a fire or confining fire spread.

Unplanned Ignition: The initiation of a wildland fire by lightning, volcanoes, unauthorized human-caused fires and escaped prescribed fires where the objective is to protect values at risk while meeting resource objectives specified in Land/Resource Management Plan

Unwanted Ignition: An ignition from any source that is unplanned and unwanted.

Use of Wildland Fire: Management of either wildfire or prescribed fire to meet objectives specified in Land/Resource Management Plans

Wildfire: Unplanned ignition of a wildland fire or escaped prescribed fire where the objective is to protect values at risk while meeting resource objectives specified in the Land/Resource Management Plan

Wildland Fire: Any non-structure fire that occurs in the wildland. Two distinct types of wildland fire have been defined and include wildfire (unplanned ignition) and prescribed fire (planned ignition).

Wildland Fire Decision Support System (WFDSS): A decision support system, utilized Nation-wide for the federal agencies after March 31, 2010.

Wildland Fire Implementation Process (WFIP): A multi-stage decision-making process triggered by the detection of a wildland fire. Initial WFIP components help managers determine initial strategies (e.g. fire use or suppression) for areas without preplanned responses; subsequent components document continued viability of fire use.

Wildland Fire Situation Analysis (WFSA): A standardized decision-making process triggered when a fire renders present management actions inadequate. WFSA components provide a means of evaluating alternative strategies and serve to document decisions, actions, and results.

Wildland Fire Suppression: Any management action based on protection goals rather than resource management concerns.

Wildland Fire Use: Any management action, related to a naturally occurring fire, implemented primarily for the accomplishment of resource objectives (including the preservation of fire in its natural role and/or the reduction of hazardous fuel loads). Also referred to as Wildland Fire Use for resource benefit (WFURB).

ACRONYMS

AICC	Alaska Interagency Coordination Center
AIWFMP	Alaska Interagency Wildland Fire Management Plan
ANILCA	Alaska National Interest Lands Conservation Act
AKSO	Alaska Support Office
AWFCG	Alaska Wildland Fire Coordination Group
BLM-AFS	Bureau of Land Management – Alaska Fire Service
DENA	Denali National Park
DNR	State of Alaska, Department of Natural Resources
DO-18	Director's Orders 18 – Wildland Fire Management
DOF	State of Alaska, DNR, Division of Forestry
FFMC	Fine Fuel Moisture Content
FMO	Fire Management Officer
FMP	Fire Management Plan
FMU	Fire Management Units
WEAR	Western Arctic National Parklands
GMP	General Management Plan
IC	Incident Commander
LCES	Lookouts, Communication, Escape Routes, Safety Zones
LCS	List of Classified Structures
MAC	Multi-Agency Coordination Group
NEPA	National Environmental Planning Act
NHPA	National historical Preservation Act
NPS	National Park Service
NWCG	National Wildfire Coordinating Group
RAWS	Remote Automated Weather Station
RM-18	Reference Manual 18 – Wildland Fire Management
RMP	Resource Management Plan
SACS	Shared Applications Computing System
SHPO	State Historic Preservation Officer
USFS	United States Forest Service
WFDSS	Wildland Fire Decision Support System
WFSA	Wildland Fire Situation Analysis
WFIP	Wildland Fire Implementation Plan

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Appendix C: Current Species of Concern

Federal Threatened and Endangered Species:
Ursus maritimus (Polar Bear)
Somateria fischeri (Spectacled eider)
Polysticta stelleri (Steller's eider)

Note for EA: "Fire likely has little effect on these species and in fact USFWS personnel have little concern of direct impacts of fire suppression activities on the eider species. FWS does hold concerns for suppression activities that occur in the terrestrial environment that have the potential to effect the marine environment (i.e. retardant use). National fire policy states clearly that, "Fire retardant will not be dropped within 300 feet of waterways."(Interagency Standards for Fire and Fire Aviation Operations 2004) This policy combined with the Limited fire management option strategy employed by the NPS and the limited fire occurrence of the area provides triplicate protection measures to this species to ensure fire management actions do not adversely affect the species."

Balaena mysticeus (Bowhead whale)

Note for EA: "According to the NOAA fisheries service, the range of these marine mammals and their occupation of distant offshore habitats leave these species unthreatened by fire and fire suppression activities."

Candidate Species
Gavia adamsii (Yellow-Billed Loon)

National Heritage Program AK Rare Plant List
Oxytropis kobukensis (Kobuk locoweed)
Oxytropis arctica* var. *barnebyana (Barneby's locoweed)
Artemisia senjavinensis (Bering Sea wormwood)
Douglasia beringensis (Bering Sea douglasia)
Rumex krausei (Cape Krause sorrel)

Globally Rare NP Species

WEAR is home to 33 additional species included in the Globally Rare NP Species database.

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Appendix D: Compliance for FMP

1. *Consultation and Coordination of the Original 2004 Fire Management Plan.*
   The following individuals were consulted in the preparation of this plan:

   Ken Adkisson, Chief of Subsistence, National Park Service, Western Arctic National Parklands
   Jennifer Barnes, Regional Fire Ecologist, National Park Service, Alaska Region
   Brad Cella, Fire Management Officer (Thru 2007), National Park Service, Alaska Region
   Lois Dalle-Molle, Assistant Superintendent, Western Arctic National Parklands.
   Terry DeBruyn Ph.D., Regional Wildlife Biologist, National Park Service, Alaska
   Eileen Devinney, Cultural Resource Specialist, National Park Service, Western Arctic National Parklands
   Bruce Greenwood, Environmental Protection Specialist, National Park Service, Alaska Support Office
   Thomas Heinlein, Chief of Resources Management, Western Arctic National Parklands.
   Marsha Henderson, Eastern Area Fire Management Officer, National Park Service, Fairbanks, Alaska
   Julie Hopkins, Superintendent, National Park Service, Western Arctic National Parklands
   Steve Klingler, Archeologist, National Park Service, Western Arctic National Parklands
   Joe Rebar, Fire Staff Officer, Alaska Fire Service, Fairbanks, Alaska
   Brad Shults, Biologist, National Park Service, Western Arctic National Parklands
   Brad Smith, Protected Resources Management Biologist, NOAA Fisheries, Anchorage Alaska
   Brian Sorbel, Fire Geographic Information Specialist, National Park Service, Alaska Region.
   Jennifer Tobey, Archeologist, Western Arctic National Parklands.
   Dave Whitmer, Fuels Management Specialist, Alaska Fire Service

2. *Contributors and Reviewers of the updated 2011 Fire Management Plan.*

   a. Contributors and Authors

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      Linda Jeschke, Chief of Interpretation, National Park Service, Western Arctic National Parklands.
      Brian Sorbel, Fire Geographic Information Specialist, National Park Service, Alaska Region.
      Morgan Warthin, Regional Fire Communication and Education Specialist, National Park Service, Alaska Region.
      Susanna Nancarrow, Fire Program Management Assistant, National Park Service, Alaska Western Area Fire Management, Alaska.
      Larry Weddle, Fire Management Officer, National Park Service, Alaska Western Area Fire Management, Alaska.

   b. Reviewers

      Tomas St. Clair, Acting Fire Management Officer, Bureau of Land Management – Alaska Fire Service, Galena Zone.
      Peter Neitlich, Acting Chief of Natural Resources, National Park Service, Western Arctic National Parklands.

3. *NEPA (EA), ANILCA 810, FONSI*

Appendix D.3.a: Environmental Assessment

ENVIRONMENTAL ASSESSMENT

FIRE MANAGEMENT PLAN

FOR

WESTERN ARCTIC NATIONAL PARKLANDS

NATIONAL PARK SERVICE

WESTERN ARCTIC NATIONAL PARKLANDS

August 24, 2004

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ENVIRONMENTAL ASSESSMENT

Fire Management Plan for Western Arctic National Parklands

I. INTRODUCTION

A. Purpose and Need

The National Park Service proposes implementing National Park Service Director's Order 18 (DO-18) (2002) by establishing a Fire Management Plan for Western Arctic National Parklands (WEAR). This fire management plan is a comprehensive document that outlines the WEAR fire management goals and describes the policies and actions by which these goals will be realized. The plan formalizes park-specific responsibilities for implementing the Alaska Interagency Wildland Fire Management Plan and formalizes park-specific fire management decision making process and procedures, redefines fire management strategies, articulates the park's fire management organization and responsibilities, and establishes the direct linkage between the resource management goals and fire management strategies. With the implementation of the proposed action, fire management within WEAR will remain status quo.

The Fire Management Plan is necessary to comply with DO-18, and codifies the way fire will be managed within WEAR. Although fire protection needs may arise and remain the first priority, managers need to consider that fire has long been an integral component of the area's ecosystems and is critical for the maintenance of virtually all indigenous conditions, from plant and animal populations to soil and permafrost layers. Accordingly, the scope of the preferred alternative and other considered alternative entail the planning and implementation of policies and practices flexible enough to allow the simultaneous pursuit of protection and resource management goals.

This Environmental Assessment (EA) has been prepared in accordance with the National Environmental Policy Act of 1969 and the regulations of the Council of Environmental Quality (40 CFR 1508.9). It evaluates the potential impacts to cultural and natural resource values that could result from implementing the Western Arctic National Parklands Fire Management Plan. The environmental assessment is intended to facilitate decision-making, based on an understanding of the environmental consequences of the proposal, and to determine whether preparation of an environmental impact statement is required.

B. Background

Two federal legislative acts, the Organic Act and the General Authorities Act, prohibit impairment of park resources and values. NPS Management Policies and Director's Order 12 use the terms "resources and values" to mean the full spectrum and intangible attributes for which the park is established and are managed, including the Organic Act's fundamental purpose and any additional purposes as stated in the park's establishing legislation. The impairment of park resources and values are not allowed unless directly and specifically provided by statute. The primary responsibility of the National Park Service is to ensure that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunity for enjoyment of them. The evaluation of whether impacts of a proposed action would lead to an impairment of park resources and values is included in this environmental assessment. Impairment may occur when there are potential impacts to a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or

- identified as a goal in the park's general management plan or other relevant NPS planning documents.

In 1980, Congress created numerous new Parks, Preserves and Monuments through the passing of the Alaska National Interest Lands Conservation Act (ANILCA). This legislation provided a comprehensive statement of purpose for all recently designated Alaskan Park, Preserve and Monument areas. Section 201[4] of ANILCA specifically establishes the four units that now comprise the Western Arctic National Parklands and ascribes them to the following missions, among others:

Bering Land Bridge National Preserve: "To protect and interpret examples of arctic plant communities, volcanic lava flows, ash explosions, coastal formations and other geological processes; to protect habitat for internationally significant populations of migratory birds; to provide for archeological and paleontological study, in cooperation with Native Alaskans, of the process of plant and animal migration, including man, between North America and the Asian Continent, to protect habitat for, and populations of, fish and wildlife including, but not limited to, marine mammals, brown/grizzly bears, moose and wolves;…to continue reindeer grazing use…in accordance with sound range management practices; to protect the viability of subsistence resources; and in a manner consistent with the foregoing, to provide for the outdoor recreation and environmental education activities including public access for recreational purposes to the Serpentine Hot Springs area."

Cape Krusenstern National Monument: " To protect and interpret a series of archeological sites depicting every known cultural period in arctic Alaska; to provide for scientific study of the process of human population of the area from the Asian Continent, in cooperation with Native Alaskans, to preserve and interpret evidence of prehistoric and historic Native cultures, to protect habitat for seals and other marine mammals; to protect habitat for and populations of birds, and other wildlife, and fish resources; and to protect the viability of subsistence resources…"

Kobuk Valley National Park: " To maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon and other rivers, the boreal forest, and the Great Kobuk Sand Dunes, in an undeveloped state, to protect and interpret, in cooperation with Native Alaskans, archeological sites associated with Native cultures; to protect migration routes for the Arctic caribou heard; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl and to protect the viability of subsistence resources."

Noatak National Preserve: "To maintain the environmental integrity of the Noatak River and adjacent uplands within the Preserve in such a manner se 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, and for waterfowl, raptors, and other species of birds; to protect archeological resources; and in a manner consistent with the foregoing, to provide opportunities for scientific research."

The Western Arctic Parks General Management Plans (Four separate plans: BELA, CAKR, KOVA, NOAT) (1986) specifies these objectives directly relevant to the WEAR fire management program: 1) To protect and interpret natural ecosystems and their individual components, based on an understanding of the role played by natural processes, including fire. (BELA, GMP: 6) 2) To manage natural resources to perpetuate ecological processes and systems. (CAKR, GMP: 196) (KOVA, GMP: 179) 3) To allow natural forest and tundra fires to fulfill their ecological role in vegetation succession. (KOVA, GMP: 63) (NOAT, GMP: 79)

In 1984 the National Park Service cooperated with Bureau of Land Management, Alaska Department of Natural Resources, Alaska Department of Fish and Game, US Fish and Wildlife Service, Bureau of Indian Affairs, and Alaska Native regional and local village corporations to produce an Interagency Fire Management Plan for the Kobuk and Seward/Koyukuk Planning Areas. This plan provided direction for fire management activity in Western Arctic National Parklands until 1998, when a variety of documents were consolidated and approved as the Alaska Interagency Wildland Fire Management Plan (AIWFMP). During the development of the original interagency fire management plan, the land owners/managers determined the protection needs for the lands they manage/own. The lands were placed under critical, full, modified or limited protection categories; with categorization based on presence and/or proximity of values to be protected, as well as the resource management objectives of the pertinent land management agency (see Table 1 for description of categories). Under the AIWFMP, the fire protection needs are reviewed annually by the land owners/managers. Each reported wildland fire is managed in accordance with the categorization of the sub-unit in which it occurs, with responses ranging from rapid and aggressive attack by all available forces in the case of fires detected in Critical Protection areas, to periodic surveillance for fires detected in Limited Protection areas (see Map 3a and 3B: Appendix S.2 for vicinity map of WEAR units).

Table 1: Alaska Interagency Wildland Fire Management Plan Options

Protection Category	Policy	Intent
Critical	• Aggressive suppression of fires within or threatening designated areas. • Highest priority for available resources.	• Prioritization of suppression actions for wildland fires threatening human life, inhabited property, and/or other designated structures. • Complete protection of designated sites.
Full	• Aggressive suppression of fires within or threatening designated areas, depending upon availability of resources.	• Protection of uninhabited cultural and historical sites, private property, and high-value natural resources.
Modified	• Fires in designated areas receive initial attack depending on availability of resources, unless land manager chooses otherwise and documents with WFSA. • After designated **conversion date**, operational response to Modified protection zones is identical to that of Limited zones.	• Greater flexibility in selection of suppression strategies when chance of spread is high (e.g., indirect attack). • Reduced commitment of resources when risk is low. • Balancing of acres burned with suppression costs and with accomplishment of resource management objectives.
Limited	• Wildland fires allowed to burn within predetermined areas. • Continued protection of human life and site-specific values. • Surveillance.	• Reduction of long-term costs and risks through reduced frequency of large fires. • Reduction of immediate suppression costs. • Facilitation of bio-diversity and ecological health

This EA presents two alternatives for the application and use of wildland fire as a management tool for resource benefits. All of the alternatives discussed here, including the preferred alternative described throughout the proposed WEAR fire management plan, would entail continued compliance with the AIWFMP, while at the same time bringing the WEAR fire management program into compliance with recently developed National Park Service directives. **NPS Director's Order 18** (2002) mandates a distinction between **prescribed fire**, defined as any fire planned and implemented by management, and **wildland fire**, defined as any unplanned ignition, whether human or natural. Wildland fire incidents, in turn, fall into two categories: **Wildland Fire Use** entails the management of certain unplanned ignitions for the achievement of management goals, including the reduction of dangerous and unnatural accumulations of burnable vegetation and the preservation of fire in its natural role; **wildland fire suppression** entails a broad spectrum of actions aimed at protecting life, property, and sensitive resources while also ensuring firefighter safety, cost effectiveness, and minor disturbance from suppression activities.

Each of the alternatives presented in this Environmental Assessment comprises of a particular combination of the various management strategies permitted under NPS Director's Order 18. These alternatives have been evaluated for their ability to contribute to the accomplishment of the resource management objectives described above.

C. Impact Topics Addressed and Analyzed

Impact topics were identified to focus the analysis of alternatives on the most relevant subject matter and resources of concern. A brief rationale for each impact topic follows, as well as the reasons for dismissing specific topics from further analysis.

Vegetation and Biodiversity
The National Environmental Policy Act (1969) requires analysis of impacts on all affected components of the ecosystem, including biotic communities of plants and animals. NPS Management Policies (2001) requires maintenance of these communities, including their natural abundance, diversity and ecological integrity. Fire plays an important role in changes to vegetative cover which in turn affects habitat and overall ecological health.

Cultural Resources
Cultural resources can be significantly affected by fire and play a critical role in determining fire management units and specific fire responses.

Aesthetics and Recreation
The mission of the NPS, as stated in the Organic Act of 1916, is to "conserve the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same." Within WEAR, Bering Land Bridge was given direction from ANILCA specifically for the management of recreation. ANILCA stated that Bering Land Bridge was "to provide for the outdoor recreation and environmental education activities including public access for recreational purposes to the Serpentine Hot Springs area." Scenic values, recreational activities, and general visitation within and around fire prone areas may be temporarily impacted by fire-related actions.

Local Economy
The National Environmental Policy Act (NEPA) regards impacts to the human environment to include any effects of federal actions on the social and economic well being of communities and individuals. Fires may limit economic opportunities and fire management may provide increased opportunities around bases of operation and for material suppliers.

Wetlands and Floodplains
Executive Orders 11988 and 11900 require the consideration of impacts to floodplains and wetlands. Fires in the interior of Alaska often burn the vegetation of wetlands, which may be the sites of management actions.

Subsistence Use and Wildlife Habitat
Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) states "in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands…the head of the federal agency…over such lands…shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs." Subsistence use may be temporarily impacted, by fire management decisions.

Air Quality
The 1963 federal Clean Air Act (42 U.S.C. 7401 *et seq.* as amended) stipulates that federal land managers have an affirmative responsibility to protect a park's air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse air pollution impacts. Specifically all four management units are classified as Class II airsheds, minimizing acceptable levels of pollutants to these areas by very specific parameters and forcing the NPS to hold Air quality to a high standard. Air quality would potentially be affected in the short-term during any type of ignition event.

Water Quality and Fisheries
National Park Service policies require the protection of water resources consistent with the Clean Water Act. Increased erosion following a fire may affect water quality.

Wilderness Resource Values
National Park Service Director's Orders 41, on Wilderness Preservation and Management, states that "Fire management activities conducted in wilderness areas will conform to the basic purposes of wilderness". Western Arctic National Parklands contains large areas of designated and suitable wilderness which would be affected by any likely ignition event.

D. Impact Topics Considered and Dismissed

Threatened and/or Endangered Species
The Endangered Species Act (1973) requires disclosure of impacts on all federally threatened or endangered species. NPS policy also requires the analysis of effects on federal species, as well as state-listed threatened, endangered, candidate, rare, declining and sensitive species.

Two species of Eider, *Somateria fischeri* (Spectacled eider), and *Polysticta stelleri* (Steller's eider*)* are currently listed as threatened on the Federal Threatened and Endangered Species list. Although not scientifically documented in any of the WEAR management units, the coastline of both Bering Land Bridge and Cape Krusenstern lay within the historic breeding range for these species. Eiders are Sea ducks that live primarily in ocean waters. During breeding however they use inland waters where they nest on tundra near small ponds. Fire likely has little effect on these species and in fact USFWS personnel have little concern of direct impacts of fire suppression activities on the species. FWS does hold concerns for suppression activities that occur in the terrestrial environment that have the potential to effect the marine environment (i.e. retardant use). National fire policy states clearly that, "Fire retardant will not be dropped within 300 feet of waterways."(Interagency Standards for Fire and Fire Aviation Operations 2004) This policy combined with the Limited fire management option strategy employed by the NPS and the limited fire occurrence of the area provides triplicate protection measures to this species to ensure fire management actions do not adversely affect the species. The USFWS concurs with the NPS on this subject and has granted dismissal of these species from the EA. Funding has been requested to further study these species and survey for their presence within WEAR.

Further federally threatened and endangered species include the endangered *Balaena mysticeus* (Bowhead whale). According to the NOAA fisheries service, the range of these marine mammals and their occupation of distant offshore habitats leave these species unthreatened by fire and fire suppression activities.

Although not federally threatened or endangered, there are a number of plant species that are considered rare to land managers (see National Heritage Program AK Rare Plant List) within Alaska. Of current species listed five are believed to occur in WEAR. These species are; *Oxytropis kobukensis* (Kobuk locoweed), ***Oxytropis arctica* var. *barnebyana*** (Barneby's locoweed), ***Artemisia senjavinensis*** (Bering

Sea wormwood), ***Douglasia beringensis*** (Bering Sea douglasia), and ***Rumex krausei*** (Cape Krause sorrel). All of the species mentioned above occupy specific micro-sites in mostly rocky or sandy soils, gravel bars, scree slopes or rock outcrops. Because of site occupation it is believed that fire in most years will not burn in these types of environments, thus posing little threat to the aforementioned species except under the most severe drought circumstances when fire behavior supercedes normal activity. Moreover, WEAR is home to 33 additional species included in the globally rare NP Species database.

Environmental Justice. Executive Order 12898,
Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations requires all federal agencies identify and address disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. This project would not be expected to result in significant changes in the socioeconomic environment of the project area, and, therefore, would not be expected to have any direct or indirect impacts to minority or low-income populations or communities.

II. RANGE OF ALTERNATIVES

A. Introduction

Each alternative consists of a different combination of the fire management strategies as mandated by NPS Director's Order 18 (DO-18), with each alternative representing a different application of fire as a management tool. The considered alternatives differ in their respective approaches to the management of wildland ignitions and in their allowance or preclusion of prescribed fire.

B. Actions Common to all Alternatives

Under each alternative, mechanical fuel reduction may be used to mitigate hazard fuel buildup or recreate historical landscapes/conditions in areas where prescribed fire or wildland fire would pose an unreasonable threat to the property or resources.

All fire management actions at Western Arctic National Parklands will be conducted in full compliance with local, state, and interstate air pollution control regulations as required by the Clean Air Act, 42 U.S.C. 7418. Currently, no local or interstate air pollution control regulations exist in Alaska.

WEAR will employ three primary strategies in order to protect archeological, cultural, and historic sites from damage by fire or fire suppression activities. First, culturally significant structures will be assigned Critical or Full Protection status, as dictated by the recommended criteria for fire protection of structural resources within WEAR. Second, personnel conducting detection and/or reconnaissance flights within WEAR will be directed to remain alert for the presence of any undiscovered cultural sites or structures and to report their presence to the Western Area FMO. Third, designated Incident Commanders will consult with appropriate resource advisors regarding the identification and sensitivity of previously unknown sites, and will cooperate with the Agency Advisor to mitigate any damage to such sites.

Certain fire suppression activities could pose a threat to fragile soil layers and to other ecosystem components. This type of risk will be mitigated through the use of minimum impact suppression tactics as specified by NPS policy.

C. Alternatives

Alternative 1: Wildland Fire Suppression

Natural ignitions occurring in certain areas and under predetermined conditions would be managed for the accomplishment of resource management goals, including the preservation of fire in its natural role and the reduction of hazardous accumulations of burnable vegetation. Any fire posing a threat to life or property would be immediately suppressed. The suppression response is described in the Alaska Interagency Wildland Fire Management Plan. Prescribed fires would not be implemented.

Alternative 2: Combination of Prescribed Fire Use, Wildland Fire Use, and Wildland Fire Suppression (NPS Preferred Alternative and No Action Alternative)

All three of the major management actions (Wildland Fire Suppression, Wildland Fire Use and Prescribed Fire) described under DO-18 would be allowed, as determined by a combination of pre-established and incident-specific decision making criteria. This alternative represents no change in the on-the-ground implementation of fire management activities; however, it does define the strategy for Wildland Fire Use. Wildland fires that do not pose a threat to life, property, or significant resources would be managed for the accomplishment of resource management goals, including the preservation of fire in its natural role and the reduction of hazardous accumulations of burnable vegetation. Prescribed fire would be implemented, in certain cases, under the direction of National Park Service personnel for the purpose of reducing hazardous fuel loads. Suppression would continue in or near developed areas and near WEAR boundaries when neighboring administrative units with different fire management objectives adjoin NPS land. In areas known to contain fire sensitive cultural and/or archeological resources that warrant protection, or whenever insufficient resources are available to ensure the effective, long-term management of wildland fire to meet resource management objectives, suppression action would continue.

D. Alternatives Considered but Rejected

Full Wildland Fire Suppression
All ignitions, including those of natural origin, would be suppressed and no prescribed fire would be implemented. Reduction of flammable vegetation would be accomplished strictly by mechanical means (e.g. through the use of chain saws, cross cut saws or other tools). Mechanical reduction would be limited primarily to the protection of historic and/or archeological sites and Park/Preserve boundary areas. In some cases, however, mechanical reduction could be used to restore selected landscapes to historic conditions.

This alternative is rejected for the following reasons: 1) the increased risk of catastrophic wildland fire which would result from the exclusion of the area's natural burn cycle; 2) the prohibitively high cost of large-scale mechanical fuel reduction; 3) non-conformance with the existing interagency management scheme and a potential to cause an impairment of park resources and values.

Full Wildland Fire Suppression and Prescribed Fire
All ignitions, including those of natural origin, would be suppressed. The effects of natural wildland fire would be simulated through the use of planned ignitions conducted by park personnel in defined zones. Such fires would be ignited under predetermined fuel and weather conditions; control problems would thereby be minor.

This alternative is rejected for the following reasons: 1) the inability to maintain a natural burn cycle through only prescribed burns; 2) the increased risk of catastrophic wildland fire which would result from the exclusion of the area's natural burn cycle; 3) the prohibitively high cost of large-scale mechanical fuel

reduction and prescribed burns; 4) non-conformance with the existing interagency management scheme and a potential to cause an impairment of park resources and values.

E. Environmentally Preferred Alternative.

Alternative 2 is the environmentally preferred alternative because it provides the full spectrum of fire management strategies and practices to accomplish WEAR fire and resource management objectives while protecting human life and identified resources/values. The potential use of prescribed fire would permit managers to reduce the risk of catastrophic fires around important cultural resource sites as well as limiting the severity of fire in natural resource areas such as floodplain forests.

III. AFFECTED ENVIRONMENT

A. Introduction

Western Arctic National Parklands encompasses 11.8 million acres. Within its boundary, the land exhibits complex ownership patterns with native and regional village corporations' land, allotments, and various mining claims. Located in the Northwest corner of Alaska, this management area is remote even by Alaska standards. Access ranges from private and chartered aircraft year round to motorized and non-motorized boats and ATVs in the summer to snow machine and sled dogs during ice and snow covered months. Numerous native villages surround the Western Arctic Parklands along major river corridors and coastlines where transportation options are not limited to aircraft travel. WEAR administrative offices are in the town of Kotzebue, located on the tip of the Baldwin Peninsula that protrudes into Kotzebue Sound and Nome on the southwestern coast of the Seward Peninsula. With regular air service to Anchorage, Kotzebue and Nome serve as the major transportation hub for travel from all villages in Northwest Alaska.

B. Natural Environment

WEAR covers a vast expanse of ecotypes and terrain features within its boundaries. The interior units (Noatak and Kobuk Valley) both encompass vast portions of watersheds of two of the largest rivers systems in Northwest Alaska. Rugged mountains, rolling hills and even sand dunes are found within these interior units. Displays of various tundra communities, healthy riparian areas and the northernmost extent of boreal spruce forest in Alaska typify vegetation. The coastal units within WEAR (Bering Land Bridge and Cape Krusenstern) display quite different terrain and vegetative features. Comprised mostly of coastal plains and plateaus these areas support large expanses of wet and moist tundra types. Areas with some elevation support a drier alpine form of tundra and trees of any type are virtually non-existent (with the exception of localized pockets of white spruce in the southeast corner of Cape Krusenstern).

Much of WEAR is underlain by permafrost that can average several hundred feet thick, with the top of the permafrost layer often occurring as little as 2 to 3 feet below the ground surface at the peak of summer. Permafrost hinders subsurface drainage, causing unstable soil conditions on sloping surfaces. Consequently, when surfaces are disturbed and permafrost is allowed to melt, soils often collapse.

The climate in WEAR consists of four distinct seasons with relatively short cool summers and long severe winters. Spring and autumn come and go rapidly with the quick increase and decrease in sunlight and temperature. Major portions of the management area receive continuous sunlight during the summer for approximately 30 days.

Numerous species of large and small mammals occur within WEAR. Large mammals include various marine life, Dall sheep, moose, muskoxen, caribou, wolves and black, brown, and polar bear. Smaller mammals, such as arctic hare, wolverine, porcupine, weasel, land otter, ground squirrel, muskrat, vole, lemming, and many others are abundant throughout the park area. In addition, over 25 species of fish and 140 species of bird are also present in WEAR on a seasonal basis.

C. Cultural Environment

Radiocarbon dating has revealed that Western Arctic National Parklands (WEAR) contains at least an 11,000-year record of human occupation, from the time of the Paleo-Indian big game hunters to the present. The modern day Iñupiat Eskimo of the region harvests subsistence within the Parks, as nine Iñupiat Nations did at the time of Euro American contact.

Although less than 1% of the 11.8 million-acre area has been surveyed by archeologists, over 1600 sites have been identified. The majority of these sites are prehistoric, varying from small lithic scatters to large villages with semi-subterranean houses. Only a small number of combustible structures are present.

D. Historical Role of Fire

Fires are infrequent occurrences in the coastal management units of WEAR. Although according to fire history records, on severe drought and active fire years fires have burned in and around both Bering Land Bridge and Cape Krusenstern. However, the two more continental units (Noatak, Kobuk Valley) see more significant fire activity most years. Major portions of the Noatak and Kobuk Valley lie within the northernmost belt of Interior Alaska, where fire has played a critical role in ecosystem sustainability. (See Appendix S.1: Fire Statistics & Graphs)

Fire has been a driving force in the Alaskan interior and arctic for thousands of years. It is a key environmental factor in these cold-dominated ecosystems. Periodic fires have served to select plants and animals that are adapted to fire-caused change. Without fire, organic matter accumulates, the permafrost table rises, and ecosystem productivity declines. Vegetation communities become much less diverse, and their value as wildlife habitat decreases.
Fire rejuvenates these systems. It removes some of the insulating organic matter and elicits warming of the soil. Nutrients are added both as a result of combustion and by increased decomposition rates. Vegetative re-growth quickly occurs, and the cycle begins again.

The impact of aggressive suppression on the Alaskan interior at large and WEAR in particular is, difficult to assess. Organized suppression has occurred on a large scale in Alaska since 1939; however, effects of suppression efforts are not clear. Alaska fire management personnel postulate that the fire ecology of the area may be relatively unchanged from its condition prior to the development of organized suppression efforts.

E. Wildland Fire Management Situation

The seasonal fire cycle in the Alaskan interior consists of four “micro” seasons or phases, each varying with the changing weather patterns and the stages of vegetation development for the growing season. The first begins in mid-May with the loss of snow cover, and ends in late May or early June when green-up begins. During the transition from 100% winter-cured fuels to green-up, human-caused fires occur frequently. These fires are usually relatively easy to suppress. Spring fires that are not suppressed, however, often grow later in the season as fuels become dryer. The second and third fire-cycle phases are primarily lightening driven. Suppression of such fires is harder. Fires occurring in June, the second

period, usually do not develop the intensity of later summer fires; during hot, dry, and windy conditions, however, June wildland ignitions can result in extreme fire behavior. The third period of fire activity begins in mid-July and runs through the first part of August. This is the period of maximum fire activity. The final micro-season runs from late August into early September. These fires are generally easy to control except during particularly dry autumn weather.

IV. ENVIRONMENTAL CONSEQUENCES

A. Impacts of Alternatives

Alternative 1. Wildland Fire Use and Wildland Fire Suppression

Vegetation and Biodiversity
Certain wildland fires would be managed for the accomplishment of resource management goals, including the preservation of fire as a natural process and the reduction of burnable vegetation therefore maintaining a naturally functioning ecosystem. However, in the Full Protection Units the exclusion of prescribed fire may result in an unacceptable increase in vegetation thereby increasing the threat to the resources found within these units.

A purpose of WEAR is to " protect and interpret examples of arctic plant communities… study, the process of plant and animal migration, including man, between North America and the Asian Continent and… to assure the continuation of geological and biological processes unimpaired by adverse human activity." Fire is an inextricable component of the fire dependant ecosystem of this area and is known to maintain a balanced, naturally functioning ecosystem. This alternative would manage ignitions within established resource objectives to maintain the natural function of the ecosystem in the WEAR.

Conclusion: Minor impacts are expected with the use of this alternative due to an increase in vegetation resulting from no prescribed fire. The level of impacts to vegetation and biodiversity anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Cultural Resources
The prohibition of prescribed fire could hamper the protection of historic and/or archeological resources and the restoration and/or protection of historic landscapes and conditions. Mechanical techniques employed in place of prescribed fire would tend to be more expensive, possibly more destructive, and may not sufficiently mimic the effects of fire. However, certain wildland fires would be managed for the accomplishment of resource management goals including the role of natural processes thereby better protecting the cultural resources from catastrophic fire.

A purpose of WEAR is "to protect and interpret archeological sites associated with Native cultures... to provide for scientific study of the process of ancient human populations of the area … to provide for archeological and paleontological study, …and in cooperation with Native Alaskans, to preserve and interpret evidence of prehistoric and historic Native cultures."

Conclusion: Minor impact would occur due to an increase in vegetation resulting from no prescribed fire. The level of impacts to cultural resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Aesthetics and Recreation
Under this alternative, impacts would include the occasional closure of specific areas due to fire activity or smoke concentrations for the safety of visitors resulting in an inconvenience for the visitors or cause them to alter their plans. Smoke will for short time periods degrade visibility which also may inconvenience visitors or cause them to alter their plans. Fire naturally occurs within WEAR ecosystems and degradation in air quality as the result of smoke is part of the function of a fire dependent ecosystem.

Through careful application of mechanical clearing to reduce hazardous fuels minor aesthetic impact may occur in the form of thinning vegetation.

Conclusion: This alternative may result in a minor impact by closing certain areas temporarily and more vegetation may be burned decreasing aesthetics in limited areas. The level of impacts to aesthetics and recreation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Local Economy
There would be a slight influx of revenue for businesses in communities near an incident resulting from occasional suppression operations. Conversely, closures of areas due to wildfire activity may affect recreational oriented businesses.

Conclusion: Fire management in WEAR under this alternative is expected to have a minor beneficial impact to the local economy.

Wetlands and Floodplains
There would be a minor impact to these areas due if fire suppression operations occur (handline construction). There may be impacts due to erosion after fire has burned through a wetlands or floodplain. Once vegetation in these areas re-establishes erosion is expected to return to normal levels.

Fire is an inextricable component of the fire dependent ecosystem of this area and is known to maintain a balanced, naturally functioning ecosystem. Managing wildland fire within established resource objectives would encourage the natural function of the ecosystem in WEAR.

Conclusion: There would be temporary minor impacts due to a loss of vegetation and temporarily increased erosion. The level of impacts to wetlands and floodplains anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or is critical to the natural or cultural integrity of the park.

Subsistence Use and Wildlife Habitat
A short-term impact on game species and plants in specific areas could occur due to the decrease of vegetation within burned areas. However, this alternative would more adequately facilitate the long-term preservation of the area's natural processes by allowing fire to play its natural role in the ecosystem. Suppression actions may adversely affect subsistence activities during the life of the incident by the increase of human activity and air traffic in the immediate area.

Conclusion: There is no critical and a relatively low percentage of full protection lands within WEAR, thus limiting negative impacts as a result of suppression actions. This would not disrupt the natural function of the ecosystem in WEAR, therefore maintaining wildlife habitat and subsistence use within the management area. There would be a negligible short-term impact resulting from a displacement of wildlife in the burned area. This, however, would replicate a naturally functioning ecosystem and subsistence regime. The level of impacts to subsistence and wildlife habitat anticipated from this

alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Air Quality
Under this alternative, smoke would be monitored for trajectory, mixing height, and impact to overall air quality. Certain wildland fires would be managed for the accomplishment of resource management goals, including the preservation of fire in its natural role. This would reduce the possibility of catastrophic fire thereby reducing the chance for long-term, intense decrease of air quality.

Conclusion: No long term impacts to air quality are expected. The level of impacts to air quality anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are critical to the natural or cultural integrity of the park.

Water Quality and Fisheries
Under this alternative certain wildland fires would be managed for the accomplishment of resource management goals including the preservation of fire in its natural role and the reduction of burnable vegetation. This would result in a greater number of low-intensity wildland fires thereby reducing the potential for erosion along streams.

Selection of this alternative would not disrupt the natural function of the ecosystems within WEAR. A fire is a common occurrence in this ecosystem and does result in some erosion, affecting water quality and fisheries habitat. Under this alternative, the amount of erosion is expected to continue at the same natural level and will not result in an impairment of the stated park purpose.

Conclusion: Long term impacts to water quality and fisheries are not expected. Short-term negligible impacts of increased sedimentation may occur initially after the fire and prior to reestablishment of vegetation. The level of impacts to water quality and fisheries anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Wilderness Resource Values
Under this alternative certain wildland fires would be managed for the accomplishment of resource management goals including the preservation of fire as a natural process.

Vast amounts of WEAR are designated wilderness or are suitable for such designation. The wilderness character of the area reflects natural conditions and a vast undeveloped sub-arctic landscape without permanent human residence. A sense of solitude and distance from modern civilization and its modifications of the natural world dominate the recreational experience. Under this alternative natural fire would be allowed to continue and would continue as an integral part of the wilderness experience.

Conclusion: Long-term impacts to wilderness resource values are not expected. Short-term impacts during fire suppression activities may occur but will be mitigated by adhering to special concerns outlined in the WEAR FMP and by the use of minimum tool/minimum requirement analysis. The level of impacts to wilderness character anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are critical to the natural integrity of the park.

Alternative 1, Cumulative Impacts: The on-going and future activity that would have a cumulative effect on resources of concern within and outside of WEAR unit boundaries analyzed in this Environmental Assessment is the adjacent landowners' fire management option selection. All public land management

agencies in Alaska are signatories of the Alaska Interagency Fire Management Plan, which allows for fire to burn on the landscape in limited suppression units. Much of the public lands surrounding WEAR is in a limited suppression unit and may result in multiple large fires in the area, especially with an increase in vegetation due to no prescribed burns. The results of these multiple fires may be greater than fires managed just within WEAR boundaries.

Alternative 2. Prescribed Fire Use, Wildland Fire Use, and Wildland Fire Suppression (NPS Preferred Alternative)

Vegetation and Biodiversity

Alternative 2 would have the least impact on vegetation with the maximum potential for maintaining diversity, by way of careful implementation of prescribed fire in areas ill suited to Wildland Fire Use. Wildland fire that poses a potential threat to life, property, or sensitive resources would be suppressed, while continued implementation of Wildland Fire Use in remote portions of WEAR would ensure the cost-effective preservation of the area's natural fire ecology as well as the reduction of potentially dangerous fuel loads.

A purpose of WEAR is to " protect and interpret examples of arctic plant communities… study, the process of plant and animal migration between North America and the Asian Continent and… to assure the continuation of geological and biological processes unimpaired by adverse human activity" Fire is an inextricable component of the environment of this area and is necessary to maintain a balanced, naturally functioning ecosystem. Selection of this alternative to use prescribed fire; Wildland Fire Use within established resource objectives, and wildland fire suppression would result in a natural functioning ecosystem within WEAR.

Conclusion: A balanced and naturally functioning ecosystem would be maintained with the use of this alternative. The level of impacts to vegetation and biodiversity anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Cultural Resources

There would be improved long-term protection of registered and unregistered cultural resources with the use of prescribed fire near and surrounding cultural resources. The occasional use of prescribed fire would allow a relatively cost-effective means of reducing fuel loads and preserving historic landscapes and conditions where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Conclusion: Long-term protection of registered and unregistered cultural resources would result from this alternative. This is anticipated to not result in an impairment of park resources, fulfilling specific purposes identified in the establishing legislation, or is key to the natural or cultural integrity of the park.

Aesthetics and Recreation

The impacts would be similar to Alternative 1 with the addition of the occasional use of prescribed fire that would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Conclusion: This alternative may result in minor impacts by closing certain areas and some vegetation may be burned decreasing aesthetics in limited areas. The level of impacts to aesthetics and recreation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Local Economy
The impacts would be similar to Alternative 1 with the addition that the occasional use of prescribed fire would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Conclusion: The increase in revenue to communities supporting fire management operations would result in a minor beneficial impact.

Wetlands and Floodplains
The impacts would be similar to Alternative 1 with the addition that the occasional use of prescribed fire would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Conclusion: There would be temporary minor impacts due to a loss of vegetation. The level of impacts to wetlands and floodplains anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Subsistence Use and Wildlife Habitat
The impacts would be similar to Alternative 1 with the addition of the occasional use of prescribed fire would also allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Conclusion: The natural function of the ecosystems within WEAR would not be disturbed, therefore maintaining wildlife habitat and subsistence use within the Park/Preserve. There would be a minor short-term impacts resulting from a displacement of wildlife in the burned area. This, however, would replicate a naturally functioning ecosystem and subsistence regime. Additional impacts may result from suppression actions; however, limited acreage of critical and full protection designation minimizes suppression needs. The level of impacts to subsistence and wildlife habitat anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Air Quality
The impacts would be similar to Alternative 1 with the addition of the occasional use of prescribed fire would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use. Fire is a naturally occurring event in the WEAR ecosystem. Degradation in air quality at the levels expected would be similar to a natural occurrence.

Conclusion: No long-term impacts to air quality are expected. The level of impacts to air quality anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the park.

Water Quality and Fisheries
The impacts would be similar to Alternative 1 with the addition of the occasional use of prescribed fire that would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

Selection of this alternative would not disrupt the natural function of the ecosystem within WEAR. Fire is a common occurrence in this ecosystem and does result in some erosion, affecting water quality and fisheries habitat. The erosion is expected to continue at the same natural levels.

Conclusion: Long term impacts to water quality and fisheries are not expected. Short-term negligible impacts of increased sedimentation may occur initially after the fire and prior to reestablishment of vegetation. The level of impacts to water quality and fisheries anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are key to the natural or cultural integrity of the management area.

Wilderness Resource Values
The impacts would be similar to Alternative 1 with the addition of the occasional use of prescribed fire that would allow a relatively cost-effective means of reducing fuel loads where the presence of values to be protected prohibits the implementation of Wildland Fire Use.

The wilderness character of the area reflects natural conditions and a vast undeveloped sub-arctic landscape without permanent human residence. A sense of solitude and distance from modern civilization and its modifications of the natural world dominate the recreational experience. Under this alternative natural fire would be allowed to continue and will not result in an impairment of the stated park purpose.

Conclusion: Long-term impacts to wilderness character are not expected. Short-term impacts during fire suppression activities (e.g. surface disturbance by handline construction) may occur but will be mitigated by adhering to special concerns outlined in the WEAR FMP and by the use of minimum tool/minimum requirement analysis. The level of impacts to wilderness character anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are critical to the natural integrity of the park. key

Alternative 2 Cumulative Impacts: The on-going and future activity that would have a cumulative effect on resources of concern within and outside of WEAR boundaries analyzed in this Environmental Assessment is the adjacent landowners' fire management option selection. All public land management agencies in Alaska are signatories of the Alaska Interagency Fire Management Plan, which allows for fire to burn on the landscape in the limited suppression option. Much of the public lands surrounding WEAR are in a limited suppression option, which has the potential to result in multiple large fires in the area. The results of these multiple fires may be greater than fires managed just within WEAR boundaries.

B. Cumulative Impact Mitigation

The convening of a Multi-Agency Coordinating (MAC) group can mitigate potential cumulative impacts. As directed in the Alaska Interagency Fire Management Plan, "A statewide Multi-Agency Coordinating (MAC) group may be convened to implement a temporary change from the selected management options for a specific geographic area(s) during periods of unusual fire conditions (e.g., numerous fires, predicted drying trends, smoke problems, unusually wet conditions or suppression resource shortages)."

C. IMPACTS OF ALTERNATIVES SUMMARY

	Alternative 1: Wildland Fire Use and Wildland Fire Suppression	Alternative 2 (Preferred): Prescribed Fire Use, Wildland Fire Use, and Wildland Fire Suppression
Vegetation and Bio-diversity	Minor impact: continued potential for minimal loss of diversity through fire exclusion in or near Critical and Full Protection Units and sites.	Least impact: maximum potential for diversity through careful implementation of prescribed fire in areas ill-suited to Wildland Fire Use.
Cultural Resources	Minor impact: Increased potential for uncontrolled fire due to increased fuels through fire exclusion in or near Critical and Full Protection Units and sites.	Improved long-term protection of registered and unregistered historic and/or archeological sites; improved maintenance of historical landscapes and conditions.
Aesthetics and Recreation	Minor impact: occasional closures of specific areas; vegetation burned may decrease aesthetics.	Minor impact: occasional closures of specific areas; vegetation burned may decrease aesthetics.
Local Economy	Minor impact	Minor impact
Wetlands and Floodplains	Minor impact: may be some erosion until vegetation returns.	Minor impact; may be some erosion until vegetation returns.
Subsistence Use and Wildlife Habitat	No long-term impact; some potential for short-term displacement of game from specific areas.	No long-term impact; some potential for short-term displacement of game from specific areas.
Water Quality and Fisheries	No long-term impact; some short-term erosion.	No long-term impact; some short-term erosion.
Air Quality	Minor impact.	Minor impact.
Wilderness Character	No long-term impact; some short-term impact from fire suppression activities.	No long-term impact; some short-term impact from fire suppression activities.

V. COORDINATION AND CONSULTATION

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LITERATURE CITED

Alaska Interagency Fire Management Council. 1984. Alaska Interagency Fire Management Plan, Kobuk Planning Area.

Alaska Interagency Fire Management Council. 1984. Alaska Interagency Fire Management Plan, Koyukuk/ Seward Planning Area

Alaska Wildland Fire Coordinating Group. 1998. Alaska Interagency Wildland Fire Management Plan.

Department of Interior. 2003. Interagency Standards for Fire and Fire Aviation Operations.

National Park Service. 2002. Director's Order 18: Fire Management.

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Appendix D.3.b: ANILCA 810

ANILCA Title VIII Section 810 (a) Summary Evaluation and Findings

I. INTRODUCTION

This section was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). It summarizes the evaluations of potential restrictions to subsistence activities that could result from the implementation of the proposed fire management plan in Western Arctic National Park Lands (WEAR).

II. EVALUATION PROCESS

Section 810(a) of ANILCA states:

> In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands…the head of the federal agency…over such lands…shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands, which would significantly restrict subsistence uses shall be affected until the head of such Federal agency—
>
> (1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 805;
>
> (2) gives notice of, and holds, a hearing in the vicinity of the area involved; and
>
> (3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minor amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.

In 1980,ANILCA created new units and additions to existing units of the national park system in Alaska. Four units that now comprise WEAR were created by ANILCA:

Bering Land Bridge National Preserve: Section 201[2] "To protect and interpret examples of arctic plant communities, volcanic lava flows, ash explosions, coastal formations and other geological processes; to protect habitat for internationally significant populations of migratory birds; to provide for archeological and paleontological study, in cooperation with Native Alaskans, of the process of plant and animal migration, including man, between North America and the Asian Continent, to protect habitat for, and populations of, fish and wildlife including, but not limited to, marine mammals, brown/grizzly bears, moose and wolves;…to continue reindeer grazing use…in accordance with sound range management practices; to protect the viability of subsistence resources; and in a manner consistent with the foregoing,

to provide for the outdoor recreation and environmental education activities including public access for recreational purposes to the Serpentine Hot Springs area."

Cape Krusenstern National Monument: SECTION 201[3] " To protect and interpret a series of archeological sites depicting every known cultural period in arctic Alaska; to provide for scientific study of the process of human population of the area from the Asian Continent, in cooperation with Native Alaskans, to preserve and interpret evidence of prehistoric and historic Native cultures, to protect habitat for seals and other marine mammals; to protect habitat for and populations of birds, and other wildlife, and fish resources; and to protect the viability of subsistence resources…"

Kobuk Valley National Park: SECTION 201[6]" To maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon and other rivers, the boreal forest, and the Great Kobuk Sand Dunes, in an undeveloped state, to protect and interpret, in cooperation with Native Alaskans, archeological sites associated with Native cultures; to protect migration routes for the Arctic caribou heard; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl and to protect the viability of subsistence resources."

Noatak National Preserve: SECTION 201[8a] "To maintain the environmental integrity of the Noatak River and adjacent uplands within the Preserve in such a manner se 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, and for waterfowl, raptors, and other species of birds; to protect archeological resources; and in a manner consistent with the foregoing, to provide opportunities for scientific research."

The potential for significant restriction to subsistence resources must be evaluated for the proposed action's effect upon subsistence uses and needs, the availability of other lands for the purposes sought to be achieved and other alternatives which would reduce or eliminate them.

III. PROPOSED ACTION ON FEDERAL LANDS

The National Park Service requires every administrative unit with burnable vegetation to develop a fire management plan—a unit-specific document outlining fire management goals and describing the policies and actions by which these goals will be realized (Director's Order 18). Since 1983, the WEAR fire management program has operated under the jurisdiction of various statewide interagency documents, including the Alaska Interagency Wildland Fire Management Plan, or AIWFMP (1998). Under the AIWFMP, fire protection needs at Western Arctic Parklands are determined by NPS and Bureau of Land Management (BLM) managers; lands within WEAR are categorized as **critical**, **full**, **modified**, or **limited** protection, depending on the proximity of values to be protected and on overall resource management objectives.

The proposed action consists of the establishment of a Fire Management Plan for Western Arctic National Parklands. The preferred alternative and the other considered alternatives (see Appendix C1, Environmental Assessment, this document) specify continued adherence to the AIWFMP as well as compliance with recently developed National Park Service directives. Specifically, NPS Director's Order 18 mandates a distinction between **prescribed fire** (planned and implemented by management) and **wildland fire** (unplanned ignitions), with wildland fire incidents further categorized, in turn, as either Wildland Fire Use or wildland fire **suppression**. Each of the considered alternatives mandates a specific configuration of DO-18 management options and relates these options to the policies and procedures outlined in the AIWFMP.

The preferred alternative allows for the continued management of wildland fire at Western Arctic National Parklands through a combination of wildland fire suppression, Wildland Fire Use, and prescribed fire use. This statement of Summary Evaluations and Findings addresses the impact of these fire management policies and actions on subsistence activities within the management area.

IV. AFFECTED ENVIRONMENT

A summary of the affected environment pertinent to subsistence uses is presented here.

WEAR is a management unit which includes Noatak National Perserve, Cape Krusenstern National Monument and Kobuk Valley National Park near Kotzebue, AK and Bering Land Bridge National Preserve located on the Seward Peninsula near Nome, AK. WEAR lies within the boundaries of wildlife management units 22, 23, and 26 where subsistence uses are allowed in accordance with Title VIII of ANILCA. Subsistence activities occur throughout the year and are usually concentrated along the coastlines and in major river corridors in WEAR. Subsistence pursuits occur often without regard to political boundaries.

In Cape Krusenstern National Monument and Kobuk Valley National Park to be eligible for subsistence uses you must be a local rural resident living in the NPS designated resident zone (community/area within the park or monument); or have a special subsistence use permit (36 CFR 13.44) issued by the Superintendent. The communities of Kivalina, Kotzebue and Noatak are included in the resident zone at Cape Krusenstern National Monument. The communities of Ambler, Kiana, Kobuk, Kotzebue, Noorvik, Selawik and Shungnak are included in the park's resident zone at Kobuk Valley National Park. Individuals residing outside of the NPS designated resident zone who have a personal or family history of using the park/monument for subsistence purposes at the time ANILCA was passed, may obtain a special subsistence use permit (36 CFR 13.44) from the Superintendent.

Bering Land Bridge National Preserve and Noatak National Preserve are also open to non-subsistence (sport) hunting, fishing and trapping. ANILCA protects subsistence uses by local rural residents as a priority consumptive use over other non-subsistence consumptive.

Cape Krusenstern National Monument is located on the western shore of northwest Alaska just north of Kotzebue and contains approximately 659,807 acres. It is characterized by a low-lying, coastal plain dotted with sizable lagoons and backed by gently rolling, limestone hills. The Monument’s bluffs and series of 114 beach ridges contain a chronological record of an estimated 6,000 years of prehistoric and historic uses by the region’s residents. Shifting sea ice, ocean currents, and waves shape the dynamic coastline and annual openings and closing of lagoon outlets. The broad plain between the cape and the hills is tundra covered and contains such features as pingos, eskers, frost polygons, thermokarst lakes, and ice lenses. Five complete, though small, arctic river systems are important resources that influence the dynamics of the Monument’s ecosystem. The entire monument is open to subsistence uses in accordance with Title VIII of ANILCA. Caribou are hunted in the Mulgrave Hills and in the Kakagrak Hills south of Kilikmak Creek and north of Krusenstern Lagoon. Dolly Varden fishing occurs in lower Rabbit Creek.

Kobuk Valley National Park is located in northwest Alaska and contains approximately 1,726,500 acres. It encompasses a nearly enclosed mountain basin on the middle section of the Kobuk River. Trees approach their northern limit in the park, where forest and tundra meet, creating a mosaic of forest and open tundra. Thousands of caribou funnel through mountain passes and cross the Kobuk River on their spring and fall migrations. Salmon and arctic char migrate to spawning grounds within the park. These and other seasonally abundant plant and animal resources have made the middle section of the Kobuk

River favorable for human occupation and use. Native people have hunted, fished, and lived along the Kobuk River for at least 12,500 years, and subsistence use of the resources in the Kobuk Valley continues into the present. The entire park is open to subsistence uses in accordance with Title VIII of ANILCA.

Noatak National Preserve covers 6,574,481 acres in northwestern Alaska. The Noatak River originates in Gates of the Arctic National Park and Preserve to the east, and flows westward through the Noatak River basin that makes up the central portion of the preserve. Major subsistence resources found in the preserve include caribou, moose, Dall sheep, grizzly bear, wolf, fox, lynx, marten, beaver and muskrat. Small mammals such as the hoary marmot, arctic ground squirrels, lemmings and porcupine also exist within the preserve. A variety of bird life inhabits the preserve, particularly during the summer migratory season, when thousands of birds congregate in the arctic for breeding. The Canada goose, white-fronted goose, tundra swan, and all four species of loon are common in the preserve.

The Noatak River is considered key in the subsistence and commercial fisheries harvest for Northwest Alaska. The most common fish, Arctic grayling and Arctic char, are found in the Noatak River and its tributaries. Salmon occur throughout the Noatak drainage system, with Chum being the most abundant, and sockeye, pinks and king found in the lower reaches of the river. Sheefish inhabit the Kobuk and Selawik Rivers in the preserve and are considered a preferred subsistence item. Trout are found in the deeper lakes within the preserve, as are burbot and freshwater cod.

Vegetation within the preserve is predominately low mat tundra. The lower Noatak drainage contains a boreal forest cover. At higher elevations, an alpine tundra community can be found, with willow, heather and combinations of grasses, sedges, wildflowers and mosses. Drier areas support lichens and saxifrages. Moist tundra community occurs along the foothills of the Noatak Valley. This is the predominant vegetation of the preserve and consists of cottongrass, willow, dwarf birch, labrador tea, Lapland rosebay, mountain alder and avens. Bog rosemary and cranberry are found in wetter areas as are salmonberry and a variety of mosses. A spruce forest community, consisting of white spruce, paper birch, aspen, poplar and black spruce, occur sporadically throughout the preserve and are generally located along the south-facing foothills and valley bottoms.

The Bering Land Bridge National Preserve contains 2.7 million acres on the Seward Peninsula. Subsistence uses are an essential park of the lifestyle of most residents of the Seward Peninsula. Subsistence hunting, fishing, and gathering activities are important not only for food, but as a foundation for native traditions, values and cultural identity. Local residents harvest marine mammals, whitefish, sheefish, Dolly Varden; a variety of edible berries, roots and other vegetation; migratory waterfowl, furbearers; and large mammals such as caribou and moose in the preserve. There is extensive subsistence use in the preserve by residents of Shishmarref, with selected areas being used by residents of Kotzebue, Deering, Wales and Nome.

More comprehensive descriptions of the affected environment within can be found in the following NPS documents.

- *General Management Plan, Land Protection Plan, Wilderness Suitability Recommendation, Cape Krusenstern National Moument, 1986.*
- *General Management Plan, Land Protection Plan, Wilderness Suitability Recommendation, Kobuk Valley National Park, 1986.*
- *General Management Plan, Land Protection Plan, Wilderness Suitability Recommendation, Bering Land Bridge National Preserve, 1986.*

The majority of WEAR lies within the Limited Protection Fire Management Unit. Under the proposed action, wildland fire ignitions occurring within this unit would be managed for the accomplishment of

resource management goals, including the preservation of the natural fire regime, and the perpetuation, in turn, of healthy and biologically diverse plant communities and fish and game habitat.

V. SUBSISTENCE USES AND NEEDS EVALUATION

To determine the potential impact on existing subsistence activities, three evaluation criteria were analyzed relative to existing subsistence resources that could be impacted.

The evaluation criteria are:

- The potential to reduce important subsistence fish and wildlife populations by (a) reductions in numbers, (b) redistribution of subsistence resources, or (c) habitat losses;
- The effect the action might have on subsistence fisherman or hunter access; and
- The potential for the action to increase fisherman or hunter competition for subsistence resources.

1) Potential to Reduce Populations:

The National Park Service has generally found populations of plants and animals important to subsistence activities to be healthy. However, site-specific information on populations, distribution, and harvest is lacking for many of these species, therefore, recognition of declining populations has been difficult.

The actions that would be implemented under the preferred alternative would be aimed directly at the safe and cost-effective preservation of the area's natural fire ecology. As such, WEAR enactment of the preferred alternative would have a beneficial effect on the long-term viability of plant and animal populations pertinent to subsistence use within WEAR. The occasional displacement of plant and animal populations from specific locales by wildland fire is a natural and inevitable occurrence within the fire-dependent ecosystems of WEAR. Although current populations may experience some adverse effects, usually those effects are greatly offset by the benefits accrued to future generations of populations.

Under the proposed action, land managers could mitigate potential losses to subsistence users through the consideration of hunting and trapping activities in the planning and implementation of Wildland Fire Use and prescribed fire incidents. There are a few users who have permits for the use of public structures within the management area. These structures are protected under Critical Suppression as noted in the accompanying Fire Management Plan (FMP, Section XVI Protection of Sensitive Resources). In the event of loss of or damage to this structure, the Superintendent of the Preserve may permit reconstruction of this structure. However, subsistence use is an important factor in the determination of prescribed fire within WEAR.

2) Restriction of Access:

NPS lands are managed according to legislative mandates, NPS management policies, and guidelinds. The proposed action is not anticipated to significantly restrict access of subsistence users to natural resources on NPS lands. Under the proposed action, such restrictions would be minimized by the continual reduction of hazardous fuels on the landscape by allowing fire to fulfill its natural role. This in turn would reduce possibility of widespread, catastrophic fire due to heavy fuel build up, in the future.

3) Increase in Competition:

NPS regulations and provisions of ANILCA provide the tools for adequate protection for fish and wildlife populations on Federal Public lands while ensuring subsistence priority for local rural residents. The enactment of the preferred alternative would not significantly increase competition for the use of subsistence resources. Displacement of plant and animal populations from specific sites would be short-term, and, in fact, in most cases the long-term viability of the populations in question depends directly on the natural processes that the proposed plan is intended to safely perpetuate.

VI. AVAILABILITY OF OTHER LANDS

As stated earlier, wildland fire is an inevitable component of the plant and animal communities of Western Arctic Parklands. Consequently, the availability of other lands is not a pertinent consideration in this particular case.

With respect to the question of subsistence use, the scope and intensity of wildland fire incidents managed for resource benefit (i.e., fire use incidents) will generally be of small significance when considered within the context of overall available acreage. Prescribed fires will be planned and managed so as to avoid any significant hardship to subsistence users.

VII. ALTERNATIVES CONSIDERED

This section discusses the considered alternatives with respect to their respective reduction or elimination of the need to use public lands necessary for subsistence purposes.

Alternative 1 (a combination of prescribed fire use and wildland fire suppression) would perhaps result in the least short-term disruption of subsistence activities, with suppression responses preventing the spread of multiple wildland fire ignitions. The long-term impacts of this alternative, however, would be negative, with the exclusion of wildland fire leading to the gradual decline of biodiversity and viable habitat throughout all areas within WEAR utilized by subsistence hunters and trappers.

Preferred alternative (a combination of Wildland Fire Use, wildland fire suppression, and prescribed fire use) would yield the same favorable long-term effects on lands used for subsistence activities as alternative two, while allowing more effective protection and restoration of significant fire-sensitive sites and/or landscapes.

Alternative 2 (a combination of Wildland Fire Use and wildland fire suppression) would not significantly differ from the preferred alternative with respect to the reduction or elimination of the need to use public lands for the accomplishment of fire management goals.

VIII. FINDINGS

This analysis concludes that the proposed action will not result in a significant restriction of subsistence uses.

[redacted]

National Park Service
U.S. Department of the Interior

Western Arctic National Parklands
WEAR

Alaska

Finding of No Significant Impact

Fire Management Plan Environmental Assessment

September 2004

Recommended: Julie A Hopkins — 9-29-04
Superintendent, Cape Krusenstern National Monument, Kobuk Valley National Park, Noatak National Preserve, Bering Land Bridge National Preserve — Date

Approved: Marcia Blaszak — 9/30/04
Regional Director, Alaska — Date

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Appendix D: Compliance for FMP (continued)

4. NHPA (Section 106)
TBA

5. ESA (Section 7)
Comments are imbedded in the Environmental Assessment.

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Appendix E: Multi-Year Fuels Treatment Plan

Fuel Treatment Plan
Western Arctic Parklands

Introduction

The purpose of the Western Arctic Parkland's Fuel Plan is to provide firefighter/public safety and to increase the probability of protecting the built environment of the park. By implementing the fuel treatment prescription to reduce or remove vegetation, a defensible space will be created and maintained around the park structures. This space allows radiant heat from a wildfire to dissipate, and reduces crown fire potential, thus keeping the building from igniting. It also prevents structural fires from igniting other structures, and provides a safe area for suppression crews to work. Creation of this space reduces the risk of property damage in the event of a wildland fire, improves security for visitors and residents, and reduces the risks for firefighters. This plan also describes implementation and maintenance schedules for specific sites.

This plan documents how to implement the fuel reduction program in the Western Arctic Parklands. An Environmental Assessment was been prepared according to the National Environmental Policy Act of 1969 and regulations of the Council on Environmental Quality (40 CFR 1508.9). The Environmental Assessment received a Finding of No Significant Impact (FONSI) September, 2004.

The Western Arctic Parkland's Fuel Plan complies with NPS policies and guidelines and provides guidance for treating vegetative fuels. The Alaska NPS Structure Protection Procedures were approved in 2005 by the Alaska Regional Director and provide direction to the park superintendents concerning structure protection.

The wildland urban interface is the line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The vegetation near structures is referred to as fuel. In some areas in the Western Arctic Parklands this vegetation is particularly thick and may touch or overhang structures. The vegetation significantly complicates the ability of fire fighters to control a wildland fire and protect the structures. Many of the structures in the Western Arctic Parklands have been built within the forest or close to the forest edge, or the forest has since expanded to the proximity of the structures. Due to the remoteness and difficulty of access, it takes a significant amount of time, effort, and resources to protect cabins and structures during a fire.

General Concept

In support of the FireWise Community Action Program, the National Park Service will remove hazardous vegetative fuel that surrounds structures in the backcountry areas within the Western Arctic Parklands.

Scope

The proposed areas will be developed through consultation with park staff, typically occurring at isolated historic and cultural sites located throughout the Western Arctic Parklands. To continue the

benefits of hazardous vegetative fuel reduction, a maintenance program involving periodic repeated removal of vegetation in these same areas is addressed in this plan. Similar treatments will be applied if additional structures are determined to warrant protection.

Treatment Zones

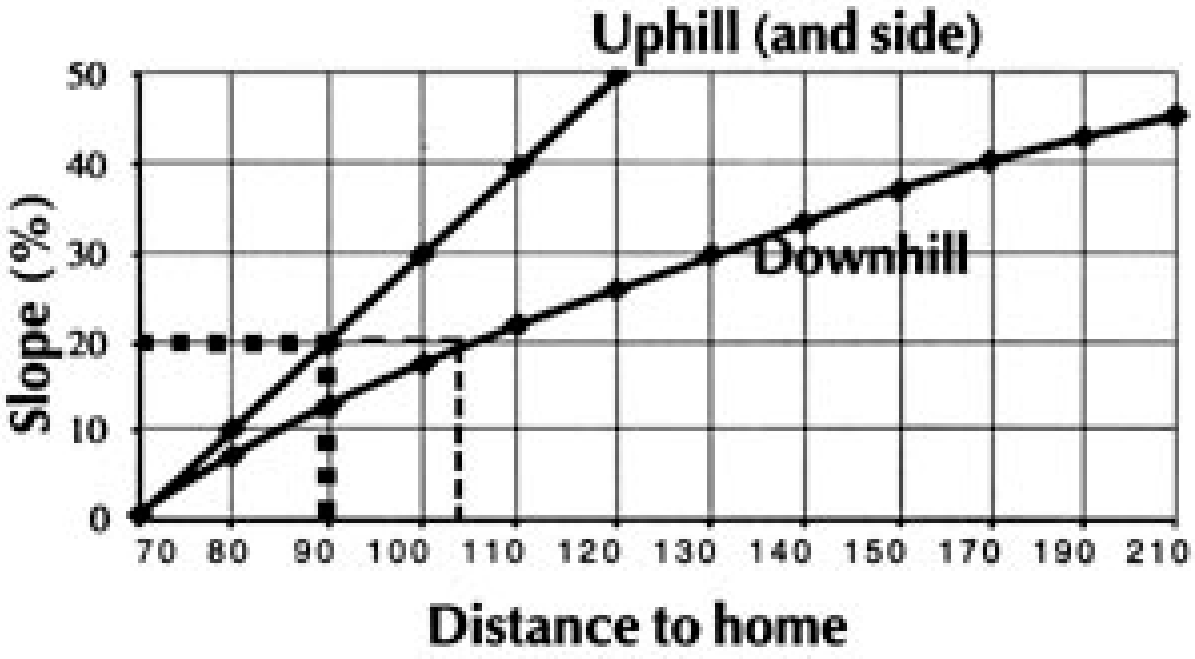
The area around each structure is divided into three fuel treatment zones.

Zone 1 extends an additional 30 feet from the structure. Combustible vegetation will removed from Zone 1 to create a 30-foot buffer around the structure.

Zone 2 extends a minimum of an additional 60 feet from Zone 1 for a minimum distance of 90 feet from each structure. In Zone 2 the fuel will be thinned out and limbed up to 6 feet. Crown spacing will be no less than 20 feet. (Crown spacing is measured from the furthest branch of one tree to the nearest branch on the next tree.)

Depending on the availability of natural barriers, the extent of Zone 2 may have to be modified. Modification of Zone 2 on slopes will expand the treatment area. The increase of space on slopes is needed to accommodate the increase intensity in fire behavior on slopes. As heat rises, fuel on slopes preheats and ignites quickly, causing fires to travel faster upslope. Enlarged defensible space around structures on slopes is needed especially on the downhill side. Figure 2-1 indicates the minimum distances that Zone 2 should be extended depending on the percent slope and position of the slope relative to the structure.

Areas around each structure will be individually evaluated to design defensible spaces within the context of that structure's use, location, and cultural significance. It is important to evaluate each structure on its own relative to the proximity of green lawns, driveways, roads or natural fuel breaks. For example, a spruce tree may be left in Zone 1 if lawn and driveway extended the largely vegetation-free area beyond the 30-foot point. Limited numbers of trees may remain as long as they are not leaning toward the structure or do not have branches that extend over the roof. Efforts will be made to work with residents to identify trees that could remain around their house. Should a fire occur and approach a particular structure, residents need to understand that there is a high probability that even those trees that are not removed in advance will have to be removed to protect the structure.



Criteria Used to Determine Treatment Priority for Structures

Because the protection of every known structure within the park cannot happen at the same time, criteria have been established to provide managers with sound methodology for determining which structures to treat first. The criteria are as follows and may be updated or improved should new information become available (Appendix G. Alaska NPS Structure Protection Procedures).

TOP PRIORITY (CRITICAL FIRE MANAGEMENT OPTION IN THE ALASKA INTERAGENCY WILDLAND FIRE MANAGEMENT PLAN, AIWFMP)

1. The structure(s) is a primary domicile.
2. Structure(s) is designated as a National Historic Landmark.

SECOND PRIORITY (FULL FIRE MANAGEMENT OPTION IN THE AIWFMP)

1. The structure has been determined eligible for or is on the National Register of Historic Places, has structural integrity (e.g. intact roof and walls, a reasonable probability for defense), is at potential risk from wildland fire and has been identified for or undergoing routine maintenance/restoration.
2. NPS administrative (e.g. patrol cabin) or public use structures – public funds expended to construct or maintain.
3. The use of the structure is provided for under NPS permit or an approved Mining Plan of Operations.

The following types of structures would not receive treatment under this Fuel Plan:

1. Trespass structures

2. Abandoned structures that are not eligible for inclusion on the National Register of Historic Places.
3. Structures without structural integrity or they have not been identified for or are undergoing routine maintenance/restoration. (It is difficult to put a sprinkler system on a structure without a roof.)

On-site Evaluation

Site reconnaissance will be completed to evaluate actual field conditions and determine planned actions. For example, trees selected for removal and areas selected for clearing and thinning will be identified and inspected to confirm planned actions. Representatives from Cultural Resources and Fire Management will review all actions in the field and agree on the designations made for each area or building perimeter. The number of trees removed will vary at each location depending on the type and characteristics of the vegetation, slope and aspect, and degree of significance of the structure. Each site, structure, and situation is unique (for example, fire history, roadside screening, roof material, siding material, continuum of fuel, location of road, privacy, aesthetic considerations) so the treatment of the site will be tailored accordingly. Paramount consideration will be for the safety of personnel protecting the structure should a fire occur.

Specific aspects of removal and clearing to be evaluated include, but are not limited to: resulting vegetative edge conditions, integration of root systems, and canopy constraints.
Resulting vegetative edge conditions should be reviewed to ascertain potential weakness of remaining plant materials that would be exposed to wind, sunlight and a change in precipitation levels. Roots of a number of trees may in fact share a singular root system and may require careful evaluation before removing single specimens. Consideration of canopy form and aesthetic appearance of those trees that remain should be evaluated to determine whether extensive pruning and/or limbing would be required.

Fire Management staff will devise a site protection plan for each backcountry structure at the initial clearing. This plan would estimate the amount of time and resources needed for protection (and maintenance) of the site.

Site Access

Staff and/or contractors involved in the removal/clearing of vegetation will be provided with the locations of all accessible routes into the area. Locations for staging, stockpiling, parking, landing, and administrative functions should also be identified so that activities are restricted from areas that will continue to be used by public/park staff during the removal period or that contain resources that are to remain undisturbed.

The following measures would be taken to mitigate noise intrusion and resource damage by motorized equipment in areas of designated and eligible wilderness:

- Strictly limit work to only necessary sites. The sites where work is proposed constitute the most critical needs. No work is proposed at less important sites.

- Control means of access. Coordinated on a yearly basis.

- Crews may perform long-term maintenance at some backcountry sites during winter. This may include debris pile burning.

- Where feasible, subsistence permit holders will be encouraged to maintain the defensible space around the cabins, in accordance with the standards identified in this plan. This would reduce NPS administrative presence and associated helicopter use. NPS fire management staff is available to consult with permit holders to identify needed treatment and if it benefits the NPS, fire management staff may assist with the treatment.

Use of Tools

Motorized tools such as chainsaws and "weed eaters" will be permitted for the initial fuel reduction at both designated and eligible wilderness sites. This exception allows motorized use and is based on weighing the need to accomplish the work expeditiously in order to avoid catastrophic harm by fire against the desire to reduce the impacts of motorized noise on wilderness users. Factors considered include labor required to accomplish the work by hand, utility of the buildings and infrequency of visitor presence. The use of mechanized and motorized tools to remove hazard fuels will be subject to the minimum requirement/ minimum tool.

Subsequent maintenance work should be accomplished only with non-motorized hand tools at all sites within the designated Wilderness.

Motorized tools will be permitted for subsequent work at sites outside the designated Wilderness. These tools are commonly used at many of the inholdings and cabin sites by landowners and subsistence users. The projected level of additional use connected with the proposed action would not be significant, and would not diminish the suitability of the portions of the park where these other sites are located from being considered for wilderness designation in the future.

Protection of Resources

Removal of vegetation will be completed in a manner that does not damage or disturb the remaining vegetation, other natural resources, historic and cultural resources, or infrastructure/improvements. If observation by archaeologists, cultural resource specialists, or other park staff is anticipated, they will coordinate with the fuels reduction crew will minimize/facilitate site visits. Park staff will be responsible for properly identifying specific resources that are to be protected and informing the fuels reduction crew.

Fuel reduction crews will be briefed about cultural resources concerns such as the need to use care when removing vegetation growing on, under, or next to structures; the types of artifacts that may be encountered when working around historic structures; and the requirement that trees and shrubs be cut off at ground level and not uprooted.

The crews will be instructed to not disturb artifacts and to immediately contact the supervisor if artifacts are found. Sensitive areas will be identified to the crew to minimize foot traffic and

dragging of brush over these sites. Tree felling will be accomplished in such a way that trees would be dropped in directions away from identified sites. A cultural monitor will be requested if historic properties are discovered or unanticipated effects on historic properties are found.

Removal Techniques

Beyond routine and accepted techniques per arboricultural standards, removal of trees will be accomplished in a manner that minimizes disturbance of administrative and public activities. Removal operations will generally occur during normal business hours. Re-routing traffic and controlling access to removal areas will be the responsibility of the involved contractor/park staff. All necessary safety precautions will be taken to protect the public, staff and contracted workers.

Trees designated for removal will ideally be felled with the stump grubbed or cut flush with the existing grade, hashed with saw cuts, and covered with dirt and forest floor debris. This will facilitate recovery of groundcover and will be consistent with the treatment and appearance of cultural landscape that is to be interpreted. Felling should be accomplished in a manner that minimizes leaving permanent markings or indentations on any surface of the ground. At remote sites logs will be bucked up, allowed to dry, and used as firewood at patrol cabins. Larger tree trunks may be saved for renovation of historic structures. Logs from trees at residences may be bucked up and used as firewood by the residents.

Successional changes at treated sites will continue through the selection of seedlings and saplings that will not be removed from Zones 1 and 2. Identified seedlings/saplings will be permitted to grow and develop naturally to replace trees and shrubs that die off.

Park residents are encouraged to discuss the details of fuel removal with fire management staff to assure that both fire protection and aesthetic concerns are addressed when fuel reduction decisions are made. The Park Superintendent will retain the authority to determine if or extent of fuel management treatments if conflicts occur .

Limb and Branch Pruning

Trees may require pruning of lower limbs, damaged or imbalanced branches, previously cut knobs, and sucker growth. Clean cuts will be kept close to the trunk or connecting branch. Trees that may be retained within the 30-foot clear zone of a building will be limbed up a minimum of 6 feet from the ground. Limbing of trees between 30 and 100 feet away from a building will be evaluated on an individual basis; however, a rule of thumb is the closer to the building, the higher the limbing. Some snags may remain on the outer edges of Zone 2 as long as they do not pose a safety or fire hazard. Snags will not remain in Zone 1 since they are an ideal source of burning embers that pose too great a threat to firefighters and structures.

Burning

Fire prevention measures as identified in a certified burn plan will be taken to assure that a wildland fire is not ignited by burning of shrub and branch debris. The burn plan will address appropriate weather conditions, adequate clearing around debris piles, limiting the number of piles that are burning at one time, and presence of trained personnel with appropriate fire fighting apparatus and personal protective equipment.

Where feasible, shrubs and branches may be scattered rather than burned if the surrounding fuel loading is not adversely affected by additional bio-debris and fire hazard is not increased. Shrubs and branches, if burned, will be piled in locations distant enough from structure areas to prevent damage to the structures. Shrub and branch piles shall be burned during a time that minimizes impact to park users, during a time when visitation is the lowest and fire danger is low. Burning will be done in compliance with National Park Service policies and Alaska Department of Conservation Open Burning regulations.

Clean Up

All tree, limb, and branch debris will be removed from non-paved areas. Additionally, the aforementioned materials plus twigs, leaves, needles, chips, and other organics will be removed from all trails and site furnishings. All refuse generated or brought on site in the form of packaging, equipment parts, or worker supplies will be removed from the park.

Periodic Maintenance

Sites in the Western Arctic Parklands will be revisited periodically following fuel removal. An evaluation of limb, sapling and shrub re-growth will occur and a determination will be made regarding removal cycles. It is generally anticipated that re-treatment may be necessary roughly every five to 10 years. In designated Wilderness, only non-motorized hand tools will be used for follow up treatments, unless there is a fire emergency. Hand tools may include hand saws, scythes, axes and pruning tools. In non-wilderness backcountry areas power hand tools may be used. Reduction in the height and density of herbaceous plants, grasses, and small shrubs may be done annually via mowing in developed areas.

Park	UNIT_ID	NFPORSTreatment Unit Name	Name		Priority (high or low)	Order	2014	2015	2016	2017	2018
AK-DEP		Front Country - East	HQ Historic District	WUI	High	1	Pile/Burn/Maintenance	Pile/Burn/Maintenance			
AK-DEP		Front Country - East	HQ Residential	WUI	High	2		Pile/Burn 3.11ac H_Unit_8			
AK-DEP		Front Country - East	Ccamp and Admin. Structures	WUI	High	3	Pile/Burn - 2.59 ac C_Unit_5	Pile/Burn 2.30 ac C_Unit_4			
AK-DEP		Front Country - West	Toklat Road Camp	WUI	High	4	Pile/Burn .86 ac T_Unit_5	Pile/Burn 2.71ac T_Unit_6	Maintenance/Pile - 2		
AK-DEP		Front Country - East	Rock House	WUI	High	5	Pile/Burn 1.58 H_Unit_10 Maintenance				
AK-DEP		Front Country - East	Visitor Center Area	WUI	High	6					
AK-DEP		Front Country - East	MSLC	WUI	High	7					
AK-DEP		Front Country - East	Wilderness Access Center	WUI	High	8					
AK-DEP		Front Country - East	HQ/Ccamp Water Facility	WUI	High	9					
AK-DEP		Front Country - East	MSLC Water Facility	WUI	High	10					
AK-DEP			Frontcountry Critical FMU	WUI	High				Planning	EA Development	Unit 1 (20 Acres)
AK-DEP	DENA-005	Front Country Cabins - West	New Thorofare River Patrol Cabin	WUI	High						
AK-DEP	DENA-009	Backcountry Cabins	Moose Creek Patrol Cabin	WUI	High	18	Finish Cut (around cache) - .4 ac	Burn			
AK-DEP	DENA-040	Backcountry Cabins	Parker's Cabin	WUI	High						
AK-DEP	DENA-074	Backcountry Cabins	Collins (12 mile slough)	WUI	High	12					
AK-DEP	DENA-076	Backcountry Cabins	Collins Slippery Creek Cabin	WUI	High	13				Evaluate	Cut/Pile/Burn
AK-DEP	DENA-077	Backcountry Cabins	Carlson's Slippery Cabin	Non-WUI	High	14				Evaluate	Cut/Pile/Burn
AK-DEP	DENA-081	Backcountry Cabins	Lower Toklat Patrol Cabin	WUI	High	21					
AK-DEP	DENA-087	Backcountry Cabins	Roosevelt Cabin	WUI							
AK-DEP	DENA-082	Backcountry Cabins	Crooked Creek	Non-WUI	High	11	Evaluate				
AK-DEP	DENA-095	Backcountry Cabins	Birch Creek Cabin	WUI	High	15				Evaluate	
AK-DEP	DENA-100	Backcountry Cabins	Lower Windy Creek Patrol Cabin	WUI	High	27					
AK-DEP	DENA-101	Backcountry Cabins	Upper Windy Patrol Cabin	WUI	High	40		Evaluate			
AK-DEP	DENA-110	Backcountry Cabins	Riley Creek Patrol Cabin	WUI	High	25		Evaluate			
AK-DEP	DENA-122	Backcountry Cabins	Lower Savage Patrol Cabin	WUI	High	31					
AK-DEP	DENA-126	Backcountry Cabins	Sushana Patrol Cabin	WUI	High	22			Evaluate	Maintenance - .65 ac	
AK-DEP	DENA-127	Backcountry Cabins	Lower East Fork Patrol Cabin	WUI	High	20					
AK-DEP	DENA-149	Backcountry Cabins	Stampede Mine	WUI	High	23	Cut/Pile - 2 ac.				
AK-DEP	DENA-187	Front Country Cabins - West	Busia Cabin	WUI	High		Cut/Pile - .72 ac.	Burn - .72 ac.			
AK-DEP	DENA-199	Backcountry Cabins	Barb Cabin	WUI	High	17				Evaluate	
AK-DEP	DENA-202	Front Country Cabins - West	Pearson Cabin	WUI	High	30					
AK-DEP	DENA-207	Front Country Cabins - East	Igloo Patrol Cabin	WUI	High	32					
AK-DEP	DENA-208		Sanctuary Patrol Cabin	WUI	High						
AK-DEP	DENA-209	Front Country Cabins - East	Upper Savage Patrol Cabin	WUI	High	36					
AK-DEP	DENA-236	Front Country Cabins - West	Gallup Cabin	WUI	High		Cut/Pile .72 ac.	Burn - .72 ac.			
AK-DEP	DENA-241	Backcountry Cabins	New Birch Creek Cabin	WUI	High	16					
AK-LCP			Frontcountry Critical FMU	WUI	High				Planning	EA Development	Unit 1 cut/pile (20 Acr
AK-LCP	LACL 271	Port Alsworth NPS Facilities	NPS Former Field Office	WUI	High	1		Cut/Pile	Burn		
AK-LCP	LACL 272	Port Alsworth NPS Facilities	NPS Duplex	WUI	High	2		Cut/Pile	Burn		
AK-LCP	LACL 074	Port Alsworth NPS Facilities	Bly House (The Point)	WUI	High	3					
AK-LCP	LACL 218	Backcountry Cabins	Snipe Lake Cabin	WUI	High	4	Burn - .7 ac.				
AK-LCP	LACL 212	Backcountry Cabins	Telaquana Ranger Cabin	WUI	High	5	Burn - .97 ac.				
AK-LCP	LACL 155	Backcountry Cabins	Hermit Lake	WUI	High	6	Cut/Pile - .65 ac.	Burn - .65 ac.			
AK-LCP	LACL 203	Backcountry Cabins	Lower Twin Ranger Cabin	WUI	High	7	Cut/Pile - .65 ac.	Burn - .65 ac.			
AK-LCP	LACL 208	Backcountry Cabins	Dick Proenneke	WUI	High	8					
AK-LCP	LACL 216	Backcountry Cabins	Igitna River - Kenibuna Lake Cabin	Non-WUI	High	9		Cut/Pile - 1	Burn		
AK-LCP		Backcountry Cabins	Priest Rock Cabin	WUI	High		2011 Burn Pile Eval. - Fire monitoring				
AK-LCP	LACL 079	Port Alsworth NPS Facilities	Joe Thompson Cabin	WUI	High		2011 Burn Pile Eval. - Fire monitoring				
			Stoney RAWS	Non-WUI	High						
			Kijik Russian Orthodox Church	Non-WUI	High						
		Port Alsworth Defensible Space	Port Alsworth Fuel Break	Non-WUI	High		Planning				
AK-WEAR	KOVA-001	Backcountry Cabins	Onion Portage Ranger Cabin/Giddings Cabin	WUI	High	1		Evaluate			
AK-WEAR	BELA-005	Backcountry Cabins	Fairhaven Ditch Cabin #1	Non-WUI	High	2					
AK-WEAR	BELA-006	Backcountry Cabins	Fairhaven Ditch Cabin #2 & #3	Non-WUI	High	3					
AK-WEAR	KOVA-022	Backcountry Cabins	Kantner Cabin 1	Non-WUI	High	4					
AK-WEAR	KOVA-023	Backcountry Cabins	Kantner Cabin 2	Non-WUI	High	5					
AK-WEAR	KOVA-024	Backcountry Cabins	Kantner Cabin 3	Non-WUI	High	6					
AK-WEAR	NOAT-002	Backcountry Cabins	Kelly River Ranger Station	WUI	High	7			Evaluate		
AK-WEAR	NOAT-048	Backcountry Cabins	Nakolik Shelter Cabin (Wolf Control Cabin)	Non-WUI	High	8		Cut/Pile	Burn		
AK-WEAR	KOVA-013	Backcountry Cabins	Portage Shelter Cabin	Non-WUI	High	9		Cut/Pile	Burn		

Appendix F: Wildfire and Prescribed Fire/Fuels Treatment Monitoring Plan

I. INTRODUCTION / EXECUTIVE SUMMARY

1.0 Introduction

Western Arctic National Parklands (WEAR) has established a program of fire management to achieve resource management objectives associated with the protection and stewardship of fire-adapted ecosystems. The purpose of fire and fuels monitoring program is to provide effective evaluation of the fire program management activities with respect to fuels, vegetation, wildlife habitat effects or additional identified objectives. The WEAR fire monitoring program is designed to determine whether fire and resource management objectives are being met, as well as to document any unexpected consequences of fire management activities. The monitoring program is intended to inform the staff about results of management activities so management can adapt to changing conditions using the best available information. In addition, the program strives to obtain baseline data on the natural variability of fire on the landscape and asses impacts of potential climate change on fire and fire effects.

The purpose of the Alaska NPS Fire Ecology program is to provide science based information to guide Alaska NPS fire and land management planning, decisions and practices in order to maintain and understand fire adapted ecosystems. The primary focus areas of the program are to:

- Participates in *planning* activities for the Fire Management and Park Land Management Programs and develops strategies to accommodate fire management issues as a result of climate change
- Provide effective evaluation of Alaska NPS fire management program activities and fire on the landscape through *monitoring*
- Coordinate *research* and facilitate the use of scientific data, modeling and technology to enhance the fire management program
- Provide fire ecology *information and outreach* to fire managers, other park staff, and the public
- *Collaborate* with other NPS programs, interagency partners, and other entities.

One of the primary tasks of the Fire Ecology program is to develop and implement a comprehensive Fire and Fuels Monitoring program for Alaska's parks. The Regional Fire Ecologist is responsible for coordinating monitoring efforts and maintaining fire effects data. Currently the Alaska NPS Fire Ecology program does not have a funded fire effect monitoring crew. The monitoring work is accomplished by NPS Fire/Fuels technicians and staff, under the guidance of the Regional Fire Ecologist. For projects conducted in Western Arctic Parklands, the NPS Western Area Fire Management staff allocates some work hours of multi-disciplinary forestry technicians and fuels technicians to fire ecology projects. To be most effective, evaluation and integration of fire monitoring data will be a shared responsibility between personnel; primarily between Regional Fire Ecologists, Western Area Fire Management personnel, and park staff.

This fire monitoring plan describes the framework that will be used to collect, manage, and evaluate fire effects information at WEAR. As new information and research results are obtained, relevant changes to the monitoring program will be made. These changes may include new or alternative monitoring techniques, changes in treatment prescriptions, or refinement of management objectives.

1.1 Need for monitoring and study in relation to management

NPS Fire Ecology Program Policy is developed by the NPS Fire Ecology Steering Committee with approval from the NPS Fire Management Leadership Board. The information within this monitoring plan is consistent with information from RM-18 (USDI NPS 2008 http://www.nps.gov/fire/fire/fir_wil_planningandpolicy.cfm) and the NPS Fire Monitoring Handbook (USDI NPS 2003 http://www.nps.gov/fire/fire/fir_eco_mon_fmh.cfm).

Each Fire Management Area unit intending to either manage wildland fire for resource benefit or conduct prescribed fire must have an approved fire management plan. In order to evaluate resource management and fire management objectives, units must monitor the effects of fire. The Fire Monitoring Plan can be prepared independent of the Fire Management Plan and attached as an Appendix at a later time. Since the Western Area Fire Management unit manages wildland fire, implements mechanical fuels reduction projects, and could potentially implement prescribed fire, this plan has been prepared.

1.2 History of Fire & Fuels Monitoring at Western Arctic Parklands (1978-2010)

Prior to the 2002 establishment of the Alaska NPS Fire Ecology program, a handful of formal fire effects study were completed in Western Arctic National Parklands. These include the Alaska Region NPS Fire Paired Plot study and tundra fire studies completed by Charles Racine. These studies are summarized below. Since the establishment of a formal Alaska NPS Fire Ecology program in 2002, all of the fire and hazard fuels treatment monitoring protocols employed in WEAR have been based on the Alaska NPS Fire Management Fire and Fuels Monitoring Program Field Method Protocol (Appendix C). The protocol is an Alaska NPS specific modification of the field-tested methods created by the Alaska Interagency Fire Effects Task Group (FETG) and compiled in the Fire Effects Monitoring Protocol (Alaska Interagency FETG 2007).

Compiled below, in the order of oldest to most recent, are summaries of each fire ecology related monitoring protocol employed in WEAR to date. The full protocol and complete methodology for each WEAR project may be referenced in Appendix C.

Alaska NPS Fire Effects Paired Plots (1982-Present)

Background & Purpose: The only formal NPS fire effects study on Alaska parklands prior to 1999 was the Alaska Region NPS Fire Paired Plot study. The project began in 1981 under the direction of Gary Ahlstrand, NPS Alaska Regional Research Ecologist. The purpose of the project was to assess vegetation change and succession as a result of fire and to determine fire history. Fire staff established paired vegetation 15-m x 30-m plots in burned and representative unburned habitat adjacent to the burned areas of varying ages. Between 1981 and 1988, at least 525 plots were installed across 9 different parks in Alaska. Most of the plot locations were not permanently marked. 144 plots were established in WEAR and are listed in table 1. A complete list of the plots and coordinates are listed in Table 1 of Appendix B. These plots provide valuable historic data on previous fires and fire effects in Western Arctic Parklands which can be used to compare vegetation succession in areas impacted by fire to those not impacted. The data is being used in other parks to develop fire succession models in order to update fuels and landcover vegetation maps for the fire management program.

Table 1. Number of known Fire Effects Paired Plots in Western Arctic National Parklands

Park	Burn Plots	Control Plots	Other Plots	Total
BELA	12	11		23
KOVA	30	28	2	60
NOAT	31	30		61

Methods: Burned sites were identified and selected for the study from historic fire reports, 1:63,360 color infrared aerial photography, and aerial reconnaissance. Plot data that was collected included: photographic slides of plot, tree density by species and diameter size class on 15-m x 30-m quadrants, vegetation cover class for 30 Daubenmire frames (20 x 50 cm), tree cores/cookies, fuels and soils data (on some plots), and general plot site descriptions. Complete protocols and methodologies are described in Appendix C.

Data Management: Up until 2008 most of the data was only available in paper format, except for the vegetation cover data was in a TWINSPAN text format. Between 2003 and 2008, paired plot data for all the parks was entered into a Microsoft Access database, and plot locations were digitized off topographic maps and aerial photos. The Access database was converted to an interagency Fire Ecology sequel server database called FFI V1.02 through a contract with SEM in 2008. Original copies of data and photos are archived at the Alaska Regional Office. Scanned copies of data and photos are stored at the regional office and with the Regional Fire Ecologist in Fairbanks.

BELA & NOAT Long-Term Tundra Fire Effects Plots – Charles Racine (1978-2009)

Background & Purpose: Two of the longest monitored sites (28-32 years) in Arctic Alaska for vegetation change and post-fire tundra succession are located in the Bering Land Bridge (BELA) and Noatak (NOAT) National Preserves in northwest Alaska. From 1978 through 1982 Charles Racine and colleagues established a series of plots for monitoring post-fire vegetation and permafrost recovery. These permanent vegetation plots were established following widespread tundra and forest fires in 1977, when one million acres burned during extreme drought in NW Alaska. Recently the NPS Arctic Network Inventory and Monitoring Program supported the re-measurements of these sites. The sites were revisited in 2005 (NOAT) and 2009 (BELA) by the Regional Fire Ecologist and an original researchers, Charles Racine and John Dennis. This long-term record of change after fire provides valuable documentation of fire effects in vegetation, permafrost, and wildlife habitat during an era of climate warming in the Alaskan Arctic.

BELA Methods and Sampling: The 8 transects at the Nimrod Hill site on the east side of Imuruk Lake in BELA burned during the large 1977 Kugrok Hill Fire. The researchers obtained pre-fire data from a 1973 soils and vegetation survey and in 1978 established 8 permanently marked transects along a topographic gradient on Nimrod Hill. The post-fire plots were re-measured in 1979, 1981, 1983, 2001 and 2002. Racine and NPS personnel located and re-visited the BELA Nimrod Hill fire plots in 2009 at which time the plots were permanently marked with wood lathe and rebar. At each of the 8 sites a 10-m x 1-m belt transect (with ten 1m x 1m plots) plot was established. Photos were taken of each plot and data collected included: vascular and non-vascular plant ocular cover, shrub heights (maximum) and stem densities, thaw depths, and general site descriptions.

NOAT Methods and Sampling: In 1981 and 1982, eight tussock-shrub tundra post-fire and control sites were established by Racine and Dennis in Noatak NP which included four sites burned in 1977, one site burned in 1972, one site burned in 1982, and 2 unburned control sites. The plot coordinates are listed in Table 2. Racine, Dennis and NPS personnel revisited these plots in 2005 for the first time since 1981 & 1982. At each site ten 1-m x 1-m plots were permanently marked and photographed. Data collected included: vascular and non-vascular plant ocular cover; shrub heights (maximum) and stem density; thaw depths; biomass, production and fuel estimates from vegetation clippings and general site descriptions. *Protocol:* Noatak Tundra Fire Effects Racine Plots_Protocol_2005.docx

Data Management: Data is currently stored as both MS Access files and MS Excel files. Preliminary analysis has been conducted for both study sites.

Reports & Publications:

Racine, C., R. Jandt, C. Meyers, and J. Dennis. 2004. Tundra fire and vegetation change along a hillslope on the Seward Peninsula, Alaska, U.S.A. Arctic, Antarctic, and Alpine Research 36 (1): 1-10.

Racine, C., Allen, J.L., and Dennis, J.G. 2006. Long-term monitoring of vegetation change following tundra fires in Noatak National Preserve, Alaska. Technical Report: NPS/AKRARCN/NRTR-2006/02. Arctic Network Inventory & Monitoring Program, National Park Service, Alaska Region. Fairbanks, AK. http://depts.washington.edu/nwfire/publication/Racine_et_al_2006.pdf

Racine, C., Barnes, J., Jandt, R., and Dennis, J. 2010. Long-term Monitoring of 1977 Tundra Fires in the Northwest Alaska Parks. Alaska Park Science, Volume 9, Issue 1: 24-25. http://www.nps.gov/akso/AKParkScience/2010Vol9-1/Long-Term-Monitoring-of-1977-Tundra-Fires-Racine.pdf

NOAT Uvgoon 2004 Fire Effects Plots (2004-2007)

Background: Fire plays an important role in maintaining a variety of vegetation types and successional phases across the landscape. The severity of a fire can play a role in determining what happens to the vegetation, soils, and the wildlife in the area. In 2004, NPS fire staff established six plots after the 2004 Uvgoon Creek fire (Fire #127) in Noatak National Preserve in tussock tundra plots. These plots will provide more recent fire effects information within tundra ecosystems.

Methods and Sampling: Six fire effects plots (3 pairs of burned and unburned tussock shrub tundra) were established in 2004 in the Uvgoon Creek Fire in Noatak NP. Plots were measured again in 2005 and 2007. 30m x 1m belt transect plots were photographed and marked permanently with rebar. Data collected at each plot included: vascular and non-vascular plant ocular cover estimates, point intercept cover estimates of vegetation and ground cover, tree density (where present), thaw depths, burn severity, photo points and general site descriptions. *Protocol:* AKR Fire and Fuels Monitoring Protocol 2010.docx

Data Management: Data entry for 2004 and 2005 were entered into FEAT dataset and converted to FFI (Database: FFI-AKWEST, Project: NOAT-PPF). However, the 2005 data was incorrectly entered as new macroplots, rather than sampling events. Therefore, both 2005 and 2007 data need to be entered into FFI. No reports have been completed and only photos have been presented.

II. FIRE ECOLOGY AND FIRE HISTORY

2.1 Overview of Western Arctic National Parklands Fire Ecology

The boreal forest and tundra of Alaska are fire-adapted ecosystems, and are characterized by a mosaic of different aged landscapes that are maintained by fire. Within this system, burn severity strongly influences vegetation patterns and succession after fire. Since many of the plant species are rooted in the organic forest floor mat, the amount of consumption of the organic mat will determine whether vegetation regeneration occurs through seeding or re-sprouting post fire (Viereck 1983). For tree establishment, seed source and seedbed conditions at the microsite scale in the immediate post-disturbance period are major drivers of recruitment (Zasada et al. 1992, Johnstone and Chapin 2006). If fire severity is low to moderate, above-ground portions of plants may be top-killed, but minimal organic mat or duff is burned and regeneration can occur quickly through re-sprouting from roots and stems for species such as aspen, paper birch, Labrador tea, willow, resin birch, rose, fireweed, tussocks or northern blue joint grass (Viereck and Schandelmeier 1980; Foote 1983; Racine, Johnson, and Viereck 1987) . On the other hand, severe burns will consume most of the organic layer and kill most of the underground root structure of shrubs and herbaceous plants, such that reproduction will occur primarily by seed. As a result, severity will influence the plant species composition at a site.

Relatively few studies have documented the effects of fire and burn severity in tundra ecosystems. In general, unless fires are severe, most shrub-tussock tundra types re-vegetate rapidly (Racine *et al.* 1987; Racine *et al.* 2004), even within weeks following the fire. High severity fires have the potential to decrease or kill tussock cottongrass (*Eriophorum vaginatum* L.) at sites. Fire is important in maintaining the long-term growth and survival of tussock cottongrass. In the absence of fire, tussock-shrub tundra undergoes a series of autogenic successional changes. These changes involve the accumulation of peat and burial or submergence of tussocks by dwarf shrubs, mosses, and lichens. This results in raised permafrost levels, reduced frost action, and senescence of tussocks. Frost action prevents such changes by churning soils, incorporating organics, and preventing the buildup of dwarf shrubs, mosses, and lichens. Frost action is renewed when enough organics are burned so that thaw depth reaches into mineral soils. Tussock cottongrass survives fire because its growing points are insulated by tightly bunched dead and live tillers, stem sheaths, and scales. The elevated position of tussocks increases resistance to ground fire. Fire provides an opportunity for seedling establishment. Since sheathed cottonsedge has both shallowly and deeply buried seed, some viable seed is available regardless of depth of burn into the peat horizon. Burned peat is an ideal seedbed. In a comparison of sheathed cottonsedge seedling emergence on different substrates, burned peat showed highest rates of emergence. Additionally, the study showed that fire releases nutrients and enriches tundra soils.

2.2 Historic Role of Fire

Climate, terrain, and vegetation strongly influence the occurrence and extent of fires within WEAR. The subarctic boreal forests and low arctic tundra biomes are subject to periodic fires. Over the last 55 years, greater than 1,248,506 acres have burned within and around the WEAR park units. An annual average of 13,397 acres burn per year just on NPS lands, 97% of which are caused by lightening (data from 1956-2010). The frequency and extent of the fires is variable within the park units (Table 2). Fires can exert landscape-scale controls on vegetation structure and composition, permafrost dynamics, nutrient cycling, carbon loss/gain, primary productivity, and biodiversity (Racine et al. 2004).

Table 2. Fire statistics for fires that have burned in and around WEAR from 1956–2010. Data is shown for both 1) fires that occurred only within park boundaries ("In Park") and 2) fires that have burned in the park boundaries, although not all acres are contained within the administrative boundary of the units ("Affecting Park"). Most fire data provided in the table is based on NPS fire records from 1950 - 2010 fires (Fire-NPS Alaska 2010, AKRO GIS permanent data set). Area burned within park boundaries are based on fire perimeter data. Lightning strike data is from AICC ARCIMS web page.

Statistic	**BELA**	**CAKR**	**KOVA**	**NOAT**	**Total WEAR**
Number of Fires Affecting Parks (Fire-NPS Alaska 2010)	45	4	63	189	301
Number of Fires Started in Park (Fire-NPS Alaska 2010)	42	3	58	186	289
Total Acres Burned - Affecting Parks (Fire-NPS Alaska 2010)	292,387	4,277	418,780	533,061	1,248,506
Total NPS Acres Burned*	136,573	673	110,103	476,087	723,435
Average Area Burned/Year Affecting Park (1956-2010)	5,415	79	7,755	9,872	23,120
Average Area Burned/Year NPS acres in Parks* (1956-2010)	2,529	12	2,039	8,816	13,397
Average Fire Size Affecting Park	6,497	1,069	3,735	2,820	4,148
Fire Cycle (years)* - number of years estimated to burn entire park area (1956-2010)	1,102	52,986	859	745	878
Average number of lightning strikes/year (1986-2010)	50	12	138	412	
Park Acreage	2,785,901	660,043	1,751,646	6,568,645	11,766,236

* Data based on acres from fire perimeter data set 1950-2010 clipped to park boundaries.

Within Noatak NPr the lowlands of the Noatak Valley are subject to periodic large fires and frequent small fires from late May until early August. Fires commonly occur in shrub-tussock tundra, sedge/graminoid lowlands, and shrub thickets of dwarf birch/ericaceous, alder (*Alnus* spp) or willow (*Salix* spp). Of all the parks in WEAR, Noatak has burned the most acreage and greatest number of fires over the last 55 years (Table 2). Recent studies indicate that over the past 2000 years in Noatak, the fire return interval has ranged from a median of 150 years down

valley to 195 years upvalley in the Noatak drainage (Hu et. al. 2010). However, Joly and others reported a fire cycle of 1,237 years for the preserve, based on fire perimeter records from 1950-2007. *Fire cycle* is defined as the length of time for an area equal to the entire area of interest to burn (McPherson et. al. 1990). More than 95% of Noatak's fires are caused by lightning. Thunderstorm development in the valley can result from synoptic widespread storms or localized air-mass storms controlled by local topography. Warm dry air masses within the Noatak Valley can encounter coastal low pressure systems from the west, leading to significant thunder cell development and lightning. When ignitions are accompanied by dry windy conditions, fires in the shrub-tussock tundra and low shrub birch/ericaceous can spread rapidly and burn thousands of acres in a few days.

Kobuk Valley NP is in the transition zone between the interior Alaska forests and northern and western tundra. Of the WEAR parks, KOVA has the greatest amount of forested lands, with a majority of the needleleaf forest mapped as white spruce (Table 1). Fires are most frequent in lower elevation forests south of the Baird Mountains within open and woodland spruce forests. Ninety two percent of starts occur between June and July. As is typical of boreal forest fires, the fires tend to have longer duration than tundra fires. No studies have been completed on the fire return intervals within KOVA. Fire cycles based on fire perimeters from 1950-2007 indicate that the fire cycle for Kobuk Valley is 840 years (Joly et. al. 2010).

Bering Land Bridge NPr (BELA) is located on the northern part of the Seward Peninsula. This area is a cold, wind-swept landmass jutting out into the Bering Sea. Vegetation is primarily tundra, with moist sedge-tussock shrub tundra communities at lower elevations and alpine Dryas-lichen tundra communities in the high mountains. Vegetation is primarily composed of sedge tussocks interspersed with scattered stringers of willows and dwarf birch. Patches of low-growing ericaceous and willow-birch shrubs occur on better-drained areas. Isolated pockets of balsam poplar occur within the region. These vegetation communities are susceptible to fire, but low frequency of lightning (Dissing and Verbyla 2003) and/or higher precipitation near coastal areas may likely reduce the number of fires within BELA. The majority of acres burned within the preserve occurred during 1977, in which several large fires burned within and around the Preserve. Over the past half century, fire suppression activity on the Seward Peninsula has possibly reduced the number of acres burned in the western half of BELA. Fire return intervals are not known for the preserve, however fire cycles based on fire perimeters from 1950-2007 indicate that the fire cycle for Bering Land Bridge is approximately 1,188 years (Joly et. al. 2010).

Cape Krusenstern National Monument (CAKR) is dominated by moist dwarf shrub-tussock tundra. The forest reaches its northwesternmost limit in North America in the vicinity of the eastern border of Cape Krusenstern National Monument. The number of fires in CAKR is much lower than the other park units, likely due to the wet maritime conditions and lack of ignition sources. Only four fires have been detected in CAKR over the past 50 years (see appendix S.2: Maps 5b: Fire History). Likewise, Joly and others found that the fire cycle for Cape Krusenstern was estimated at 53,349 years. No studies have been completed on the fire return intervals within CAKR.

III. MANAGEMENT GOALS, OBJECTIVES, AND DESIRED CONDITIONS

3.0 Monitoring Program Goals and Objectives

The Western Area Fire Management program has developed comprehensive fire suppression planning and programs for Western Arctic National Parklands and some investigation post-fire and long-term fire effects has been implemented by the Alaska Regional Fire Ecology program. Program requirements found in the national policy are described in the Fire Ecology and Monitoring chapter in RM-18 (Ch. 8, USDI NPS 2008). Within RM-18 it is stated that: "Fuels management activities and treatments must be monitored in order to assess treatment effectiveness and to determine whether management objectives were met. Moreover, monitoring is the basis of a successful adaptive management program."

Fire Management Goals

Whenever safely possible, Western Arctic National Parklands will utilize the role of fire in the natural environment in the fulfillment of NPS natural resource management directives. Accordingly, WEAR will direct all fire management activities toward the accomplishment of the following goals

1. The protection of human life, property, and irreplaceable natural and cultural resources.
2. The preservation of fire in its natural role and as a natural process to the fullest extent possible.
3. The maintenance of dynamic natural processes occurring within the WEAR.
4. The use of selected wildfires for the accomplishment of resource management objectives and for the reduction of hazardous fuels.
5. The minimization of adverse effects of fire and/or fire suppression activities.
6. The coordination and scientific management of wildland fire based upon natural resource management program, park and NPS goals and objectives.
7. The education of employees and public about the scope and effect of wildland fire management.
8. The management of wildland fire incidents in accordance with accepted interagency standards and the achievement of maximum efficiency through interagency coordination and cooperation.
9. Ensure Natural and Cultural Resource concerns are addressed on wildfire incidents through training of appropriate WEAR personnel as Resource Advisors.
10. The presentation of timely and accurate fire situation, fire behavior and fire effects information to the WEAR Superintendent, park staff, regional fire management staff or Incident Management Team and to appropriate Alaska Fire Service personnel.
11. Support resource inventories, monitoring and research to better understand the current and potential impact of changing climate on park resources in relation to fire.

Fire Ecology Monitoring Program Goals

The natural fire regime shapes many of these ecosystems on a landscape scale, therefore a better understanding of the effects of fire on the ecological community and its environment is necessary for detecting responses to environmental change and management decisions. In particular, an understanding of the ways in which plant systems are affected by fire should allow us to determine appropriate fire management options. This will allow us to more effectively and efficiently achieve our goals and hopefully add some understanding to the intricacies of these ecosystems, as a whole functioning unit in nature. Monitoring should help us answer the questions; How should management be executed? How should these systems be managed?

The overarching goals of the Fire Ecology Monitoring program are to:

- Verify that fire management objectives are met.
- Document long-term trends and natural level of variation in the frequency, extent, and severity of fires, monitor for impacts of climate change.
- Monitor fire and mechanical fuels treatment effects including:
    - effects of time since fire and burn severity or mechanical treatments on vegetation species composition, vegetation structure, and ground cover in varying vegetation types
    - effects of time since fire and burn severity or mechanical treatment on soil parameters
    - effects of time since fire on the abundance, distribution and composition of the wildlife populations (i.e. moose, caribou, small mammals, birds)?**
    - effects of time since fire on water quality and air quality? **
- Document fire behavior information for wildfires or prescribed fires if feasible
- Monitor fuel moisture of applicable fuel types
- Facilitate the sharing of fire-related information with fire managers to promote science-based management decisions

**The effects on wildlife populations, water quality and air quality are factors that may not be directly monitored by the fire management program and could be shared responsibility with the Inventory & Monitoring Programs.

Objectives and desired conditions are continually being developed and redefined from knowledge of the past and present. The methodologies and objectives need to be updated periodically. Monitoring objectives and precision levels will vary depending on project objectives and vegetation type. Vegetation monitoring objectives are used to verify that objectives are met. Documenting post-fire effects will allow us to follow trends in plant communities, which will improve our knowledge and direct our future management actions.

3.1 Adaptive Management

As the monitoring results become available, they are used to determine if management objectives are achieved and to determine if management activities need to be adjusted. Also at this time, an assessment of whether the management objectives are still desired is warranted in light of ongoing monitoring results and any new information made available. In this adaptive way, we can be sure that the monitoring program will adequately assess the success of the fire management program. Any changes or additions will be included in future revisions of this fire monitoring plan.

3.2 Desired Conditions

In managing and restoring the ecological benefits of fire on the landscape, managers must understand the differences between current conditions and desired conditions. Managers must also understand the practices and environmental factors that contributed to the current conditions. Information used to develop the desired conditions includes research data (where available), historic photos and written documents, and expert opinion. Desired conditions must be periodically evaluated to determine whether they are still realistic and wanted in light of a changing environment. For example, desired conditions may be based on our knowledge of past

long-term climate conditions; however, future climate changes may preclude achieving these targets.

It is important to recognize that further work is needed at WEAR to better understand the interrelationships within natural systems. As this occurs, we may be able to refine these desired conditions – as part of adaptive management. This could be accomplished at the landscape or vegetation community scale and could be useful in developing ecological models and refining ecosystem priorities. Currently no Desired Conditions are developed for Western Arctic National Parklands. The following Interim Fire Management Desired Conditions are proposed by the Fire Program and will be evaluated and updated, as appropriate, in the Resource Stewardship Strategy planning process scheduled for 2014/2015 and the development of interdisciplinary Desired Condition Western Arctic National Parkland wide:

Interim Fire Management Desired Conditions

1. Vegetation will be managed according to enabling legislation, mandates and guiding documents for ecological integrity and natural processes, including wildfire.
    a. The number of acres burned per year per Park Unit are within the range of natural variability (1984-2010)
    b. The number of natural fire starts per year per Park Unit are within the range of natural variability (1956-2010)
    c. Total duration (days) of fire incidents annually per Park Unit are within the range of natural variability (1984-2010). The count of days from the first fire discovered to the final fire declared out date.
    d. Percent of wildfire burn severity, by severity class, remain within the natural range of variability (1983 to Current) (if burn severity remote sensed data is available).
2. In Bering Land Bridge National Preserve, within Reindeer herding areas, as established on January 1 1976, manage wildfire in accordance to ecological integrity while maintaining sound range management practices.

IV. MONITORING DESIGN AND METHODOLOGY

The Western Arctic National Parkland's Fire Management Plan mandates that fuels treatments and management ignited prescribed fires must have measurable objectives. Consequently, pre- and post-fire and fuels treatment monitoring is necessary to determine if project objectives were met. Monitoring protocols document the sampling design, methods, frequency, and analysis for a monitoring program.

The national recommended standard for monitoring is the National Park Service, National Fire Monitoring Handbook (USDI 2003). However within the Fire Ecology and Monitoring chapter of RM-18 (USDI NPS 2008, Ch. 8), it is also stated that alternative monitoring protocols may be used to address local/regional needs and objectives. In addition, monitoring protocols can be developed at the park level, community level or project level. All alternative protocols need to be reviewed by the Regional Fire Ecologist.

4.0 Design and Methodology

In 2002, a Regional Fire Ecologist was hired for the Alaska Region parks. Since 2002, most of the fire effects monitoring project conducted in Alaska's parklands have been based on the Alaska NPS Fire Management Fire and Fuels Monitoring Program Field Method Protocol (Appendix C). Past fire monitoring methods for specific projects within WEAR are also presented

in Appendix C. The full protocols and methodologies used for fire and fuels monitoring plots in WEAR through 2010 are provided in Appendix C of this document. General design and methodologies are outlined in this plan. The following is the general framework, timing and data management plan for monitoring. Refer to the specific protocols in Appendix C for detailed methodologies.

4.1 Fire & Fuels Monitoring Framework

Fire and non-fire fuels treatment monitoring is an important part of adaptive management. Guidelines for monitoring wildland fires, prescribed fires and mechanical treatments within WEAR were developed in consultation with the Interagency Alaska Fire Effects Task Group (FETG), NPS Fire Monitoring Handbook (FMH 2001), and the NPS Alaska Regional Fire Ecologist. These guidelines provide recommendations for minimum variables to monitor fire or treatment effects within a framework of three monitoring intensities (Level 1 – 3) and are shown in Table 2. Brief descriptions of the three monitoring levels are provided below:

Level 1, Surveillance Monitoring - This level provides a basic overview of the baseline data that is required to be collected for all wildland or prescribed fires, some variables are required for mechanical treatments. Information at this level includes such items as RAWS weather data, general description of the fire environment (i.e. topography and fuel types), and fire location or perimeter. Information collected at this level precludes the necessity for on the ground measurements and can be done from remote sensing or an aerial platform. This data is necessary to satisfactorily complete a Wildland Fire Report.

Level 2, Moderate Intensity Monitoring - This level of monitoring documents fire behavior observations (not addressed in this document), fuels, and general effects of wildland fires, prescribed fires or mechanical treatments on vegetation. Information at this level includes characteristics of the fire, such as rate of spread, fire behavior, and burn severity, as well as current weather conditions. Fuel conditions would be assessed by determining the fuels array, composition, and dominant vegetation within the burn area, in addition to using vegetation and fuels maps to predict potential fire spread. Information to assess pre and post fire or treatment effects would include duff depth and moisture measurements, photo points, vegetation cover, and tree parameters. This level of monitoring is recommended for the use of wildland fire and prescribed fires, but is dependent on the objectives of the burn and the resources of concern. Some of the variables monitored at this level would require on the ground measurements of specific sites.

Level 3, Comprehensive Monitoring (Short or Long-term Fire Effects) – This level would be used to monitor the effects of prescribed or wildland fires in greater depth, it may also be used for mechanical treatments. Level 3 monitoring requires collecting information on fuel reduction, vegetative changes, and soil parameter changes. This level of monitoring may also include wildlife utilization techniques. The number of variables monitored increases and the techniques are more rigorous. Information collected at this level is based upon management objectives and the resources of concern. Variables monitored at this level would require the establishment of ground based plots.

Table 3: Monitoring level requirements and recommendations for Fire Management Activities

Management Activity	***Minimum Required* Monitoring Levels**	***Recommend* Monitoring Levels**
Wildfire	Levels 1 *Burn Severity	Levels 1, 2, 3, *Burn Severity
Prescribed Fire	Levels 1, 2, 3, *Burn Severity	Levels 1, 2, 3, *Burn Severity
Non-Fire Treatments	Level 1	Levels 1, 2, 3

*Burn Severity should be requested for all fires > 500 acres on NPS lands (RM 18, Chapter 8, 4.3)

Fire and mechanical treatment monitoring should be designed to meet the objectives of each project and therefore the components of monitoring should be developed based on the project objectives.

Wildfire Monitoring

The minimum required monitoring for wildfires on AK NPS lands includes the data necessary to fill out DOI required Wildland Fire Management Information (WFMI) fire reporting documentation (http://www.nifc.blm.gov/nsdu/fire_reporting/NPS/doc/NpsUserGuides.html). This includes documentation of information such as the fire origin, fire start and end dates, fuels, weather, final fire size (acres), and suppression actions. Currently, remotely sensed burn severity data using dNBR is required for all wildfires and prescribed fires exceeding 500 acres on National Park Service lands (RM-18, USDI NPS 2008 Chapter 8). A description of burn severity mapping and monitoring is provided in the Fire & Fuels Monitoring Plan in Appendix F. Fire effects plots may be established if Fire Management, Resource Management or other needs are identified for specific fires. The AKR Fire and Fuels Monitoring Protocol is recommended for monitoring wildfire effects (Appendix F).

Prescribed Fire Monitoring

All prescribed fires that are implemented in WEAR are required to have a monitoring plan that addresses the objectives of the prescribed fire. Not all prescribed fires need to be monitored, if representative fuel types are being monitored with similar prescription and fuels. All prescribed fires >500 acres are required to have a burn severity assessment map.

Non-Fire Fuels Treatment Monitoring

Mechanically treating fuels has recently become an important part of reducing fuel densities and reducing overall threats associated with wildland fires. A fuels treatment plan should be prepared for each project and include the following components. This plan includes a description or purpose of the project in an executive summary. A detailed description of the fuels to be treated is discussed. The area is identified with a project map listing the goals and objectives of the project. Project costs are calculated and summarized in the plan. The plan addresses the protection of sensitive features, safety of the personnel and the public, interagency coordination, public involvement, a monitoring plan, and post project rehabilitation issues. The main body of the plan addresses the statement of work to be done and specifications for treatments. These specifications address plant species by diameter and percent of stand for treatment. The monitoring section of the plan contains information on documenting and collecting photo point information and addresses other techniques or methods used to monitor the effectiveness of mechanically treating the vegetation.

Minimum Recommendations for Non-Fire Treatment Monitoring

- Describe treatment objectives and methods
- Document location, size, and data of treatment
- Photo points or video documentation

4.2 Monitoring Basics – Frequency, Timing, Locations (GPS/GIS)

Established plots will be re-measured following the protocols documented in Alaska NPS Fire Management Program Fuels Treatment Monitoring Program Field Method Protocol (Appendix C). It is recommended that variations on the Field Method Protocol are applied to meet specific project objectives.

Frequency of Monitoring - Plots will be sampled pre-treatment, post-treatment, and in subsequent years on a time schedule determined based on project objectives.

Timing - Monitoring will be done from June through August, with peak plant phenology occurring during these summer months. When possible the same month will be used each year for the sampling of the fire effects monitoring plots. For the sake of continuity and statistical validity, plot re-reads should follow the pre-treatment established monitoring protocol. New plot installations should precede treatment occurrence or application. Plot re-reads should be conducted within one year of treatment application and at time intervals deemed fit to meet project objectives. For prescribed fires, immediate post fire reads will be done within one month of the completion of the burn or at the earliest possible time thereafter.

Location - Global Positioning System (GPS) will be used to record all plots. In the event a GPS reading cannot be sampled at the time the plot is sampled, attempts will be made in later years or sample periods to obtain this data. Data will be processed and archived by the Fire Ecology program. General GPS data will be maintained on computers in the Fire Management Office for use in making maps and in ArcGIS projects. Directions for plots will be recorded on forms. For detailed information on how to record plot location refer to Appendix C.

V. PROGRAM MANAGEMENT

Fire effects monitoring plots will be established as part of the planning process with a treatment schedule. The fire ecologist or responsible party will coordinate these activities. It is recommended that plots are established following methods listed in the NPS Alaska Fire and Fuels Monitoring protocol (Appendix C). Not all burn units may have monitoring plots installed. Plots will be installed in representative vegetation types or in vegetation types that may have a special interest or concern. These descriptions will be developed by the fire management and resource management staffs. Plots will be sampled following protocols of the NPS Alaska Fire and Fuels Monitoring protocol. Plots will be sampled pre-burn, post-burn, and then as deemed necessary by the Regional Fire Ecologist in following years.

5.0 Information Management

Data will be entered, checked for errors, and managed by the Fire Ecology Program staff and supervised by the Fire Ecologist. Original copies of all data will be kept by the Fire Ecology Program office and disseminated as requested. Reporting fire effects information serves a number of purposes. Program status and results will be recorded in an annual report and reported in the spring of the year for the previous fiscal year. The annual report is flexible and is geared towards the needs of the park. The annual report includes a summary of monitoring activities from the year, results from data analysis, and discussion on objectives. In addition to these written annual reports, presentations are to be made to park staff. Formal presentations of the program and data has occurred at WRST, however staff changes do occur so these presentations need to occur on a regular basis. These presentations allow for open discussions of the program

and the results. In addition to the reports and staff presentations, articles may be submitted to the fire ecology and fire management newsletters, scientific journals, and "popular" publications. Communication is not limited to written reports and articles, but should include utilization of intranet and internet web sites, and oral presentations. Fire ecologists should work with NPS Fire Communication and Education staff to assist with communication results and success stories.

- Communicating results to park resource staff for adaptive management
- Presenting accountability to regional and national offices
- Communicating results to scientific community
- Presenting success stories to NPS staff, interagency community, NGO's and general public

5.1 Data Management and Analysis

The national database, FEAT-FIREMON Integrated (FFI) software provides the digital computer database tool where the fire effects monitoring data is entered, stored, and to some degree analyzed. These databases are maintained at the Fairbanks Administrative Center as part of the Alaska Regional Fire Ecology program.

Data collection will be directed by the fire ecologist and or assistant fire ecologist. Data collection will follow standard operating procedures of data collection following Alaska NPS Fire and Fuels Monitoring protocols. Other data management will include computer data entry, quality control checks, filing of raw data; development, labeling, and filing of slide film and/or digital copies on disc or compact disc. All data will be entered, corrected, and analyzed at the end of the year and will be formally reported with copies of the report and backed up data sent to the regional office.

Data entry and analysis will be done using the national database FFI, and ARC/INFO GIS mapping software. Database files will be stored in the Fire Ecology program office on the Fire Ecology computers and backed up on the NPS Fairbanks Administrative Center computer network and compact discs. These backups are zipped database files for each area. Backups are done either daily or weekly depending on the work load, status of the crew, and crews assigned work. The NPS Fairbanks Administrative Center computer network backs up files. The master copy of all data files will be maintained in the Fire Management Office. Annual reports are reviewed with Resource Management staffs and each area receives a copy of the Alaska Regional Fire Ecology program annual report. Copies of all data and data summaries will be shared upon request. All plot locations will be geologically referenced using GPS receivers.

Through the collection and analysis of the data we will be able to compare our results with other fire effects studies in similar vegetation types that have been conducted. The data will initially be analyzed using the FFI software. Once the data has been analyzed a statistician may be consulted to assist with determining if the data is skewed and normally distributed. Other statistical programs will be used in analyzing the data.

5.2 Management Implications of Monitoring Results

Monitoring results will be reviewed by the Fire Ecologist each winter. Data collected in this program will be used to evaluate whether fire management program goals and objectives are being met. The Fire Ecologist, in consultation with Western Area Fire Management and WEAR Resource Management Staff, will determine if the results of fuels treatments or planned fire management activities are on target. Acceptable results include meeting the monitoring objectives stated within the specific prescribed fire, mechanical treatment or monitoring plans. If monitoring

results show deviations from desired vegetation conditions, or if resource needs change, the group will determine changes necessary for future activities.

When data is collected for fire related studies, presentations or reports will presented to the park and fire management staff to inform staff of findings. Possible items would include evaluating program objectives to see if they were achieved, any observable trends, areas of concern, and needed assistance or further study and research. This presentation will be open to the entire park staff but its main audience will be the Fire and Resource Management staffs. Following each program evaluation, a summary will be prepared, including any changes that need to be made along with what procedures were successful and those that were not. If the data shows that objectives are not being met, alternatives will be considered, including modification of prescriptions or objectives, or to provide for research.

5.3 Responsible Party – Staffing Roles and Responsibilities

This plan will be prepared by and updated by the Alaska Region Fire Ecologist based at the Fairbanks Administrative Center in Fairbanks, Alaska. The Alaska Western Area Fire Management Officer and the WEAR Chief of Resource Management will provide review. This plan will be ready for approval by the WEAR Superintendent after these reviews. Identified Fire and Resource Management Personnel will plan projects, develop specific fire and resource objectives, and review projects and objectives following completion of the project.

Staffing for fire ecologists and fire effects technicians is primarily a function of fire and fuels management activity at the park or area level.

VI. RESEARCH

Implementation of this fire management plan is not contingent upon the completion of research. A limited body of scientific information exists regarding effects of fire and fire regimes for the Western Arctic National Parklands. Information regarding primary and secondary fire effects in most ecosystems of WEAR is incomplete. A summary of fire research and monitoring are listed below, as new information becomes available fire-related resource management objectives can be refined in an adaptive management style.

6.1 Known research studies on fire in WEAR

Long-term fire effects on vegetation and permafrost after tundra fires

Two of the longest monitored sites (28-32 years) in Arctic Alaska for vegetation change and post-fire tundra succession are located in the Bering Land Bridge (BELA) and Noatak (NOAT) National Preserves in northwest Alaska. Between 1978 and 1982, Charles Racine and colleagues established a series of plots for monitoring post-fire vegetation and permafrost recovery in BELA and NOAT. These permanent vegetation plots were established following widespread tundra and forest fires in 1977, when one million acres burned during extreme drought in NW Alaska. Recently the NPS Arctic Network Inventory and Monitoring Program has supported the re-measurements of these sites. The sites were revisited in 2005 (NOAT) and 2009 (BELA) by the NPS Regional Fire Ecologist and an original researchers, Charles Racine and John Dennis.

Published reports:

Racine, C., R. Jandt, C. Meyers, and J. Dennis. 2004. Tundra fire and vegetation change along a hillslope on the Seward Peninsula, Alaska, U.S.A. Arctic, Antarctic, and Alpine Research 36 (1): 1-10.

Racine, C., Allen, J.L., and Dennis, J.G. 2006. Long-term monitoring of vegetation change following tundra fires in Noatak National Preserve, Alaska. Technical Report: NPS/AKRARCN/NRTR-2006/02. Arctic Network Inventory & Monitoring Program, National Park Service, Alaska Region. Fairbanks, AK. http://science.nature.nps.gov/im/units/arcn/documents/documents/NPS_ARCN_NRTR-2006-02-LongTermMonitoringVegetationChangeFollowingTundraFiresNoatakNPAlaska.pdf

Racine, C., Barnes, J., Jandt, R., and Dennis, J. 2010. Long-term Monitoring of 1977 Tundra Fires in the Northwest Alaska Parks. Alaska Park Science, Volume 9, Issue 1: 24-25. http://www.nps.gov/akso/AKParkScience/2010Vol9-1/Long-Term-Monitoring-of-1977-Tundra-Fires-Racine.pdf

Reconstructing fire regimes in tundra ecosystems to inform a management-oriented ecosystem model

The fire history of the past 6,000 years in the Noatak National Preserve was investigated through research funded by the Joint Fire Science Program. The goal of the study was to understand how fire regimes varied in relation to climate and vegetation. The study capitalized on the ability to reconstruct both vegetation and fire history using lake-sediment records. Pollen grains dispersed from plants and charcoal pieces dispersed from fires are well preserved in the sediments at the bottom of lakes, where a lack of oxygen prevents decomposition. As sediments accumulate over time, so too does a record of vegetation and fire history.

By collecting and analyzing individual layers of lake sediments, vegetation and fire regimes spanning the past 6,000 years were reconstructed. Lake-sediment cores from four lakes along an east–west transect in Noatak National Preserve. These lakes span a modern gradient in climate and vegetation, with down-valley sites characterized by slightly warmer, drier summers and a greater abundance of tussock-shrub tundra and white spruce. To estimate vegetation composition within approximately 0.6-3.1 miles (1-5 km) of each lake, pollen grains were counted in sediment samples at circa 250 to 500 year intervals. To reconstruct when fires burned within approximately 0.6 mi (1 km) of each lake, macroscopic charcoal pieces were counted macroscopic charcoal pieces in each sediment layer, and used statistical methods to identify fire events in the record (as described by *Higuera et al. 2009*). Estimated fire events were used to calculate fire-event return intervals (FRIs - years between fire events), providing a conservative estimate of site-specific fire return intervals.

Charcoal records from the study area provide unambiguous evidence of burning over the past 6,000 years, with individual FRIs ranging from 30 to 840 years. This variability reflects differences across space and changes in climate and vegetation through time. The best estimates of recent FRIs come from the charcoal records of the past 2,000 years, a period long enough to capture multiple fire events for a statistical assessment. Median FRIs varied among sites, from 113 years (95% confidence interval [CI] 75-150) at Uchugrak Lake to 240 years (CI 105-548) at Little Isac Lake. When pooled, the two down-valley sites of Raven and Uchugrak had shorter FRIs (median 150 yr, CI 101-150) than those from the two up-valley sites of Poktovik and Little Isac (median 218 yr, CI 128-285).

Published reports:

Hu, F.S., Higuera, P., Barnes, J.L., Rupp, T.S., Chipman, M., and Duffy, P.A. 2010. Reconstructing fire regimes in tundra ecosystems to inform a management-oriented ecosystem model. Final Report, JFSP Project Number 06-3-1-23, CESU Agreement J979106K153/001, April 2010. https://www.firescience.gov/projects/06-3-1-23/project/06-3-1-23_hu_et_al_finalreport_jfsp_06-3-1-23.pdf

Future Fire Regime and Climate Modeling

A CESU agreement was developed with Dr. Scott Rupp at the University of Alaska-Fairbanks to assess how different climate scenarios may impact the fire regimes and vegetation within several parks over the next 100 years. The landscape dynamics model, Boreal ALFRESCO, was used to simulate the potential response of vegetation and fire regimes to likely scenarios of future climate change using IPCC models. The following parks were selected for analysis: Denali, Yukon-Charley Rivers, Gates of the Arctic, Noatak, Bering Land Bridge, and Wrangell-St. Elias. Results of this study were presented to Park Service personnel and a final report was prepared in 2009. It was noted in the report that they have less confidence on the results for tundra dominated areas such as Bering Land Bridge and Noatak, and they were in the process of further developing and refining tundra vegetation and fire models.

Springsteen, A, and Rupp, T.S. 2009. Summary report for Alaska National Parks: Projected vegetation and fire regime response to future climate change in Alaska. CESU Final Report, NPS. (Contact: Jennifer Barnes, Regional Fire Ecologist, NPS AKRO, for copy of report)

Burn Severity – Boreal and Tundra Fires NPS

In Alaska the level of burn severity strongly influences post-fire vegetation succession, soil erosion, and wildlife populations in the fire-adapted boreal forest and tundra ecosystems. Methods have been developed to map burn severity for landscape level fires using remote sensing. The NPS–U.S. Geological Survey (USGS) National Burn Severity Mapping Project and the Monitoring Trends in Burn Severity Project (MTBS) sponsored by the Wildland Fire Leadership Council address the need to quantify fire effects on public lands in order to develop an archive of fire history. The goal of both projects is to monitor fire effects using standardized geographic databases employing consistent measures of *burn severity*, which is defined as the magnitude of ecological change caused by fire. The process uses Landsat 30-meter data and a derived radiometric value called the ***Normalized Burn Ratio (NBR)***. The difference between pre- and post-fire NBR datasets is computed to determine the extent and degree of landscape change resulting from fire.

The NPS Alaska fire program has investigated the accuracy of the remote sensed burn severity maps in various fuel types. To do so satellite-derived estimates of burn severity (differenced Normalized Burn Ratio [dNBR] calculated from pre- and post-fire Landsat TM/ETM+ data) have been compared to ground-based burn severity measures in several of Alaska National Parks. The purpose of this project was to provide ground verification of remotely-sensed burn severity data in Alaskan ecosystems through the installation of burn severity plots - Composite Burn Index (CBI) plots.

Burn severity assessment plots have been established in several park units. In 2003, 93 CBI plots were installed within the perimeters three 2002 tundra fires that occurred in Noatak National Preserve (Cottonwood Bar and Uyon Lake fires) and on the Seward Peninsula south of Bering Land Bridge National Preserve (Mile Post 85). This data has been included in a formal report and presented to land-managers.

Published reports:

Allen, J.L. and Sorbel, B. 2008. Assessing the differenced Normalized Burn Ratio's ability to map burn severity in the boreal forest and tundra ecosystems of Alaska's national parks. International Journal of Wildland Fire. 17: 463-475.

Sorbel, B. and Allen, J. 2005. Space-based burn severity mapping in Alaska's National Parks. Alaska Park Science. Vol 4(1): 4-11 (Link to article: http://www.nps.gov/akso/AKParkScience/Vol4-Issue1.html)

Fire and Caribou

Several research studies have been completed to assess the impacts of fire on lichen and caribou winter grazing habitat in Northwest Alaska. Listed below are the references and abstracts for published papers.

Holt, E.A, McCune, B. and Neitlich, P. 2008. Grazing and fire impacts on macrolichens communities of the Seward Peninsula, Alaska, U.S.A. The Bryologist 11(1): 68-83.

Abstract: We sought to assess impacts of fire and grazing by reindeer and caribou on lichen communities in northwestern Alaska. Macrolichen abundance was estimated from 45, 0.38-ha plots. Eighteen of those plots, scattered throughout the southern Seward Peninsula, represented two levels of grazing, heavy and light. We found lightly grazed areas had taller lichens and greater total lichen cover than heavily grazed sites. Minor yet statistically significant changes in community structure were also observed between heavily and lightly grazed sites. However, lichen species richness did not differ by grazing status. Overall, average lichen height appears to be the best indication of grazing intensity on the Seward Peninsula. Apart from the 18 grazing plots, 8 additional plots were established in previously burned sites to represent reference conditions with a known time since disturbance date. These plots provided a framework of vegetation recovery from severe, recent disturbance towards pre-disturbance conditions. Patterns in lichen, bryophyte and vascular plant characteristics from these fire plots in combination with our findings from the grazing plots were then used to interpret the disturbance history of new plots. These new plots comprise the remaining 19 plots (of the total 45) that were sampled within the Bering Land Bridge National Preserve (BELA). We believe the location of BELA, regardless of disturbance history, is more favorable to vascular plants and Sphagnum, and lichens grow taller in response, compared to areas on the Seward Peninsula further south. In addition, lower cover in the Preserve may be attributed to site or climatic differences rather than grazing.

Joly, K., F.S. Chapin, and D.R. Klein. 2010. Winter habitat selection by caribou in relation to lichen abundance, wildfires, grazing, and landscape characteristics in northwest Alaska. Ecoscience 17 (3): 321-333.

Abstract: Lichens are an important winter forage for large, migratory herds of caribou (*Rangifer tarandus granti*) that can influence population dynamics through effects on body condition and in turn calf recruitment and survival. We investigated the vegetative and physiographic characteristics of winter range of the Western Arctic Herd in northwest Alaska, one of the largest caribou herds in North America. We made 3 broad comparisons: habitats used by caribou *versus* random locations, burned *versus* unburned habitats, and habitats within the current winter range *versus* those in the historic winter range and potential winter ranges. We found that lichen abundance was more than 3 times greater at locations used by caribou than found at random. The current winter range does not appear to be overgrazed as a whole, but continued high grazing pressure and consequences of climate change on plant community structure might degrade its condition. Within the current winter range, lichen abundance was more than 4 times greater at unburned locations than at recently (< 58 y) burned locations. Other than lichen abundance, there

were few vegetative differences between burned (mean = 37 ± 1.7 y) and unburned locations. The historic winter range has low lichen abundance, likely due to sustained grazing pressure exerted by the herd, which suggests that range deterioration can lead to range shifts. Recovery of this range may be slowed by continued grazing and trampling during migration of caribou to and from their current winter range, as well as by high wildfire frequency and other consequences of climate change. The area identified as potential winter range is unlikely to be utilized regularly by large numbers of caribou primarily due to low lichen abundance associated with extensive deciduous stands, large areas of riparian habitat, high moose (*Alces alces*) densities, and greater prevalence of wildfire. Our results suggest that lichens are important in the overwintering ecology of caribou that face the energetic costs of predator avoidance and migration.

Joly, K., T.S. Rupp, R.R. Jandt, and F.S. Chapin. 2010. Fire in the range of the Western Arctic Caribou Herd. Alaska Park Science 8 (2): 85-91.
Abstract: Wildfire is the dominant ecological driver in boreal forest ecosystems. Although much less is known, it also affects tundra ecosystems. Fires effectively consume fruticose lichens, the primary winter forage for caribou, in both boreal and tundra ecosystems. We summarize 1950-2007 fire regime data for northwestern Alaska and subregions. We also identified meteorological factors that help explain the variability in fire extent across this landscape. We review information and inferences from recent studies on tundra fire regimes for managing caribou winter range. Climate warming may increase fire size and frequency in this region, which may substantially impact the vegetation, wildlife, and people of this region.

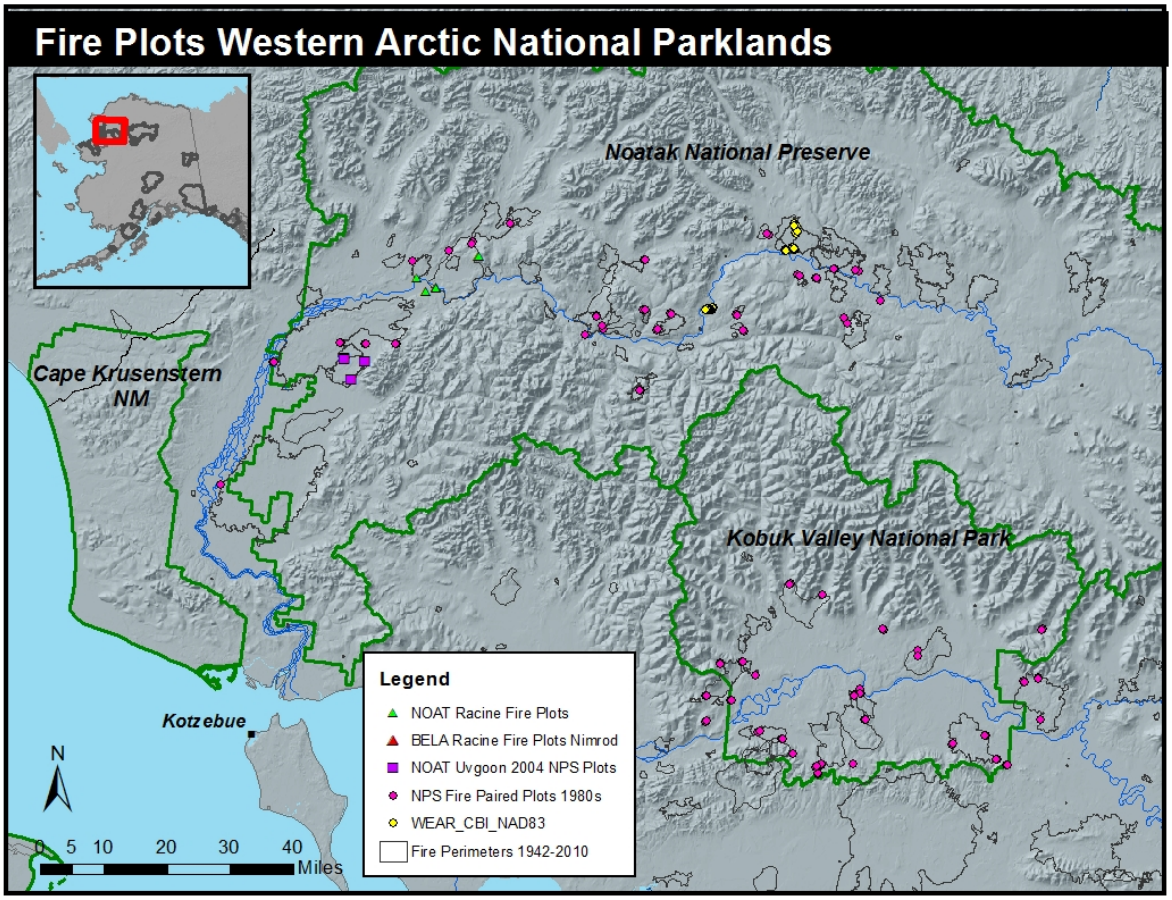
6.2 Fire Research Needs in WEAR

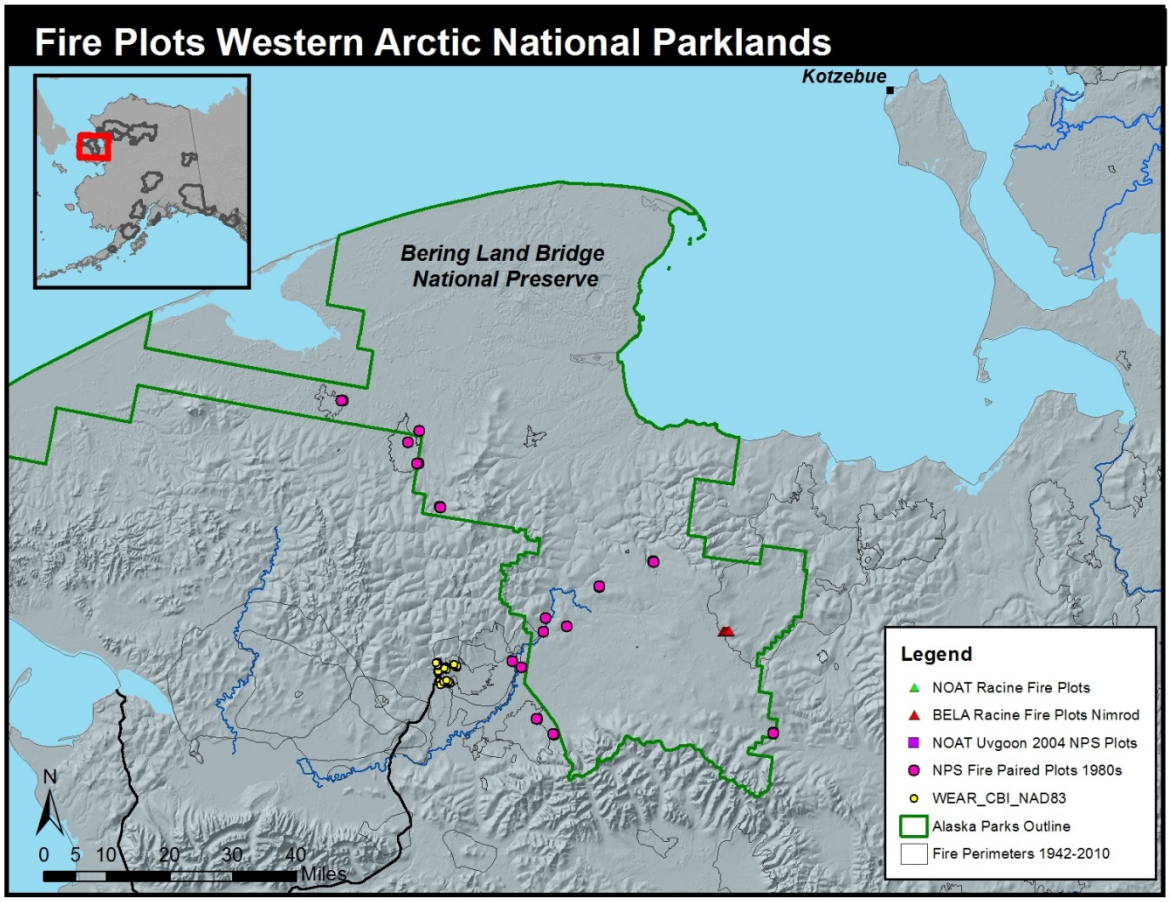
Opportunities will be taken to coordinate and work with NPS staff, Fire Management Staff, and Arctic Network Inventory and Monitoring Program to identify and encourage fire related research within the park. As research needs are identified, funding will be sought so studies may be undertaken. Fire research has limited funding within the NPS. If it is determined, however, that significant information is needed concerning the effects of fire, park managers may submit proposals through the NPS Fire Research Funding call. Opportunities exist for making requests for research funding through the Joint Fire Science Program. Other opportunities exist under the (CESU) Cooperative Ecosystem Study Units (CESU 2004) and National Park Service requests (Fee Demonstration Program, Project Management Information System (PMIS), and Natural Resource Challenge). The following list are fire research and monitoring needs currently identified for Western Arctic National Parklands:

- Determine fire effects at WEAR through the establishment of vegetation and/or soils plots in past burned areas or during on-going fires.
- Document and assess long term impacts of fire on wildlife habitat.
- Document and assess impacts of fire on permafrost and erosion.
- Assess the risk of fire and fire behavior in relation to climate change.
- Determine historic fire regime in BELA, KOVA and CAKR, utilizing dendrochronology or lake core methods. Map and determine pre-1940 fire history.

VII. APPENDICES

Appendix A. General Location Map of Fire & Fuels Plots, 1978-2010




Fire Plots Western Arctic National Parklands
Kotzebue
Bering Land Bridge
National Preserve
Legend
NOAT Racine Fire Plots
BELA Racine Fire Plots Nimrod
NOAT Uvgoon 2004 NPS Plots
NPS Fire Paired Plots 1980s
WEAR_CBI_NAD83
Alaska Parks Outline
Fire Perimeters 1942-2010
N
0 5 10 20 30 40
Miles

Appendix B. NPS WEAR Fire Plot Locations

Table 1. List of all 1980s Fire Effects Paired Plots in WEAR.

Park	Paired Plot ID	Plot Type	Date Visited	Viereck Classification Pre-Fire	Latitude (NAD-83)	Longitude (NAD-83)
BELA	BELA-ALB-1	Burn	9/6/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.5789754	-163.9887732
BELA	BELA-BCA-1	Control	7/17/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.7551645	-163.5679691
BELA	BELA-BCB-1	Burn	7/15/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.7547242	-163.5650647
BELA	BELA-BMA-1	Control	8/20/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.3312182	-163.9696429
BELA	BELA-BMB-1	Burn	8/20/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.3314142	-163.9754195
BELA	BELA-ECA-1	Control	7/31/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	66.0075731	-165.4187810
BELA	BELA-ECB-1	Burn	7/31/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	66.0064409	-165.4271514
BELA	BELA-FCA-1	Control	8/24/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.5911144	-164.1132994
BELA	BELA-FCB-1	Burn	8/24/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.5592220	-164.1130375
BELA	BELA-GCA-1	Control	7/22/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.8934976	-164.9447859
BELA	BELA-GCA-2	Control	7/30/1985	Wet Sedge Meadow Tundra	65.9686221	-164.9687662
BELA	BELA-GCB-1	Burn	7/22/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.8929789	-164.9498715
BELA	BELA-GCB-2	Burn	7/30/1985	Wet Sedge Meadow Tundra	65.9372510	-165.0224818
BELA	BELA-KRA-1	Control	7/25/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.4060528	-162.7820551
BELA	BELA-KRB-1	Burn	7/25/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.4053613	-162.7811074
BELA	BELA-LCA-1	Control	9/6/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.6806095	-163.8418755
BELA	BELA-LCB-1	Burn	9/6/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.6810663	-163.8422943
BELA	BELA-NRA-1	Control	8/8/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.3598362	-164.0741165
BELA	BELA-NRB-1	Burn	8/8/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.3596950	-164.0778882
BELA	BELA-SHA-1	Control	7/14/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.8045947	-164.7857368
BELA	BELA-SHB-1	Burn	7/14/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.8032253	-164.7818950
BELA	BELA-TCA-1	Control	9/4/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.4720182	-164.2016886
BELA	BELA-TCB-1	Burn	9/4/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	65.4816766	-164.2577561
KOVA	KOVA-CAC-A	Control	8/27/1984	Open Black Spruce Forest	67.0943745	-159.8494832
KOVA	KOVA-CAC-B	Burn	8/27/1984	Open Black Spruce Forest	67.0955505	-159.8488138

KOVA	KOVA-COL-A	Control	8/16/1984	Open Black Spruce Forest	67.1564419	-159.7179621
KOVA	KOVA-COL-B	Burn	8/16/1984	Open Black Spruce Forest	67.1573610	-159.7204655
KOVA	KOVA-DAN-A	Control	8/14/1984	Open Black Spruce Forest	66.9431335	-159.3070910
KOVA	KOVA-DAN-B	Burn	8/14/1984	Open Black Spruce Forest	66.9441376	-159.3085453
KOVA	KOVA-DUN-A	Control	8/28/1986	Open Black Spruce Forest	67.1436282	-159.1046835
KOVA	KOVA-DUN-B	Burn	8/28/1986	Open Black Spruce Forest	67.1354456	-159.0987988
KOVA	KOVA-ELD-A	Control	8/17/1984	Open Black Spruce Forest	66.9857911	-159.4623568
KOVA	KOVA-ELD-B	Burn	8/17/1984	Open Black Spruce Forest	66.9846301	-159.4626966
KOVA	KOVA-FIN-A	Control	8/30/1984	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.1030416	-158.0428103
KOVA	KOVA-FIN-B	Burn	8/30/1984	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.1029155	-158.0401283
KOVA	KOVA-GKD-A	Control	7/12/1984	Open Black Spruce Forest	67.0759422	-159.0642185
KOVA	KOVA-GKD-B	Burn	7/12/1984	Open Black Spruce Forest	67.0766354	-159.0569668
KOVA	KOVA-HUR-A	Control	8/8/1984	White Spruce Woodland	67.2428236	-158.7861594
KOVA	KOVA-HUR-B	Burn	8/8/1984	White Spruce Woodland	67.2315372	-158.7832352
KOVA	KOVA-JAN-A	Control	8/25/1984	Open Black Spruce Dwarf Tree Scrub	67.0173221	-159.5385306
KOVA	KOVA-JAN-B	Burn	8/25/1984	Open Black Spruce Dwarf Tree Scrub	67.0168848	-159.5331655
KOVA	KOVA-JDE-A	Control	6/11/1985	Open White Spruce Forest	67.2002753	-158.0665738
KOVA	KOVA-JDE-B	Burn	6/11/1985	Open White Spruce Forest	67.1961342	-158.0719324
KOVA	KOVA-JDM-A	Control	6/15/1984	Open Black Spruce Forest	67.1900429	-158.1516904
KOVA	KOVA-JDM-B	Burn	6/15/1984	Open Black Spruce Forest	67.1881534	-158.1454519
KOVA	KOVA-JED-A	Control	8/23/1984	Open Low Mixed Shrub-Sedge Tussock Tundra	66.9714535	-159.1126895
KOVA	KOVA-JED-B	Burn	8/23/1984	Open Low Mesic Shrub Birch-Ericaceous Shrub	66.9729118	-159.1115554
KOVA	KOVA-KAC-A	Control	7/20/1984	Open Black Spruce Forest	67.1438190	-159.1069067
KOVA	KOVA-KAC-B	Burn	7/20/1984	Open Black Spruce Forest	67.1353536	-159.1007664
KOVA	KOVA-KEY-A	Control	8/20/1984	Open Tall Alder Shrub	67.1769297	-159.9337509
KOVA	KOVA-KEY-B	Burn	8/20/1984	Open White Spruce Forest	67.1764771	-159.9311331
KOVA	KOVA-KLY-A	Control	7/26/1984	Open Black Spruce-White Spruce Forest	67.1000577	-159.9982653
KOVA	KOVA-KLY-B	Burn	7/26/1984	Open Black Spruce-White Spruce Forest	67.1001003	-159.9951589

KOVA	KOVA-LDS-A	Control	7/27/1984	Spruce-Paper Birch Woodland	66.9946960	-158.2215780
KOVA	KOVA-LDS-B	Burn	7/27/1984	Spruce-Paper Birch Woodland	66.9942390	-158.2189696
KOVA	KOVA-LKD-A	Control	6/18/1984	Open Black Spruce Forest	67.0057090	-158.2796034
KOVA	KOVA-LKD-B	Burn	6/18/1984	Open Black Spruce Forest	67.0067930	-158.2850590
KOVA	KOVA-NCR-A	Control	6/20/1984	Open Low Mixed Shrub-Sedge Tussock Tundra	67.0338331	-158.5470117
KOVA	KOVA-NCR-B	Burn	6/20/1984	Open Low Mixed Shrub-Sedge Tussock Tundra	67.0347060	-158.5396649
KOVA	KOVA-NIG-A	Control	7/10/1984	Vaccinium Dwarf Shrub Tundra	66.9652617	-159.2928246
KOVA	KOVA-NIG-B	Burn	7/10/1984	Vaccinium Dwarf Shrub Tundra	66.9672487	-159.2949586
KOVA	KOVA-NUN-A	Control	8/28/1984	Open Black Spruce Forest	67.3115967	-158.0630595
KOVA	KOVA-NUN-B	Burn	8/28/1984	Open Black Spruce Forest	67.3099779	-158.0672149
KOVA	KOVA-RCH-A	Control	7/30/1984	Open Black Spruce Forest	67.2855233	-158.9902327
KOVA	KOVA-RCH-B	Burn	7/30/1984	Open Black Spruce Forest	67.2868002	-158.9991941
KOVA	KOVA-RIC-A	Control	8/21/1984	Open Black Spruce Forest	67.1861372	-159.8039663
KOVA	KOVA-RIC-B	Burn	8/21/1984	Open Black Spruce Forest	67.1861780	-159.7996986
KOVA	KOVA-TET-A	Control	8/18/1984	Open Black Spruce Forest	66.9582631	-159.3244887
KOVA	KOVA-TET-B	Burn	8/18/1984	Open Black Spruce Forest	66.9595456	-159.3225063
KOVA	KOVA-TRI-2-B	Burn	8/7/1984	Open White Spruce Forest	67.0390353	-159.9876205
KOVA	KOVA-TRI-B	Burn	8/7/1984	Open White Spruce Forest	67.0424565	-159.9828357
KOVA	KOVA-TUN-A	Control	8/7/1984	Open White Spruce Forest	67.0597869	-158.3551101
KOVA	KOVA-TUN-B	Burn	8/7/1984	Open White Spruce Forest	67.0583995	-158.3611140
KOVA	KOVA-TUS-A	Control	6/19/1985	Open Black Spruce Forest	67.3727884	-159.5624865
KOVA	KOVA-TUS-B	Burn	6/19/1985	Open Black Spruce Forest	67.3706550	-159.5636290
KOVA	KOVA-TUT-A	Control	7/31/1984	Open Black Spruce Forest	67.3549570	-159.3691885
KOVA	KOVA-TUT-B	Burn	7/31/1984	Open Black Spruce Forest	67.3538373	-159.3666907
KOVA	KOVA-WAR-A	Control	8/6/1984	Black Spruce Woodland	67.0285388	-159.6775127
KOVA	KOVA-WAR-B	Burn	8/6/1984	Black Spruce Woodland	67.0300576	-159.6680611
KOVA	KOVA-WCR-A	Other	1/1/1984	NO DATA		
KOVA	KOVA-WIG-I-B	Other	1/1/1984	NO DATA		

KOVA	KOVA-WWB-A	Control	7/28/1984	Black Spruce Woodland	67.1300342	-159.1326515
KOVA	KOVA-WWB-B	Burn	7/28/1984	Black Spruce Woodland	67.1279525	-159.1376547
NOAT	NOAT-ANI-1	Control	7/11/1985	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-ANI-2	Control	7/10/1985	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-ANI-B1	Burn	7/11/1985	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-ANI-B2	Burn	7/10/1985	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-ANT-A	Control	8/16/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1686787	-159.8683002
NOAT	NOAT-ANT-B	Burn	8/16/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1698110	-159.8800393
NOAT	NOAT-CAB-A	Control	8/13/1986	Open White Spruce Forest	67.7516792	-162.7553570
NOAT	NOAT-CAB-B	Burn	8/16/1986	Open White Spruce Forest	67.7517173	-162.7516793
NOAT	NOAT-DRY-A	Control	6/26/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.8166631	-162.3693981
NOAT	NOAT-DRY-B	Burn	6/26/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.8167381	-162.3739238
NOAT	NOAT-EAS-A	Control	6/11/1986	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-EAS-B	Burn	6/11/1986	Open Low Mixed Shrub-Sedge Tussock Tundra		
NOAT	NOAT-ELI-A	Control	7/11/1986	White Spruce Woodland	67.4560289	-162.9647091
NOAT	NOAT-ELI-B	Burn	7/11/1986	White Spruce Woodland	67.4556162	-162.9692469
NOAT	NOAT-FEN-A	Control	7/30/1985	Sedge-Birch Tundra		
NOAT	NOAT-FEN-B	Burn	7/30/1985	Sedge-Birch Tundra		
NOAT	NOAT-I65-A	Control	7/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.8995315	-160.9152773
NOAT	NOAT-I65-B	Burn	7/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.8994852	-160.9177622
NOAT	NOAT-IE2-A	Control	8/3/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0785452	-159.5634005
NOAT	NOAT-IE2-B	Burn	8/3/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0790224	-159.5566731
NOAT	NOAT-IMI-A	Control	6/24/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0850678	-160.6062824
NOAT	NOAT-IMI-B	Burn	6/24/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0849152	-160.6038257
NOAT	NOAT-IN6-A1	Control	7/26/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9664260	-160.4190163
NOAT	NOAT-IN6-A2	Control	7/26/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9267752	-160.4914117
NOAT	NOAT-IN6-B1	Burn	7/26/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9653914	-160.4125043
NOAT	NOAT-IN6-B2	Burn	7/26/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9295207	-160.4852427

NOAT	NOAT-ITI-A	Control	8/14/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1028016	-159.3066151
NOAT	NOAT-ITI-B	Burn	8/14/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1048154	-159.3298550
NOAT	NOAT-IW7-A	Control	7/27/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9781276	-160.0209063
NOAT	NOAT-IW7-B	Burn	7/27/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9781048	-160.0151079
NOAT	NOAT-KAI-A	Control	8/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1354063	-161.4410764
NOAT	NOAT-KAI-B	Burn	8/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1353242	-161.4377117
NOAT	NOAT-KAL-A	Control	8/20/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9444727	-160.8596732
NOAT	NOAT-KAL-B	Burn	8/20/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9432956	-160.8610173
NOAT	NOAT-KALII-A	Control	6/13/1986	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.9159245	-160.8107204
NOAT	NOAT-KALII-B	Burn	6/13/1986	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.9229876	-160.8198721
NOAT	NOAT-KUG-A	Control	7/30/1986	Open White Spruce Forest	68.0570097	-161.7872118
NOAT	NOAT-KUG-B	Burn	7/30/1986	Open White Spruce Forest	68.0561447	-161.7882294
NOAT	NOAT-N67-A	Control	7/25/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9421660	-159.9686720
NOAT	NOAT-N67-B	Burn	7/25/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9436200	-159.9737880
NOAT	NOAT-NNO-A	Control	8/6/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1018071	-159.4501274
NOAT	NOAT-NNO-B	Burn	8/6/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.1017230	-159.4570092
NOAT	NOAT-OKO-A	Control	8/9/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9801169	-159.3527903
NOAT	NOAT-OKO-B	Burn	8/9/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9800483	-159.3495706
NOAT	NOAT-RID-A	Control	6/9/1987	Tussock Tundra	67.8198880	-162.2277316
NOAT	NOAT-RID-B	Burn	6/9/1987	Tussock Tundra	67.8199548	-162.2205218
NOAT	NOAT-SHO-A	Control	7/18/1986	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.7846153	-160.5484564
NOAT	NOAT-SHO-B	Burn	7/18/1986	Open Low Mesic Shrub Birch-Ericaceous Shrub	67.7845535	-160.5548283
NOAT	NOAT-SIS-A	Control	7/25/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9688506	-160.5832978
NOAT	NOAT-SIS-B	Burn	7/25/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	67.9689241	-160.5713506
NOAT	NOAT-SNO-A	Control	8/7/1985	Open Low Alder Shrub	68.0818796	-159.6769969
NOAT	NOAT-SNO-B	Burn	8/7/1985	Open Low Alder Shrub	68.0806061	-159.6577869
NOAT	NOAT-TAK-B	Burn	8/16/1985	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0393111	-159.1611119

NOAT	NOAT-TAR-A	Control	9/17/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0220499	-162.0016477
NOAT	NOAT-TAR-B	Burn	9/17/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0218319	-161.9997920
NOAT	NOAT-TAY-A	Control	8/9/1985	Open Low Alder Shrub	67.9929189	-159.3730559
NOAT	NOAT-TAY-B	Burn	8/9/1985	Open Low Shrub Birch-Willow Shrub	67.9935674	-159.3748719
NOAT	NOAT-UCH-A	Control	7/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0823058	-161.6492146
NOAT	NOAT-UCH-B	Burn	7/8/1986	Open Low Mixed Shrub-Sedge Tussock Tundra	68.0781863	-161.6607725
NOAT	NOAT-UVG-A	Control	8/21/1986	Open White Spruce Forest	67.8299047	-162.0365839
NOAT	NOAT-UVG-B	Burn	8/21/1986	Open White Spruce Forest	67.8298333	-162.0409397

Table 2. Location of Racine Noatak fire plots re-measured in 2005.

Site Name	Plot ID	Rebar	Plot type-Burn Year	LAT_NAD83	LONG_NAD83
Kugururok	KUG-B	yes	Burned 1972 and 1984	67.98649371	-161.96182796
Kungiakrok Burned	KNG-B	yes	Burned 1982	67.95749903	-161.89485320
Kungiakrok Unburned	KNG-U	yes	Unburned	67.95785844	-161.89507314
Noatak 1	NOA1NE	yes	Burned 1977	67.96900570	-161.84069940
Noatak 2	NOA2SE	yes	Burned 1977	67.96771824	-161.84045264
Noatak 3	NOA3SW	yes	Burned 1977	67.96666682	-161.84125193
Uchugrak	UCHB-W	yes	Burned 1977	68.04991186	-161.60514780
Uchugrak Unburned	UCHU-E	yes	Unburned	68.04987431	-161.60441288

Table 3. Location of Racine Bering Land Bridge fire plots re-measured in 2009. Latitude and longitude in decimal degrees (Datum NAD-83) of the 8 fire effects plots from the 1977 fire in Bering Land Bridge on Imuruk Lake-Nimrod Hill. Ninth plot shown, but has not been measured in several years, no plot markers.

Park	**Plot ID**	**Waypoint ID**	**Latitude NAD-83**	**Longitude NAD-83**
BELA	Nimrod 1	Nim1-0M	65.61844624	-163.12973865
BELA	Nimrod 2	Nim2-0M	65.61953916	-163.12490529
BELA	Nimrod 3	Nim3-0M	65.61996813	-163.12105943
BELA	Nimrod 4	Nim4-0M	65.62016796	-163.11498833
BELA	Nimrod 5	Nim5-0M	65.62038647	-163.11092361
BELA	Nimrod 6	Nim6-0M	65.62102953	-163.10591274
BELA	Nimrod 7	Nim7-0M	65.62129566	-163.10346321
BELA	Nimrod 8	Nim8-0M	65.62183663	-163.09470278
BELA	Nimrod 9	Nim9-0M	65.62217215	-163.09287209

Table 4. Location of Uvgoon 2004 Fire plots re-measured in 2007. Latitude and longitude in decimal degrees (Datum NAD-83). Six plots that were installed immediately after the 2004 Uvgoon fire (fire # 127). Plots beginning with A are control plots and B are burned plots.

Park	Plot ID	Last Sampled	Latitude NAD-83	Longitude NAD-83	Plot Markers
NOAT	127-A001	2007	67.7829700	-162.3355100	Rebar
NOAT	127-A002	2007	67.7814600	-162.2101000	Rebar
NOAT	127-A003	2007	67.7354700	-162.2783100	Rebar
NOAT	127-B001	2007	67.7811500	-162.3343500	Rebar
NOAT	127-B002	2007	67.7818500	-162.2127800	Rebar
NOAT	127-B003	2007	67.7349200	-162.2802700	Rebar

Appendix C. Applied AK Regional NPS Fire and Fuels Monitoring Protocols

Appendix C.1. Fire and Fuels Monitoring Protocol

Alaska NPS Fire Management Program
Fire and Fuels Monitoring Protocol
Field Method Protocol 2010

Fire and Fuels Belt Transect Monitoring Protocol

Overview

The Alaska NPS Hazard Fuels Treatment Monitoring Protocol (Hazard Fuels Protocol) was established as a guideline for establishing fuels treatment (i.e. hazard fuels reduction treatments) monitoring projects within Alaska National Park Service lands. The purpose of the Hazard Fuels Protocol is to provide a standardized approach to monitor the results of fuels thinning projects implemented by NPS fire management. The overarching purpose of the NPS studies which employ the Fire and Fuels Protocol is to gain an understanding of the natural variability related to fuels treatments in Alaska parklands. A baseline understanding of fuels treatment effects is necessary to identify potential abnormal or unusual effects which could be associated with long-term climate change or management activities. This protocol is a NPS specific modification of the field-tested methods created by the Alaska Interagency Fire Effects Task Group (FETG) and compiled in the Fire Effects Monitoring Protocol (Allen et al, 2007). All or any combination of the protocol methods (i.e. point intercept, tree density, tree measurements etc.) maybe be used, depending on the objectives of the fuels treatment project.

Instructions for Project-level Fire and Fuels Monitoring Plan

This document provides protocol methods, instructions and data sheets for fuels and vegetation sampling in fuels treatment areas. For specific project level monitoring plans, a document should be prepared that provides the following descriptions of the planned project and monitoring:

- Project Background & Purpose
- Project Area Description (general vegetation, treatment area)
- Treatment Goals & Objectives
- Monitoring Objectives
- Plot Selection Methods
- Map and/or table of plot location coordinates
- Sampling Schedule
- Protocols selected for monitoring, with reference to this document for methodologies. Note any alterations to standard methodologies.
- Data entry and data management

Descriptions and recommended methods for the above listed sections for a project level monitoring plan are provided below. Overview of methods and detailed methodology instructions for individual monitoring protocols are provided in Section 2 and 3 of this document.

Monitoring Goals

The studies which utilize the Fire and Fuels Protocol are implemented to meet the following project objectives:

1) Validate predictive fire models used by managers,
2) Identify vegetative and structural components that are important fire fuels,
3) Identify short and long-term fuels treatment effects for varying treatment levels.

Varying treatment levels may be associated with levels of fire severity and extent of hazard fuels reduction.

Purpose

Application of this protocol in full (or based on project objectives) can be for the following purposes:

Pre- post fire effects protocol application: The Fire and Fuels Protocol may be utilized to monitor wildfire effects. Project objectives may be met by establishing vegetation/soil plots in front of active fires and evaluating them prior to, during and after fire treatments. The full protocol may be modified to meet the objectives of a wildfire monitoring project.

Hazard fuels reduction protocol application: The protocol may be utilized to monitor hazard fuels reduction treatment effects. Project objectives may be met by establishing vegetation/soil plots prior to hazard fuels reduction treatments and evaluating them before and after hazard fuels treatments. The full Fire and Fuels Protocol may be modified to meet the objectives of a specific hazard fuels treatment project to meet specific monitoring goals.

Prescribed fire effects protocol application: The protocol may be utilized to prescribed fire treatment effects. No prescribed fires have been conducted in WRST to date. However, it is worth noting that the Alaska Eastern Area Fire Management program is in the planning stages for conducting at least one prescribed fire in WRST within the next 5 years which will require a monitoring effort by the Alaska Regional Fire Ecology program.

Plot Selection/Location

Pre-Post Fire Plots

For Pre- and Post-Fire plots, locations will be randomly established. Two methods for plot location selection are given below. Alternative methods may also be used:

Transect Method – Using the fire perimeter map draw transects parallel to the head of the fire, flank of the fire, and rear of the fire. Mark 6 points that fit equally along the transect. For instance if the transect is 1-mile long, put a point every 1/6th of a mile. Fly the transect and determine if the points are in a vegetation type that should be sampled, if not fly to the next point.

GIS Method - In ArcMap use the buffer tool to create a buffer around the current fire perimeter of a distance safe for sampling based on the fire rate of spread. Use the Arc Toolbox random point generator (also available in Alaska Pak tools) within the buffered polygon, select a minimum spacing of 500 m between points.

Hazard Fuels Plots

Sample plots will be randomly established within the treatment zones and control areas immediately adjacent to the treatment areas in stands representative of the pre-treatment forest. GIS layers of the treatment and control areas are utilized to select plot locations. A GIS random point generator and manual manipulation to spread plot distribution is used to establish plots in the treated areas and control area. For the control area, a 200-m buffer around the thinning unit is created using ArcGIS. The treatment and control plots are randomly

selected using ArcGIS random point tool within the treatment area and control area polygons. Plots that fall within parking areas or other built features are thrown out.

Plot Naming Convention: Fire and Fuels Protocol

The plot names will follow this naming convention: PARK- PPP-LOCATION-###, where the first four letters (PARK) is the park identifier (i.e. DENA, YUCH), the next three letters (PPP) are the project identifier, the third letters (LOCATION) are the fire number or treatment level (e.g. A503 or Headquarters HQ), and the last three are plot identifiers. For the pre/post-fire plots project the three letter project identifier will be: PPF (pre-post-fire). For hazard fuels treatment plots the project identifier will be: HZF (hazard fuels). The plot identifiers are numerical as established. EXAMPLES: DENA-PPF-A503-003 or WRST-HZF-HQ-C-03.

Method Overview: Fire and Fuels Protocol

The following section is a quick reference of methods for each protocol. Full methods are described in the following sections. A complete plot with all protocols can be laid out and read by an experienced crew in less than 2 hours. All or any combination of the protocol methods (i.e. point intercept, tree density, tree measurements etc.) maybe be used, depending on the objectives of the monitoring project.

For simplicity, the myriad of options for modifying and customizing monitoring protocols or plot sizes, levels of monitoring intensity, deciding on the number of plots to use, placement of plots, other variables to include, etc. are not discussed here. It is recommended the user consult many other excellent references on setting up a monitoring study, including Measuring and Monitoring Plant Populations (Elzinga et al. 1998) or the NPS Fire Monitoring Handbook (USDI NPS 2003). Data can be entered into the National Fire Effects Database program FFI (FEAT FIREMON Integrated). Refer to the "FFI Data Entry Instructions for NPS Alaska Manual" (Mitchell and Barnes, 2009) for specific data entry protocols.

The following section provides an overview of the AK Fire and Fuels Monitoring Program Field Method Protocol.

1. PLOT LAYOUT (See Figure 1.)
   - Set up a 30-m x 1-m transect plot based off a random point coordinate. Determine plot azimuth (random, fixed or previously established).
   - Stake the zero end of a 30-m (or 100-ft) tape with a chaining pin and stretch the tape straight to 30-m end, stake with chaining pin or conduit. Keep the tape low to the ground.
   - If a permanent plot, stake the 0-m end and 30-m end with rebar, conduit, fiberglass posts or other plot marker.
   - Mark each end with flagging and GPS a point at the 0-m end and 30-m end of the tape.

2. SITE DESCRIPTION (*Site Description* datasheet)
   - General plot description, direction to plots
   - Lat/Long, datum, error
   - General vegetation type/fuel model
   - Photograph both ends of the transect looking towards the middle of the transect. Take both vertical and horizontal photos from each end.

3. GENERAL VEGETATION (*General Vegetation* datasheet)
   - Estimates of vegetation and ground cover (%) cover are recorded for the plot area
   - Estimates of height classes are recorded for trees and shrubs

4. VEGETATION COVER (Point Intercept) (*Vegetation Point Intercept* Datasheet)
   - Point intercept 30-m transects (60 points, every 0.5-m along 30-m baseline). Use a bike flag or other narrow pole for recording point intercepts "hits".
   - Record all trees, shrubs, herbaceous species, include substrate or groundcover that are located at each point along the transect ("hits").
   - Read on right, walk on left of baseline.

5. TREE DENSITIES (*Tree Density Tally* Datasheet)
   - 1-m x 30-m belt transect rectangle for all trees >4.5' (1.37 m) tall.
   - Tally trees >4.5' in height by species and diameter size classes: (< 5 cm, 5.1-10 cm, 10.1-15 cm, 15.1-23 cm, >23 cm), and status (Live/Dead).
   - Tally small trees (<4.5' tall) in 3 subplots, 1-m x 1-m located at 3, 15, & 27-m marks along transect (total "seedling" area of 3.0 m^2 or 0.00037 ac).

6. TREE MEASUREMENTS (*Tree Measurement* Datasheet)
   - For two trees of each species and size class record diameter (DBH), height, crown base height (CBH), ladder fuel heights, and crown radius. Choose trees closest to circular plot center point.

7. ACTIVE LAYER & SOILS (*Active Layer/Soils* Datasheet)
   - Every 3-m beginning at 3-m mark (10 total points) record:
     - Active layer depth; record depth to rock, ice or seasonal frost.
     - Surface fuel code for the top layer of ground cover (live moss, dead moss, upper duff, lower duff, mineral soil)
   - Optional: soil moisture and pH of soils at the 3-m, 15-m and 27-m points along transect.

8. BURN SEVERITY & DUFF CONSUMPTION (*Burn Severity/Duff Consumption* Datasheet)

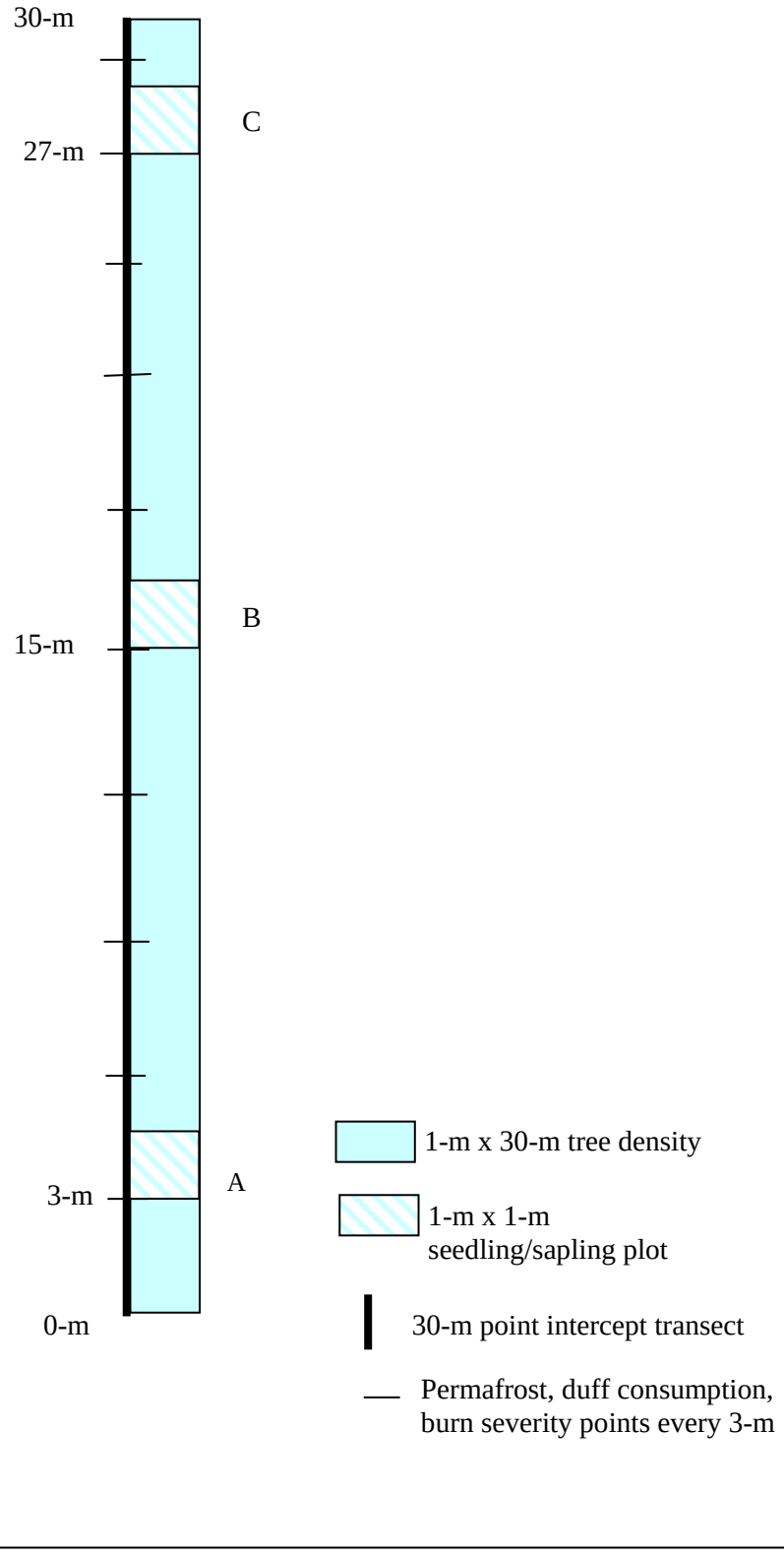
- Post-burn: Record micro-site specific burn severity index, use FMH convention with 5-class severity codes for substrate and vegetation, every 3-m beginning at 3-m mark, for 10 total points.
- (Optional) If plots are established pre-fire, duff consumption pins (pre-burn) can be placed every 3-m, for a total of 10 points, co-located with FMH burn severity index).
- (Optional) CBI (Composite Burn Index) for overall burn severity score of plots, and for comparison to remote-sensed burn severity (D-NBR normalized burn ratio). Determined using the Composite Burn Index methodology (See Lutes et al. FIREMON 2006 for methods).

9. DUFF & FUEL MOISTURE (*DOWN WOODY DEBRIS & DUFF DEPTHS and FUEL MOISTURE* Datasheets*)*
   - Measure the depth of the forest floor surface material (live moss, dead moss, upper and lower duff layers) at two places displaced at least 1 m off the transect which appear similar to the forest floor along the transect.
   - Collect duff plugs for determination of fuel moisture.

10. DOWN WOODY FUEL LOADING (*DOWN WOODY DEBRIS & DUFF DEPTHS* Datasheet)
    a. Brown's transect along 16m baseline transect: 2m for 1-hr and 10-hr; 4m for 100-hr, and 16m for 1000-hr fuels. (6.6 ft, 13.1 ft, and 98 ft).
    b. Litter and duff depths should be taken at each end of the 30-m transect (off-set 0.5 m)
    c. If quantitative fuel loading is desired, place additional Brown's transects at 120 deg and 240 deg from origin and mark end w/ pin flag.

1) SHRUB DENSITY (*SHRUB DENSITY* and *MOOSE BROWSE ARCHITECTURE* Datasheets)
   - For quantifying woody browse or shrub species, tally individuals (or **stems above ground** for clonal spp. such as alder, or when it is not possible to distinguish individual shrubs) in the same 1-m x 16-m belt which was used for trees. In very dense brush, may need to subsample to 0.5 X 30 m belt, or tree seedling subplots.
   - Additional shrub data options (moose browse):
     i) Assign an architectural classifications of each plant along transect.
     ii) Note browsing frequency, extent and brooming of the main apical stem.

Figure 1. Plot diagram. (Fire and Fuels Protocol)



Method Detailed: Fire and Fuels Protocol

Plot Layout

Standard plot configuration is depicted in Figure 1. A 30-m x 1-m plot will be setup based off the random point coordinate. Determine a random azimuth, using a random number generator or the compass spin method. Setup a 30-m transect by staking the zero end of a 30-m/100-ft with the chaining pins or conduit and pull the end of the tape in a straight line in the direction of the random bearing (be sure to record declination used). Drive spray painted 2.5-ft conduit or rebar into each end of the plot as marked on the figure. Tag the zero-end of the transect ("origin") with an aluminum tag displaying the plot number and date. Mark additionally with flagging for easy visual in aerial photo. Avoid walking or trampling on the right side of the transect, where the vegetation measurements will be made. For all plots collect a GPS position at the 0-m and 30-m end of the tape. Record the waypoint number or point name and lat/long on the data sheet, as well as noting the error. For all plots collect an averaged (20 pt average or more) GPS position at the zero end of the tape. Record the WP number and lat/long on the data sheet. NAD-83 Datum will be used in the GPS receivers (Standard for DOI agencies).

Site Description

General site information will be collected and recorded for each plot on the Site and General Vegetation Datasheet. It is recommended that additional site location descriptions, diagrams of plots, and additional notes on the plot be written up on separate sheet. The definitions of the fields for the Site Description Datasheet are given below:

- **Unit** – land unit identifier or write out land unit name - (i.e. Steese White Mtns, Yukon-Charley NP) (NPS - four letter park acronym)
- **Project** – Description of project: PPF (pre/post fire), CBI (burn severity), HZF (for hazard fuels), PP (paired plots). Also include an identifier for the area, such as a fire name or cabin name.
- **Plot ID** – Identifier for the plot within the project. For pre/post fire plots, use the fire number and sequential numbering 01 through x.
- **Field date** – Sample date
- **Field Crew** – Names of crew members
- **Transect Azimuth** – record the azimuth of the transect facing from the zero end to the 30-m end, recorded in True North (declination set).
- **Declination used** – record the declination setting used on your compass, for the initial reading, base your declination on the most recent topographic map. For future reading use the declination used in the original setup.
- **Transect slope** – record the slope looking down the transect
- **Slope** – Percent slope of the site, use clinometer
- **Aspect** – Slope aspect (facing downhill) azimuth in degrees, recorded in True North
- **Elevation** – Taken from GPS or maps in feet or meters (record units)
- **Soil** – Estimate of soil drainage: wet, moist, dry.
- **Disturbance** – General note of disturbances, record date estimate if known. This is for the plot and general vicinity.
- **Evidence of fire** – record evidence of fire, if older burn area, estimate time since fire if possible.
- **Fire Name and Fire Number**– Fire name/number
- **Fire Date** - Date of fire (year)
- **Pre or Post** – time since fire (yrs or months), if pre-fire, circle "pre"
- **Treatment** – If hazard fuels monitoring - circle whether plot is intended as a treatment or control plot. Record location of project or cabin name/number.

- **Treatment Phase** – Record if pre-thinning or post-thinning and time since thinning date for if hazard fuels. Maintenance thinning if second entry to site.
- **GPS Type** – record the type of GPS used to collect location information. i.e. Garmin 76CSX
- **GPS Identification** – record an identifier for the GPS used (person's name or unit number)
- **GPS Datum** – GPS datum used for collecting and navigating to plots, use NAD-83 (this is essentially the same as WGS-84).
- **Description (WP)** – describe the coordinate taken. 0-m end of the plot transect, LZ for the plot or other info needed.
- **WP number/name**– record the WP number of the collected point, best to re-name the points to the plot-id with a 0m and 30m at the end of the plot id. i.e. 362-03-0m (where 362 is the fire number and plot number, taken at the 0-m end of the plot)
- **Lat/Long** – Using a GPS (Garmin 76CSX or Trimble recommended), collect a lat/long averaging the time of collection for a minimum of 20 points. Record in Decimal Degrees - i.e. Lat: N 65.634891° Long: W 142.982340°
- **GPS Error** - Record the error EPE and units, this must be recorded before you save the averaged waypoint in Garmin handhelds.
- **Photo number, time and camera** – describe photos taken and record the time of the photos (for digital cameras) and the camera used. For traditional cameras with film, keep a photo log and record photo numbers. See below for description of photos to be taken.
- **Vegetation Class –** *Current/Pre-DisturbanceViereck Class* – Using Viereck's (1992) Alaska Vegetation Classification, determine the vegetation class currently and if possible (if post fire monitoring) determine what the vegetation was prior to disturbance. Describe to level IV, or if possible level V for the plot area. Either write it out: Open PICMAR/LEDGRO/HYSPLE or use numeric: I.A.2.f with Labrador tea.
- **Vegetation Dominant Species** - record the dominant species in the plot area (particularly if not using the Point Intercept or General Vegetation data sheets. If using these, can be skipped.
- **Plot Layout and General Notes** – use back of page to describe how to get to site, draw maps and other notes of interest regarding the plot.

Photos: A minimum of four photos will be taken for each plot. Aerial photos should be taken of the plot where applicable. The photos will be taken from each end of the vegetation sampling transect looking towards the plot center. Take both a horizontal and vertical photo from the 0-m end and the 30-m end of the tape looking towards the plot center. Label a dry-erase board with the park-project-location-plot ID (i.e. YUCH-PPF-A324-02), sample date, transect azimuth (direction facing) and designate as 0-m ---> 30-m and vice-versa. Hold the board to the edge of the photo view within the first 1.5 - 2 m of the transect with the camera set at a fixed height of 5 ft above the ground and record the photo time on the Plot Description datasheet.

General Vegetation and Ground Cover

Ocular Vegetation Sampling-

Ocular estimates of vegetation and ground cover are recorded on the *SITE AND GENERAL VEGETATION* Datasheet for dominant vegetation and ground cover within the 30-m transect. The cover classes are defined in 10% increments (e.g. **1-10%, 10-20%....90-100%**). Estimate the cover of each species or ground cover and check the appropriate column. Due to overlapping and canopy cover, the total cover can equal more than 100%. Additional species can be added on the second page or by crossing out pre-written species. Estimate the height by height class in meters for all trees and shrubs. Species are listed by layer as described below:

- *Tree Layer* - List all the species that occur within the plot and estimate the percent cover. Willows or alders of tree size are not considered trees. Check the box showing the average height of the canopy, estimate average tree diameter, ladder fuel heights and live crown heights. If a single species forms

two distinct sub-layers, list it twice. Use scientific names where possible to indicate species, use first two letters of the genus and the species.

- *Shrub Layer* - Shrubs are defined as woody plants with multiple stems. For each shrub species check the appropriate cover class and height class. If there are newly established shrubs, identify if plants are new seedlings or re-sprouts, otherwise leave the column blank.
- *Dwarf Shrub and Herbaceous Layer* - Estimate the % cover of herbaceous (non-woody) and dwarf shrub layer. Herbaceous includes graminoids (grasses, sedges, rushes), forbs (flowering) plants, ferns, and horsetails. If there are newly established shrubs or herbs, identify if plants are new seedlings or re-sprouts, otherwise leave the column blank.
- *Non-vascular and Ground Cover* - Estimate the % ground cover provided by mosses and hepatics (liverworts), lichens, litter (dead leaves or needle litter), down woody fuels and bare ground or duff.

Point-Intercept Sampling-

Along the 30-m transect, the point intercept method will be used to determine plant and ground cover. Every 50 cm along the 30-m transect, all plant species and forest floor surface cover (mosses, lichens, litter) that are intercepted at that point will be recorded. Start at the 0.5 m mark and sample along the right side of the transect.

- Using a ¼" diameter pole (6 ft fiberglass bike flag), gently lower the pole so that the rod is plumb to the ground (on slopes this will not be perpendicular to the ground). At each point intercept record the species that touch one side of the pole from top to bottom, for example if black spruce was the tallest vegetation at that point hit it would be recorded first, similarly ground cover will always be last.
- Record the species code on the POINT INTERCEPT Data Sheet. Use the NRCS four letter code for vascular plants, bryophytes (mosses) and lichens. In general the first two letters are the genus (i.e. Salix) and the last two are the species (i.e glauca) is SAGL. Use the USDA plants database for most current species codes (http://plants.usda.gov/). Numerics are frequently used to differentiate species with similar codes, if you can't remember the exact code write out the species on the bottom of the sheet and the acronym used for that species. If there are unknown species that are common, collect for identification and record an identifiable acronym and note on the data sheet. For dead standing trees record the species and include D after the species code. For dead branches on a live tree, record the tree as though it were alive. From this data we will calculate the species composition and percent cover by species or substrate.

Forest Measurements

Tree Density - Tally all trees taller than 1.4-m (4.5 ft) that occur within an a 1-m x 30-m belt transect on the right side of the transect by species and diameter size classes (< 5 cm, 5.1 - 10 cm, 10.1 - 15 cm, 15.1 – 23 cm, > 22.5 cm DBH) (as defined by the Forest Service Natural Fuels Photo Series, 2001). Use a linear metric measuring tape or the folding ruler to determine if trees are within 1-m of the transect line (30 m^2). All live "seedling" trees less than 4.5 ft tall will be tallied by species on 3 subplots (1-m x 1-m) at the 3, 15, and 27-m mark along the base transect (total seedling area of 3.0 m^2 or 0.00037 ac).

Tree Measurements - Detailed tree measurements will be recorded for two live trees (> 4.5 feet tall) of each species and each size class within the tree density plot. When selecting trees for measurement choose the trees closest to the 0-m end of the transect. If re-visiting the plot is intended then mark the trees with metal tags and unique identifiers. The following measurements will be taken: DBH (diameter at breast height), tree height, height to live crown, height to live and dead ladder fuels, and crown radius. Data will be used to determine summary data such as, density, basal area, crown bulk density, and stand height. Data sheets for measurements are in Appendix A.1.1 and examples of tree measurements are in Appendix B. Definitions of the parameters measured are given below:

- **Species** - record the species of the tree using six letter acronyms (first three letters of genus and first three letters of species). All willows and alders will be classified as shrubs.
- **DBH** - measure the diameter of the tree in centimeters at 4.5 ft or 1.37m above the ground, using the metric logger's tape.
- **Tree height** - Measure the tree height in meters with a clinometer. Measure from 10 to 30 m away from the tree, depending on tree height. Use the percent side of the clinometers to calculate tree height. Tree height in meters equals: = (distance from tree in meters) x (% to top of tree - % to base of tree). Note that if the base % is negative this will be added to the total height (Math: minus a negative is positive). See Appendix B.
- **Crown base height** (main live crown) – the height in meters from the forest floor to the obvious live crown. Use a clinometer or measure with tape or pole (See Appendix B.2).
- **Height to live ladder fuel** – the height (cm) from the forest floor to the lowest point of a live branch on the tree. Measure with a tape or pole.
- **Height to dead ladder fuel** – the height (cm) from the forest floor to the lowest point of a dead branch on the tree.
- **Crown radius** -measure the crown radius to the average widest branch or drip-line of the crown, measure to the nearest centimeter.

Permafrost & Soils

Active Layer Depths - Ten active-layer depth measurement points are located along the transect at 3-m intervals; except the last point is placed at 29-m (Fig. 1). At each point measure the depth of the active layer by inserting the bike flag rod or permafrost probe into the ground. Record the depth (cm) to permafrost or bedrock. If possible record whether active layer depth is limited by rock, permafrost, or seasonal frost and note on datasheet. Record the surface fuel codes for each point: LC = lichen, FM = feather moss, SM = sphagnum moss, DM = dead moss, UD = upper duff, LD = lower duff, MIN = mineral, LTRH = Litter herbaceous, LTRNDL = Litter needle.

Optional: Record soil moisture (%) and pH at 3-m, 15-m and 27-m points on transect.

Burn Severity & Duff Consumption

Point Burn Severity & Duff Consumption (optional) – at points every 3-m along the 30-m transect assess burn severity and record burn severity code (BSC) for both substrate and vegetation as described in Fire Monitoring Handbook (USDI NPS, 2003) and summarized in Table 1.

Table 1. Burn severity code matrix (modified from NPS Fire Monitoring Handbook [2003])

	Forest and Shrub Types	
	Substrate (S)	Vegetation (V)
(5) Unburned	Not burned	Not burned
(4) Scorched	Litter/moss partially blackened; duff nearly unchanged; wood/leaf structures unchanged	Foliage scorched and attached to supporting twigs
(3) Lightly Burned	Litter/moss charred to partially consumed; upper duff layer may be charred but the duff layer is not altered over the entire depth; surface appears black; small woody debris is partially burned.	Foliage and smaller twigs partially to completely consumed; branches mostly intact; less than 40% of the shrub canopy is commonly consumed
(2) Moderately Burned	Litter entirely consumed, leaving coarse, light colored ash; duff deeply charred to lower duff or upper /lower duff interface, but underlying mineral soil is not exposed; woody debris is	Foliage, twigs, and small stems consumed; some branches (>0.5 – 2.5 cm) still present. 40-80% of the shrub canopy is commonly consumed

	mostly consumed; logs are deeply charred, burned-out stump holes are common	
(1) Heavily Burned	Litter and duff completely consumed, or within 1 cm of mineral soil; mineral soil may be visibly altered, sometimes reddish; if present, sound logs are deeply charred, and rotten logs are completely consumed. *Marcantia* and fire mosses may be present.	All plant parts less than 2.5 cm in diameter are consumed, leaving some or no major stems or trunks; any left are deeply charred
(NA) Not applicable	Inorganic pre-burn	None present pre-burn

To quantify duff consumption by fire, place 10 non-flammable burn pins (15-30" welding rods work well) firmly in the ground every 3 meters along the transect before the fire. Ensure that the pins are pushed into the ground so that the top of the pin is even with the ground. If this is not possible, either cut the burn pin to be flush with the ground using small bolt cutters or record in centimeters the length of the segment above the ground *BURN SEVERITY/ACTIVE LAYER* Datasheet. Revisit plots to record duff consumption as soon as possible post-fire or within 1 year of the fire event. To measure duff consumption record the length of the pin exposed as a result of the fire.

Composite Burn Index (Full Plot Severity Assessment)

Composite Burn Index (CBI) is a ground-based plot methodology utilized to field-verify remotely-sensed burn severity measures such as the differenced Normalized Burn Ratio (dNBR). CBI plots are used throughout the National Park Service as a tool for validating the satellite-derived estimates of burn severity delivered by the U.S. Geological Survey. CBI ratings can be taken to assess the overall plot burn severity.

Plots are usually 20-m (non-forested sites) or 30-m (forested sites) diameter circular areas. Plot locations are usually pre-determined prior to field-visits to insure that the full range of likely burn severity levels and vegetation types within the fire perimeter are represented in the final dataset. Usually plots are clustered in groups of 8-10 plots within hiking distance of one another and a single group of 8-10 plots may be assessed in a day. CBI plots are usually not permanent and plot markers are usually not installed (unless desired by the park for future monitoring).

The most current data sheet and instruction are provided in the appendix and more recent versions can be obtained from: http://frames.nbii.gov/ffi/docs/Composite_Burn_Index.pdf and a brief overview of major components is provided here. The Composite Burn Index is based on ocular (visual) estimates of the degree of environmental change caused by fire to surface features and vegetation layers (strata). Strata are based on height above ground and include:

- **Substrates** - inert surface materials (soil, duff, litter, and downed woody fuels)
- **Herbs, low shrubs and trees < 3 ft (1m) -** grasses and forbs, as well as shrubs and small trees <3 ft (<1m) tall.
- **Tall shrubs and trees 3-16 ft (1-5 m)-** tall shrubs and trees
- **Intermediate trees (subcanopy and pole-sized trees)** - trees canopy layer situated between "tall shrubs and trees" and "big trees" layers, ~ 4–10 inches (10–25 cm) DBH. Trees may be of stratified heights and extend to upper canopy, but crowns receive little direct sunlight.
- **Big trees (upper canopy, dominant, and codominant trees)** - Tree layer taller than intermediate canopy layer which occupies the upper canopy and receives direct sunlight.
- **Total Plot, or Overall** - All strata of the plot combined for assessment of total burn severity.

Within each stratum, there are 5 or more burn severity variables assessed; each is scored from 0-3 (0 = unburned, 3 = high severity). An overall CBI score is calculated for each plot by averaging the individual

severity scores from each of the individual measures. This overall CBI score is then cross-referenced with the satellite measure of severity to determine the degree of correlation.

Alaska Specific Modifications to CBI ranking: The CBI datasheet includes optional fields which provide an opportunity to score additional fields to more accurately represent a specific region. These optional fields are provided for each strata and are called "CBI_1". For Alaska it is recommended to add the following user-defined fields to the "CBI_1" fields on the datasheet:

> **Medium Fuel, 3-8":** If medium down woody fuel **(**3-8" diameter [7.6-20.3 cm]) are present in plot then rate the consumption of down woody fuel as usual. If medium woody fuels are not present and tussocks are present; rate consumption of **tussock (*Eriophorum vaginatum)* basal stock**. Do not score if no medium fuels or tussocks pre-fire.
>
> **Substrate CBI_1:** For the user-defined substrate CBI_1, score the consumption of moss and/or lichen species. The scale is the same as used for "Duff" (see below example).

CBI_1: Moss/Lichen Cover	Unchanged	--	Light Char	--	50% Loss deep char	-	Consumed

Forest Floor Duff Depths and Moisture

Measurement of litter and duff layer depths is standard for many fire ecology monitoring projects. In some cases duff moisture measurements may also be needed for a project. Both "duff and litter depth" and "duff moisture" measurements are conducted using duff plugs (removable sections of forest floor).

> **Duff plug removal:** When removing duff plugs do not disturb the forest floor or the vegetation in the 1 x 30 m belt transect area. If permafrost or other obstructions limit the depth of the duff plug then measure the layers available and indicate the type and depth of obstruction. To extract a duff plug carefully cut down through the forest floor (using a compass saw, trowel and/or shovel) to either mineral soil or permafrost. For duff depth measurements plug size is not crucial, but for fuel moisture measurements extract ~ 4-inch-square plugs.
>
> **Duff depths:** Remove duff plugs from at least two sites located at least 1-m away from the belt transect. Choose sites that appear to be representative of the forest floor in the larger plot area. Examine the duff plugs removed and record the depth of forest floor layers (live moss, dead moss, upper and lower duff layers). Measure the depth of each layer down to mineral soil (live moss, lichen, dead moss, upper duff, and lower duff) with a ruler to the nearest 0.5 cm (See Wilmore 2001, duff moisture collection methods).
>
> **Fuel moisture measurements:** For duff moisture sampling record the duff depths as described above and then collect samples from each layer. Place samples in nalgene plastic sampling bottles, and record the number on the bottle selected for identification. More detailed information on duff layer distinctions, duff moisture sampling and specialized data sheets for destructive fuel sampling can be referenced (Wilmore 2000, Jandt et al. 2005).

Down Woody Fuels

Down woody fuel loading can be measured along the 30-m transect by employing the planar intersect method outlined in Brown (1974), commonly referred to as Brown's transects. Woody debris is categorized by size class as follows: 1 hr fuels (0 to 1/4" diam), 10 hr fuels (1/4 to 1" diam), 100 hr fuels (1 to 3" diam) and 1000 hr sound (>3" diam), 1000 hr rotten (> 3" diam). Woody fuels which intersect the transect line are tallied by size class as follows: 0 - 2 m for 1-hr and 10-hr fuels; 0 - 4 m for 100-hr fuels, and 0 to 30 m for 1000-hr fuels (6.6 ft, 13.1 ft, and 98 ft respectively).

Shrub Density

To quantify shrub or woody browse (tree and shrub) density, tally the number of individuals in the 1 x 30 m belt transect. Where not possible to distinguish between individual shrubs, record the number of *stems above ground* (e.g. semi-clonal species such as alder and willow). If needed, tally shrubs by life stage (mature, resprout, seedling). Where shrub density is very high it may be necessary to subsample using 0.5-m x 30-m belt or tree seedling plots. (*Recommend not tallying rose, raspberry, or spirea in shrub transects; accurate counts are very difficult.*)

Moose Browse Architecture

Moose in interior usually select certain shrub and tree species for consumption; these species are referred to as preferred species. To measure habitat-use based on browse evidence employ the following modification of the general methodology outlined by Seaton (2002). For each individual of each preferred species located within the 1 x 30 m belt transect assign one of the following architectural classifications:

a) **Broomed** - (sapling type plants) the main apical stem has been broken by moose. Look back through the history of the plant, this may have happened 2–10 years before you measured it; (bushy type plants) more than half of the current annual growth (CAG) stems arise from lateral stems that were produced as a result of browsing. Look back through stems that are many years old.
b) **Browsed** - Has been browsed some in the past, but browsing has not significantly affected its growth. Less than half of CAG twigs between 0.0 and 3.0 m arise from lateral stems that were produced from browsing.
c) **Unbrowsed** - There is no visible evidence that moose have ever browsed this plant.

Note in comments evidence of bark stripping and other evidence of moose or other wildlife use in the area. (Enter data in the *MOOSE BROWSE ARCHITECTURE* Datasheet).

Data Sheets

Field Gear List

General	Item	Per Plot
Plot	30 meter tape	1
Plot	Bike flag	1
Plot	chaining pins	2
Plot	Clinometer	1
Plot	Clipboard	2
Plot	Compass	2
Plot	Diameter calipers	1
Plot	Diameter logger's tape, metric	1
Plot	Diameter tape (small), metric	2
Plot	Field vest	1/person
Plot	Folding ruler 1 meter	2
Plot	Handlens	2
Plot	Paintsticks	2
Plot	Rebar	2 per plot
Plot	steel tags w/wire	2 per plot
Plot	welding rods (duff consumption)	10 per plot
Plot	white board/dry erase pen	1
duff	4" quilting square	1
duff	compass saw	1
duff	duff containers	40
duff	Green duff mat	1
duff	Pruners	1
duff	Ruler, centimeter	1
duff	special duff plug shovel	1
Tech	Digital Camera	1
Tech	GPS w/appropriate map coverage downloaded	1
logistic	BK Radio w/appropriate freqs	1
logistic	Copies of original Datasheets for each paired plot.	1 set for each year
logistic	Datasheet organizer for plot project w/ data sheets	1
logistic	Maps of plot locations	1
logistic	Satellite Phone	1
logistic	Shotgun w/ammo	1
Personal	Food, Clothing, Shelter	Yes

Plot Data Collection Check List

Unit: _____ Project: _____ Plot ID: _____ Date (M/D/Y): ___/___/_____

Protocol/Data Sheet	**Check if Data Form Used**	**Modifications/Comments**
Site Description		
General Vegetation Information		
Vegetation Point Intercept		
Tree Density Tally		
Tree Measurement		
Active Layer/Soils		
Burn Severity/Duff Consumption		
Down Woody Debris & Duff Depths		
Burn Severity- Composite Burn Index		
Fuels Moisture Data Sheet/Duff Plug		
Shrub Density		
Moose Browse Architecture		

Site Description: Fire and Fuels Protocol

General Site Information:

Unit: _____ Project: _____ Plot ID: _____ Date (M/D/Y): ___/___/_____

Field Crew: _____ Plot Markers: _____

Transect Azimuth: _____ (0m to 30m) Transect Slope: _____% Declination used: _____

Slope: _____% Aspect: _____Deg Elevation: _____ ft/m

Soil **(**circle): Wet Moist Dry Disturbance (circle): Fire Wind Insect Other: _____

Fire Indicators (circle): Burn Snags Burned Stumps Fire Scars Burned Plants Charcoal

Fire or Treatment Description:
Fire Number: _____ Fire Name:_____ Fire Year: _____ Pre or Post: _____ yrs

OR

Treatment (circle): Thinning Control Treatment Year: _____
Treatment phase (circle): Pre-thinning Post-thinning _____ Maintenance Thinning _____
(Time since treatment, yrs)

Latitude/Longitude: (DD.DDDD)

GPS Type: _____ GPS Identification: _____ GPS Datum: _____

Description	Waypoint	Latitude (DD.DDDD)	Longitude(DD.DDDD)	GPS Error
		N	W	m/ft
		N	W	m/ft
		N	W	m/ft
		N	W	m/ft

Photos Camera used: _____

Description	Azimuth	Photo Time (military)

Vegetation Class: Current Viereck class: _____ Pre-Disturbance Viereck Class:_____
List Dominant Species of plants within plot area

Lifeform	Species 1	% Cover	Species 2	% Cover
Tree Sp.				
Tall Shrub Sp.				
Low Shrub Sp.				
Graminoid/Herbaceous Sp.				
Moss/Lichen/Ground Cover				

Plot Layout and General Notes: Provide notes and map on relocating or LZ, burn information and other plot notes as needed below.

Notes on Back of Page

General Vegetation Information: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post _____ yrs
Field Date: _____ Field Crew: _____

SPECIES Tree Layer	Common Name	Cover Class					Height Class					Ht to live crown (cm)	Ht to Ladder Fuel (cm)	Avg DBH (cm)
		1-9%	10-24%	25-59%	60-74%	≥75%	0-3 m	3-5 m	5-9 m	9-21 m	> 21 m			
PIGL	White spruce													
PIMA	Black spruce													
LALA	Larch													
POTR5	Aspen													
POBA2	Balsam poplar													
BEPA	Paper birch													
Tall and Low Shrub Layer		1-9%	10-24%	25-59%	60-74%	≥75%	<0.2 m	0.2-1.5 m	> 1.5 m	Seedling	Re-sprout			
ALVIC	Green alder													
SALIX	Unknown willow													
SAGL	Glaucous willow													
SABE2	Bebb's willow													
BENA	Dwarf birch													
BEGL	Tall shrub birch													
DAFL3	Shrubby cinquefoil													
LEPAD	Narrow leaf Labrador tea													
LEPAG	Wide leaf Labrador tea													
SHCA	Soapberry													
CHCA2	Leatherleaf													
RIBES	Unknown Currant													
ROAC	Prickly Rose													
VAUL	Blueberry													
Dwarf Shrubs and Herbs		1-9%	10-24%	25-59%	60-74%	≥75%	Seedling	Re-sprout						
VAVI	Lowbush cranberry													
LIBO3	Twin flower													
ARRU	Bear berry													
COCA13	Dwarf Dogwood													
RUCH	Cloudberry													
EMNI	Crowberry													

Dwarf Shrubs and Herbs		**1-9%**	**10-24%**	**25-59%**	**60-74%**	**≥75%**	**Seedling**	**Re-sprout**		
ERVA4	Tussocks									
CAREX	Unknown carex									
CACA4	Northern blue-joint									
GRASS	Unidentified grass									
MEPA	Blue bells									
EQUIS	Unknown Horsetail									
EPAN	Fireweed									
LYCOP2	Club Moss									
POAL	Wild Rhubarb									
Nonvascular		**1-9%**	**10-24%**	**25-59%**	**60-74%**	**≥75%**	**Seedling**	**Re-sprout**		
MOSS*	Unidentified moss									
SPHAG2	Sphagnum moss									
FMOSS	Unknown feather moss									
HYSP70	Stair-step moss									
PLSC70	Big red stem moss									
CEPU12	Ceratadon moss									
POJU	Polytricum juniperous moss									
AULAC2	Unknown aulacomnium moss									
MAPO12	Marchantia liverwort									
LICHEN*	Unknown lichen									
CLRA60	Reindeer lichen									
CLADI3	Unknown Cladina									
CLADO3	Unknown Cladonia									
PEAP60	Freckle pelt lichen									
LTRNDL	Needle Litter									
LTRH	Leaf Litter									
DUFF	Duff									
BARE	Bare Ground									
1hr	0-0.25” fuels									

Vegetation Point Intercept: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post _____ yrs
Field Date: _____ Field Crew: _____

Record substrate and species codes of trees, shrubs, forbs and groundcover intercepted at each 50 cm interval, record plants tallest to lowest. **Record status** (superscript): **D** (dead), **C** (charred), **S** (scorched). ***=collected**

PNT	Meters	*Tallest* SPP 1	SPP 2	SPP 3	SPP 4	SPP 5	SPP 6
1	0.5						
2	1						
3	1.5						
4	2						
5	2.5						
6	3						
7	3.5						
8	4						
9	4.5						
10	5						
11	5.5						
12	6						
13	6.5						
14	7						
15	7.5						
16	8						
17	8.5						
18	9						
19	9.5						
20	10						
21	10.5						
22	11						
23	11.5						
24	12						
25	12.5						
26	13						
27	13.5						
28	14						
29	14.5						
30	15						
31	15.5						
32	16						
33	16.5						
34	17						
35	17.5						

PNT	Meters	*Tallest* SPP 1	SPP 2	SPP 3	SPP 4	SPP 5	SPP 6
36	18						
37	18.5						
38	19						
39	19.5						
40	20						
41	20.5						
42	21						
43	21.5						
44	22						
45	22.5						
46	23						
47	23.5						
48	24						
49	24.5						
50	25						
51	25.5						
52	26						
53	26.5						
54	27						
55	27.5						
56	28						
57	28.5						
58	29						
59	29.5						
60	30						

Common codes:

Trees

Code	*Name*
PIGL	Picea glauca – White spruce
PIMA	Picea mariana – Black spruce
BEPA	Betula papyrifera – Paper birch
POTR	Populus tremuloides – Aspen
POBA	Populus balsamifera – Balsam poplar

Shrubs

Code	*Name*
BENA	Betula nana- Dwarf birch
ALNUS	Alnus spp – Alder , SALIX – willow
LEPA11	Ledum palustre – Labrador tea
VAUL	Vaccinium uluginosum – blue berry
VAVI	Vaccinium vitis-idaea – lowbush cranberry

Ground

Code	*Name*
FMOSS	Feather moss
HYSP70	Hylocomium splendens – Stair step moss
SPHAG2	Sphagnum spp (moss)
LTRH	Leaf Litter
LTNDL	Needle Litter
DUFF	Organic duff
BARE	Bare Mineral soil
1 HR, 10HR…	Woody debris by size class

Code	*Name*
CHAN	Chamerion angustifolium – Tall Fireweed (EPAN2)
POAL	Polygonum alpinum – Wild rhubarb
MEPA	Mertensia paniculata - Tall blue bells
LIBO3	Linnaea borealis – Twin flower
EQUIS	Equisetum spp – Horsetail
CACA4	Calamagrostis canadensis – blue joint grass

Tree Density Tally: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Field Date: _____Field Crew: _____ Plot Size: _____

Tally the number of dead or trees taller than 4.5' (1.37-m) by diameter size class and species within the 1-m x 30-m belt transect plot area Tally by live, dead, or if disease or insects are prevalent, record what type of damage code and if live or dead. Dead trees with less than 45 degree angle with the ground are not tallied (counted as fuel). For small "layering" trees, pull trees upright to determine if height is > 4.5'. Tally the "seedlings"/saplings - *live* trees less than 4.5' tall by species and resprout/seedling/mature in the three 1-m x 1-m subplots at 3-m, 15-m and 27-m transect. **Resprouts:**new growth from older root stock < 1.37 m tall, **Seedlings:** new plants from seeds < 10cm high, **Mature** >10cm

		Tree Counts by DBH (cm)					Seedling <4.5ft 3 M	Seedling <4.5ft 15M	Seedling <4.5ft 27M
Tree Species	**Status**	**< 5cm**	**5.1-10 cm**	**10.1-15 cm**	**15.1-23 cm**	**>23 cm**			
Black Spruce (*Picea mariana*)	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M
White spruce *(Picea glauca)*	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M
Aspen *(Populus tremuloide)*	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M
Paper birch *(Betula papyrifera)*	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M
Balsam poplar *(Populus balsamifera)*	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M
Larch Tamarask (*Larix laricina*)	LIVE						R	R	R
	Dmg____						S	S	S
	DEAD								
	Dmg____						M	M	M

Tree Measurement Data Sheet: Fire and Fuels Protocol

Park Unit: ______ Project: ___________ Plot ID: __________________ Pre or Post _______ yrs

Field Date: _____________ Field Crew: ___________________________

Record the following data for two live trees (> 4.5 feet tall) of each species for each size class recorded within the tree density plot. Select the trees to be measured, by those closest to the mid-point of the tree density belt (15-m point). Measure the heights in 1/10ths of meters (i.e 15.3 m) and DBH in 1/10ths of centimeters (i.e. 5.3 cm). Note in comments tree damage, insects or disease.

Tree No.	Tree Species	DBH (cm)	Height (m)	Crown Radius (m)	Ht to Dead Ladder Fuel (cm)	Ht to Live Ladder Fuel (cm)	Main Crown Base Ht (cm)	Comments

Active Layer/Soils: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post_____ yrs

Field Date: _____ Field Crew: _____

Point	Distance	Active Layer Depth (cm)	Surface Layer Fuel Code	Comment (Permafrost/ Rock)	Soil Moisture (%)	pH	
1	3-m						
2	6-m						
3	9-m						
4	12-m						
5	15-m						
6	18-m						
7	21-m						
8	24-m						
9	27-m						
10	29-m						

Fuel Codes: LC = lichen, FM = feather moss, SM = sphagnum moss, DM = dead moss, UD = upper duff, LD = lower duff, MIN = mineral, LTRH = Litter herbaceous, LTRNDL = Litter needle litter

Burn Severity/Duff Consumption: Fire and Fuels Protocol

Date: _____

		Post-Fire		Pre-fire	Post-fire	
Point	Distance	Burn Severity Code (Substrate)	Burn Severity Code (Vegetation)	Burn Pin above surface (cm) (A)	Burn Pin Exposed (cm) (B)	Burn Depth cm (B-A)
1	3-m					
2	6-m					
3	9-m					
4	12-m					
5	15-m					
6	18-m					
7	21-m					
8	24-m					
9	27-m					
10	29-m					

Down Woody Debris & Duff Depths: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post _____ yrs
Field Date: _____ Field Crew: _____

Record the number of intercepts of woody fuels along the 50 ft transect by size class. 1hr (0 - 1/4") and 10 hr (1/4"- 1") from 0 to 6 ft along transect, 100 hr (1" - 3" diameter) from 0 to 12 ft along transect, and 1000hr (> 3" diameter) from 0 to 100 ft along transect. Record the diameter of fuels >3" diameter. Measure litter and duff depths at each end of the transect. Or use meters: 2-m (6.6 ft), 4-m (13.1 ft), 30-m (98 ft).

	# of intercepts			Record Diameter (inches) > 3" diam		Litter and Duff Depths (cm)			
Transect	0 – 0.25" 1 hr	0.25 - 1" 10 hr	1 - 3" 100 hr	3"+ solid 1000 hr S	3"+ rotten 1000 hr R	Sample site 1	Depth cm	Sample site 2	Depth cm
Dir. ____ Slope ___						Litter		Litter	
						Lichen		Lichen	
						Live Moss		Live Moss	
						Dead Moss		Dead Moss	
						Upper Duff		Upper Duff	
	Total:	Total:	Total:			Lower Duff		Lower Duff	

Transect	0 – 0.25" 1 hr	0.25 - 1" 10 hr	1 - 3" 100 hr	3"+ solid 1000 hr S	3"+ rotten 1000 hr R	Sample site 3	Depth cm	Sample site 4	Depth cm
Dir. ____ Slope ___						Litter		Litter	
						Lichen		Lichen	
						Live Moss		Live Moss	
						Dead Moss		Dead Moss	
						Upper Duff		Upper Duff	
	Total:	Total:	Total:			Lower Duff		Lower Duff	

Definitions & Tally Rules

>Downed woody material are dead twigs, branches, stems and boles of trees and shrubs that have fallen and lie on or above the ground.
>Measure woody material first to avoid disturbing it and biasing your estimates.
>Do not count dead woody stems and branches still attached to standing shrubs and trees (see below)
>If more than 45 degrees and dead, but still attached at the bole it is still counted
>Do not tally any particle having a central axi that coincides perfectly with the sampling plane.
>If the sampling plane intersects a curved piece more than once tally each intersection
>For rotten logs that have fallen apart try to estimate its original diameter
>Tally uprooted stumps and roots not encased in dirt. Do not tally undisturbed stumps.

CBI Data Sheet (FFI 2007)

FFI -- BURN SEVERITY -- COMPOSITE BURN INDEX

PD - Abridged	Examiners:			Fire Name:		
Administrative Unit		Project Unit		Macro Plot		
Field Date mmddyyyy	/ /	Fire Date mmyyyy	/			
Plot Aspect		Plot % Slope		UTM Zone		
Plot Diameter Overstory		UTM E plot center		GPS Datum		
Plot Diameter Understory		UTM N plot center		GPS Error (m)		
Number of Plot Photos		Plot Photo IDs				

BI – Long Form	% Burned 100 feet (30 m) diameter from center of plot =					Fuel Photo Series =		
STRATA RATING FACTORS	**BURN SEVERITY SCALE**							**FACTOR SCORES**
	No Effect	**Low**		**Moderate**		**High**		
	0.0	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	
A. SUBSTRATES								
% Pre-Fire Cover: Litter =	**Duff =**		**Soil/Rock =**	**Pre-Fire Depth (inches): Litter =**		**Duff =**	**Fuel Bed =**	Σ =
Litter/Light Fuel Consumed	Unchanged	--	50% litter	--	100% litter	>80% light fuel	98% Light Fuel	
Duff	Unchanged	--	Light char	--	50% loss deep char	--	Consumed	N =
Medium Fuel, 3-8 in.	Unchanged	--	20% consumed	--	40% consumed	--	>60% loss, deep ch	
Heavy Fuel, > 8 in.	Unchanged	--	10% loss	--	25% loss, deep char	--	>40% loss, deep ch	$\bar{X}$ =
Soil & Rock Cover/Color	Unchanged	--	10% change	--	40% change	--	>80% change	
CBI_1								
B. HERBS, LOW SHRUBS AND TREES LESS THAN 3 FEET (1 METER):								
%Pre-Fire Cover =			**% Enhanced Growth =**					Σ =
% Foliage Altered (blk-brn)	Unchanged	--	30%	--	80%	95%	100% + branch loss	
Frequency % Living	100%	--	90%	--	50%	< 20%	None	N =
Colonizers	Unchanged	--	Low	--	Moderate	High-Low	Low to None	
Spp. Comp. - Rel. Abund.	Unchanged	--	Little change	--	Moderate change	--	High change	$\bar{X}$ =
CBI_1								
C. TALL SHRUBS AND TREES 3 to 16 FEET (1 TO 5 METERS):								
%Pre-Fire Cover =			**% Enhanced Growth =**					Σ =
% Foliage Altered (blk-brn)	0%	--	20%	--	60-90%	> 95%	Signifcnt branch loss	
Frequency % Living	100%	--	90%	--	30%	< 15%	< 1%	N =
% Change in Cover	Unchanged	--	15%	--	70%	90%	100%	
Spp. Comp. - Rel. Abund.	Unchanged	--	Little change	--	Moderate change	--	High Change	$\bar{X}$ =
CBI_1								
D. INTERMEDIATE TREES (SUBCANOPY, POLE-SIZED TREES)								
%Pre-Fire Cover =	**Pre-Fire Number Living =**				**Pre-Fire Number Dead =**			Σ =
% Green (Unaltered)	100%	--	80%	--	40%	< 10%	None	
% Black (Torch)	None	--	5-20%	--	60%	> 85%	100% + branch loss	N =
% Brown (Scorch/Girdle)	None	--	5-20%	--	40-80%	< 40 or > 80%	None due to torch	
% Canopy Mortality	None	--	15%	--	60%	80%	%100	$\bar{X}$ =
Char Height	None	--	1.5 m	--	2.8 m	--	> 5 m	
CBI_1								
Post Fire: %Girdled =			**%Felled =**		**%Tree Mortality =**			
E. BIG TREES (UPPER CANOPY, DOMINANT, CODOMNANT TREES)								
%Pre-Fire Cover =	**Pre-Fire Number Living =**				**Pre-Fire Number Dead =**			Σ =
% Green (Unaltered)	100%	--	95%	--	50%	< 10%	None	
% Black (Torch)	None	--	5-10%	--	50%	> 80%	100% + branch loss	N =
% Brown (Scorch/Girdle)	None	--	5-10%	--	30-70%	< 30 or > 70%	None due to torch	
% Canopy Mortality	None	--	10%	--	50%	70%	%100	$\bar{X}$ =
Char Height	None	--	1.8 m	--	4 m	--	> 7 m	
CBI_1								
Post Fire: %Girdled =			**%Felled =**		**%Tree Mortality =**			

Community Notes/Comments:	**CBI = Sum of Scores / N Rated:**	**Sum of Scores**	**N Rated**	**CBI**
	Understory (A+B+C)			
	Overstory (D+E)			
	Total Plot (A+B+C+D+E)			

% Estimators: **20 m Plot:** 314 m^2 1% = 1x3 m 5% = 3x5 m 10% = 5x6 m
30 m Plot: 707 m^2 1% = 1x7 m (<2x4 m) 5% = 5x7 m 10% = 7x10 m

After, Key and Benson 1999, USGS NRMSC, Glacier Field Station.
Version 4.0 8 27, 2004 (updated 11/26/07 for FFI)

Strata and Factors are defined on the reverse side of this form. See the FIREMON Landscape Assessment, Chapter 2, available at http://frames.nbii.gov/firemon, for more information.

CBI Instruction (FFI 2007)

STRATA

Substrates—Inert surface materials of soil, duff, litter, and downed woody fuels. **Herbs, Low Shrubs and Trees**—All grasses + forbs, and shrubs + small trees <3 ft (<1 m). **Tall Shrub and Trees**—Shrubs and trees 3–16 ft (1–5 m) tall. **Intermediate Trees (pole-size, subcanopy)**—Trees between tall shrubs/trees and upper canopy, approximately 4–10 inches (10–25 cm) diameter, and 25–65 ft (8–20 m) tall. May be stratified heights and extend to upper canopy, but crowns receive little direct sunlight. Size is relative to upper canopy and varies by community. If this size is upper canopy, count as intermediate trees. **Big Trees (mature, dominant and co-dominant, upper canopy)**—Larger than intermediate trees, occupy upper canopy, receive direct sunlight; tallest may extend above average big-tree level. **Understory**—Substrates, herbs/low shrubs+trees, tall shrubs+trees. **Overstory—**Intermediate and big trees. **Total Plot, or Overall**—All strata of the plot combined.

GENERAL

Pre-fire exposed soil/rock is considered unburned if there is no sign of overlying substrates or vegetation that burned. Avoid sites with >50% exposed pre-fire soil/rock, see guidelines. **Rehab Site**—Mulch or other does not count, estimate as if that was not present. Planted, growing vegetation can be tallied where appropriate, but not as new colonizers. A specific factor may not be rated if is not relevant, shows inconsequential presence or insignificant indication of severity (write in N/A for not applicable), or when effects are unclear and cannot be reasonably judged (write in UC for uncertain). **Percent Plot Area Burned**—Record the percent surface area (burned substrates and low-growing plants) showing any impact from fire for the 98-ft (30-m) diameter plot, and for the nested 66-ft (20-m) plot, if that is used for the understory. **Prefire Variables**—Report cover (percent area), depth (inches) and density (number of trees) plot-wide as if before fire. Consider burned evidence + unburned areas within plot or nearby; reasonable approximation of prefire conditions. If too difficult to estimate, write in UC for uncertain. **Enhanced Growth Factors**—100 percent + percent productivity above that, judged to be fire-enhanced; regard amount of green biomass in terms of cover, volume and density. If plots show about the same or less productivity than before fire, then enter as not applicable (N/A). If plot shows enhanced growth, then enter the percent productivity that is augmented by fire, with 100 percent being the same postfire productivity as prefire (for example, 200 percent represents double the estimated prefire productivity); write in UC if uncertain.

SUBSTRATE RATING FACTORS (Do not count litter or fuels built up after fire.)

Litter/Light Fuel—Relative amount consumed of leaves, needles, and < 3-inches (<7.6-cm) diameter wood on the ground at time of fire. Not new litter-fall. Count litter/light fuel even if it occurs under living plants. **Duff condition**—Relative amount consumed and charring of decomposed organic material lying below the litter. Not fine root mass. Count duff even if it occurs under living plants. **Medium Fuel**—Consumption of down woody fuel between 3–8 inches (7.6–20.3 cm). **Large Fuel**—Loss and charcoal from down woody fuel >8-inch diameter (20.3 cm). Base both classes on change to fuel load. Omit or join as one if either fuel class < 5 percent plot cover, see text. Include stumps in appropriate size class, if relevant. **Soil Cover/Color**—New exposed soil and color change; lightening at moderate to high, ~10 percent red at high severity— overlook ash. Consider soil or rock surface *not* covered by litter, duff or low herbaceous cover less than about 30 cm. If such occurs under taller shrubs and trees, count it.

HERBS, LOW SHRUBS AND TREES LESS THAN 3 FEET (1 METER) RATING FACTORS

Percent Foliage Altered—Only low shrubs and trees (<3 ft), prefire live or dead cover that are newly brown, black or consumed. Ignore resprout. **Frequency Percent Living—**Percent of prefire vegetation that is still alive after fire, based on number plot-wide; survivorship, not cover, not new seedlings. Include unburned as well as burned, resprouting perennial herbs, low shrubs and trees (<3 ft) pot-wide. Include all green vegetation as well as burned plants that have not had enough time to resprout but remain viable. Burned plants may need to be examined for viable growth points. Do not include new plants from seed or suckers. **Colonizers**—Potential dominance 2–3 years postfire of new (native or exotic) plants from seed; includes herbs and tree seedlings, plus aspen or other tree-to-shrub suckers, and nonvascular plants (for example, thistle, fireweed, pokeweed, ferns, moss, fungi, seedlings of lodgepole pine, slash pine, western larch, many weedy spp.). Rate only if spp. response to fire is known. **Species Composition/Relative Abundance—**Change in spp. and/or relative abundance of spp. anticipated 2–3 years postfire. How much does postfire spp. composition resemble prefire stratum? Consider presence of new or absence of old spp., plus how dominance is spread across spp.

TALL SHRUBS AND TREES 3 TO 16 FEET (1 TO 5 METERS) RATING FACTORS

Percent Foliage Altered—Percent prefire live-or-dead crown volume (leaves, stems) newly brown, black or consumed. Ignore new resprout; it does *not* lessen the amount of prefire foliage altered. **Frequency Percent Living**—Percent of prefire tall shrubs/trees that are still alive after fire. This is a measure of survivorship based on numbers of individuals. Include unburned as well as burned but viable tall shrubs/trees 3–6 ft (1–5 m) tall plot wide; examine growth points for viability if needed. Do not include new plants from seed or suckers. Account for potential mortality that could occur up to 2 years postfire. **Percent Change in Cover**—Overall *decrease* in cover of tall shrubs/trees between 3 and 16 ft tall (1 and 5 m), relative to the area occupied by those plants before fire. Count resprouting from plants that burned, plus the unburned plants as cover that lessens the amount of decrease in cover. Do not include suckers or plants newly germinating from seeds. **Species Composition/Relative Abundance** Change in spp. composition and/or relative abundance of spp. Anticipated 2 to 3 years postfire.

INTERMEDIATE AND BIG TREE RATING FACTORS (COMBINED)

Percent Unaltered (green)—Percent prefire live-or-dead crown volume unaltered by fire. Include new resprout from burned mcrowns, not from bases. **Percent Black (torch)**—Percent prefire live-or-dead crown volume that actually caught fire (black or consumed stems, leaves). May or may not be viable postfire; resprout from black crowns does not lessen percent black. At high severity, consumption of fine branching is evident. Include deciduous blackened crowns. **Percent Brown (scorch)—**Percent prefire live crown volume affected by scorch or girdle without direct flame contact. Brown is due to proximal heating, where foliage did not catch fire. Includes delayed mortality, insect damage, and brown foliage that has fallen to ground. **Percent Canopy Mortality** —Percent prefire live canopy volume made up by trees killed directly or indirectly by fire within 1–2 years. Proportion of a plot's total once-living canopy lost to dead trees (include insect/disease kill) in relation to total prefire canopy volume. **Char Height**—Mean char height from ground flames averaged over all trees. The mean is halfway between upper and lower heights on a tree. Include unburned (char height = 0) and burned trees ***only*** when char height is discernable. Do ***not*** include black from crown fire; enter N/A for most crown fire burns.

RECORD FOR EACH OVERSTORY STRATUM, BUT DO NOT COUNT IN CBI SCORES

Percent Girdled (at root or lower bole)—Percent of trees effectively killed by heat through the lower bark, sufficient to kill cambium around lower boles or buttress roots. Include trees either dead or likely to die within 1–2 years. Do not include trees killed by torch or scorch to crown. May or may not char through bark and into the wood; may have loose sloughing bark in 1–2 years. **Percent Felled (downed)—**Percent live-or-dead trees, that were standing before fire but now are on the ground. Usually from wind throw after fire, they exhibit fresh up-turned root masses, and different charring patterns than trees that were down when fire occurred. **Percent Tree Mortality**—Percent of once living trees on the plot that were killed by the fire, based on number of trees. Suspected insect and disease effects also may be included, if such contributed to killing whole trees relatively soon after fire (for example, within 1–2 years).

RATING ADVICE

Factors that are not applicable or cannot be resolved in a plot are not rated; they are omitted from that plot's composite ratings. Moreover, if there is much uncertainty about how a specific factor should be rated, or whether it is even relevant to the plot, then that factor should be left unranked. Only the number of rated factors is used to compute averages. If a factor is not rated, enter not applicable (N/A) or uncertain (UC) on the CBI data form. Do not just leave the field blank; such factors are not part of the CBI average, but one wants to know whether these factors were actually assessed and it was decided not to rate them, or just accidentally overlooked and skipped. Zeros, on the other hand, are valid entries and do get averaged into composite scores. Zeros should be used when a rating factor is applicable and exhibits an unburned condition. A zero represents no detected change in an observable factor.

Fuel Moisture Data Sheet/Duff Plug: Fire and Fuels Protocol

Project name _____			Recorders: _____			Date: ____/____/____		
Plot ID _____	Fuel Type Sampling _____			Phenology: _____		Time: _____		
Location: _____		Lat: _____	Long: _____			Datum: _____		
Avg slope (%): _____		Elevation: _____			Aspect: _____			

Sample #	Type	Fuel Codes	Sample Depth (cm)*	Thickness (cm)**	V/G*	Bottle #	Wet Wt	Dry Wt	Tarre Wt	Comments
1-example	Duff	lm	0-3cm	3	V	23	75.3	58.7	52.9	
1-example	Duff	dm	3-7cm	4	V	22	80.5	58.7	52.9	

Fuel Codes: lm=live moss (feather), dm = dead moss, ud = upper duff, ld = lower duff

pima = black spruce, pigl = white spruce, lepa = labrador tea, vavi = cranberry, spha = sphagnum

Shrub Density Data Sheet: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post ____ yrs

Field Date: _____ Field Crew: _____

The 30 meter belt transect is 1 meter wide. For each plant (see protocol for details) of the preferred species, within the 30-m x 1-m belt transect, record the number of shrubs by life status. Record average height class (optional).

Shrub Species	***Avg. Height (m)***	***Mature***	***Resprout***	***Seedling***

Moose Browse Architecture Data Sheet: Fire and Fuels Protocol

Park Unit: _____ Project: _____ Plot ID: _____ **Page ___ of ___**

Pre or Post ____ yrs Field Date: _____Field Crew: _____

The 30 meter belt transect is 1 meter wide. For each plant (see protocol for details) of the preferred species, within the 1 meter belt transect, assign a architecture classification. [**Broomed** - (sapling type plants) the main apical stem has been broken by moose. Look back through the history of the plant, this may have happened 2–10 years before you measured it; (bushy type plants) more than half of the CAG stems arise from lateral stems that were produced as a result of browsing. Look back through stems that are many years old. **Browsed** - Has been browsed some in the past, but browsing has not significantly affected its growth. Less than half of CAG twigs between 0.0 and 3.0 m arise from lateral stems that were produced from browsing. **Unbrowsed** - There is no visible evidence that moose have ever browsed this plant.] Note in comments evidence of bark stripping and other evidence of moose or other wildlife use in the area.

Species	*Average Height Class*	*Unbrowsed*	*Browsed*	*Broomed*

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.
Height classes: 0-0.5m, 0.5-1m, 1-3m, 3-5m, > 5m

Appendix C.2. Fire Effects Paired Plot Protocol

Alaska NPS Fire Ecology Program
Fire Effects Paired Plot
Field Method Protocol 2005

Background: Fire Effects Paired Plots

The fire effects paired plot project began in 1981 under the direction of Gary Ahlstrand, NPS Alaska Regional Research Ecologist. The purpose of the project was to assess vegetation change and succession as a result of fire and to determine fire history. Fire staff established paired vegetation 15-m x 30-m plots in burned and representative unburned habitat adjacent to the burned areas of varying ages. Burned sites were identified and selected for the study from historic fire reports, 1:63,360 color infrared aerial photography, and aerial reconnaissance. Some plots were established in front of active wildfires and control plots were not established. Between 1981 and 1988, at least 525 plots were installed across 9 different parks in Alaska. Plot data that was collected included: photographic slides of plot, tree density by species and diameter size class on 15-m x 30-m quadrats, vegetation cover class for 30 Daubenmire frames (20 x 50 cm), tree cores/cookies, fuels and soils data (on some plots), and general plot site descriptions.

Up until 2008 most of the data were only available in paper format, except for the vegetation cover data was in a TWINSPAN text format. Between 2003 and 2008, paired plot data for all the parks was entered into an Access database and plot locations were digitized off topographic maps and aerial photos. The Access database was converted to Interagency Fire Ecology sequel server database called FFI V1.02 through a contract in 2008. Original copies of data and photos are archived at the Alaska Regional Office. Scanned copies of data and photos are stored at the regional office and with the Regional Fire Ecologist in Fairbanks.

Data from this project can be used to determine the vegetative and structural components that have changed over time since fire. Currently the data is being utilized to develop fire successional models to update landcover vegetation maps and fuels maps utilized by the fire management program. This information is being used to understand the potential impacts of shortened fire return intervals and future climate warming.

Plot Locations and Layout: Fire Effects Paired Plots

Plot Locations

Plots were located in an area of the stand free of ecotonal effects in which environment, overstory and understory were as homogenous as possible. Originally the plot locations were pin pricked on 1:63,000 aerial photography and marked on 1:63,360 topographic maps. Some of the plots have since been digitized, although they are not precise locations. For most of the permanently marked plots, there are written instructions with marker trees and azimuths to re-locate the plots. Plots that were permanently marked appear to have 4 corner markers of rebar or welding rod with aluminum cans. Use the photos, maps and written instructions to locate the plots. For all plots that are re-visited, GPS locations will be collected and recorded, corners will be re-established with re-bar.

Plot Layout

A 15-m x 30-m rectangle plot was laid out so that the long axis paralleled the contour of the slope. Use a 100-m tape to outline the 15-m x 30-m plot. Two 30-m vegetation transects are established within the 15 x 30-m rectangle, at 5-m and 10-m along the 15-m end of the rectangle (see plot layout Figure C.4.1). To measure vegetation cover, thirty 20 x 50 cm microplots (Daubenmire frames) were placed every 2-m along the inside

edges of the two vegetation transects (A and B). The central transects will be used for point intercept measurements, active layer depths and burn severity code scores if recently burned.

Plot Naming Convention
The plots were named with a three letter acronym based on a physical feature or the fire name. In general plots ending in a "B" were burned plots and plots ending in an "A" were control plots. For example: plots were established near Trout Creek in Yukon-Charley Rivers. The burn plot was named TCB-1 and the control plot was TCA-1. However over the different years that plots were established and among the different parks the plot names often got duplicated. For example, YUCH also had plots established at Todd Cr and were also named TCA-1/TCB-1. Therefore it is recommended that the original plot designators utilize the park code first, and if repetitive names occur within the parks that an "a", "b" or "c" be added to the end of the plot name to distinguish between different plots.

Data Collection: Fire Effects Paired Plots

Site and Photo Points
General site information will be collected and recorded for each plot on the *SITE AND GENERAL DESCRIPTION* Datasheet. It is recommended that additional site location descriptions, diagrams of plots, and additional notes on the plot be written up on separate sheet. The definitions of the fields for the *SITE AND PLOT DESCRIPTION* Datasheet are given below:

- **Land Unit** – land unit identifier or write out land unit name - (i.e. Steese White Mtns, Yukon-Charley NP) (NPS - four letter park acronym)
- **Project** – Description of project: PPF (pre/post fire), CBI (burn severity), HZF (for hazard fuels), PP (paired plots).
- **Plot ID** – Identifier for the plot within the project, i.e. ECA-1, TCB-1 etc
- **Fire Name and Fire Date** – Fire name/number or project location or cabin name and thinning date if hazard fuels
- **Fire Date** - Date of fire or fuels treatment (pre-treatment will be blank).
- **Field date** – Sample date
- **Field Crew** – Names of crew members
- **WP number and GPS number** – record the WP number of the collected point and the name or number of the GPS used.
- **Lat/Long** – Using a GPS (Garmin V recommended), collect a lat/long averaging the time of collection for 20 points. Record in Decimal Degrees - i.e. Lat: N 65.634891° Long: W 142.982340°
- **GPS Error** - Record the error EPE and units, this needs to be recorded before you save the waypoint in Garmin handhelds.
- **Datum** – GPS datum used for collecting and navigating to plots, use NAD-83 (this is the same as WGS-84).
- **Transect Azimuth** – record the azimuth of the transect facing from the zero end to the 30-m end.
- **Declination used** – record the declination setting used on your compass, for the initial reading, base your declination on the most recent topographic map. For future reading use the declination used in the original setup.
- **Transect slope** – record the slope looking down the transect
- **Slope** – Percent slope, use clinometer
- **Aspect** – Slope aspect (facing downhill) azimuth in degrees
- **Elevation** – Taken from GPS or maps in feet or meters (record units)
- **Viereck Class** – Using Viereck's (1992) Alaska Vegetation Classification, determine the vegetation class to level IV, or if possible level V for the plot area. Either write it out: Open PICMAR/LEDGRO/HYSPLE or use numeric: I.A.2.f with Labrador tea.
- **Soil** – Estimate of soil drainage: wet, moist, dry.
- **Disturbance** – General note of disturbances, record date estimate if known. This is for the plot and general vicinity.
- **Evidence of fire**
- **Photo number, time and camera** – record the photo number in the digital camera or keep a photo log if standard camera, record the time of the photos (for digital cameras) and the camera used.

At least four photos will be taken for each plot. The photos will be taken from each end of the vegetation sampling transect looking towards the plot center. Label a dry-erase board with the date, park, plot ID, transect letter (A or B), transect azimuth (direction facing) and designate as 0-m ---> 30-m and vice-versa. Hold the board to the edge of the photo view within the first 1.5 - 2 m of the transect. In addition, original photos that were taken at the plot will be duplicated as closely as possible.

Map of Plot Layout

Record the latitude/longitude for all four corner markers. If corners cannot be relocated estimate using tapes and azimuths. Draw corner plot identification and direction of daubenmire frame readings or any other plot information pertinent to the plot.

Vegetation and Ground Cover

Point-Intercept Vegetation Sampling- Two 30-m point intercept transects will be established along the two transects A and B within the macroplot (see Figure 1). The zero end of the transect will be the start of the transect. Every 1-m along the 30-m transect, all plant species and forest floor surface cover (mosses, lichens, litter) that are intercepted at that point will be recorded. Using a ¼" diameter pole (6 ft fiberglass bike flag), gently lower the pole so that the rod is plumb to the ground (on slopes this will not be perpendicular to the ground). At each point intercept record the species that touch the pole from top to bottom, for example if black spruce was the tallest vegetation at that point hit it would be recorded first, similarly ground cover will always be last. Record the species code on the *POINT INTERCEPT* Data Sheet. This data was not originally collected at the Paired Plots – added in 2005.

-Vegetation Cover Class - To estimate vegetation cover, thirty 20 x 50 cm microplots (Daubenmire frames) are placed every 2-m along two transects A and B, starting at the 1-m point and continuing with every odd meter. The long edge of the frame parallels the transect. Estimate canopy cover for each species of live shrub, herb, bryophyte, lichen and for tree species less than 1-m tall, that is rooted in the plot frame. The following cover classes are used: **0 = 0-5%; 1 = 5-25%; 2 = 25-50%; 4 = 50-75%; 5 = 75-95% ; 6 = 95-100%**

Record the cover estimate of each species for each frame, number 1 through 30. Frame 1 begins at the 1-m point on transect A, continuing to frame 16 -30 on transect B. (Note: the exact sequence of frames was not recorded in any of the plot methodologies written up for the plots in the 1980's, the sequence shown was drawn for a plot in YUCH CCPB-1.)

Active Layer Depths and Burn Severity

Active Layer Depths - Ten active layer points are located along the two transects (A & B) at 3-m intervals, except last point is placed at 29-m. At each point measure the depth of the active layer with the bike flag rod and tape measure. Measure the depth in cm to the point of permafrost or bedrock. If it is possible to determine that depth is to rock, note this on the datasheet.

Burn Severity (1 yr post fire) **-** Up to 1 yr postfire, at each active layer depth point determine burn severity code (BSC) as described in FMH 2003 for the substrate and vegetation at each active layer point, see Appendix for codes. Burn severity for the plot can be determined using the Composite Burn Index methodology (See FIREMON 2004).

Forest Density

All live trees taller than 1 meter within the 15 x 30-m macroplot will be tallied by species and diameter size classes (< 5 cm, 5.1-10 cm, 10.1-15 cm, 15.1-20 cm, 20.1-25 cm, 25-30 cm, and > 30 cm DBH). To facilitate the counting of trees, tally each 5 x 30-m sub-plot separately – either use one data sheet for each sub-plot or label on the datasheet within each size class columns with 1, 2, and 3. This is also being done so that we can reduce the plot size to the central 5 x 30-m subplot for subsequent measurements. Label the subplot number on the plot map. Count all trees less than 1.4 m tall along two 1-m wide strips along the inner side of the central subplot (Note: it's unclear in original documentation if the whole plot was tallied for seedlings/saplings or a sub-sample)

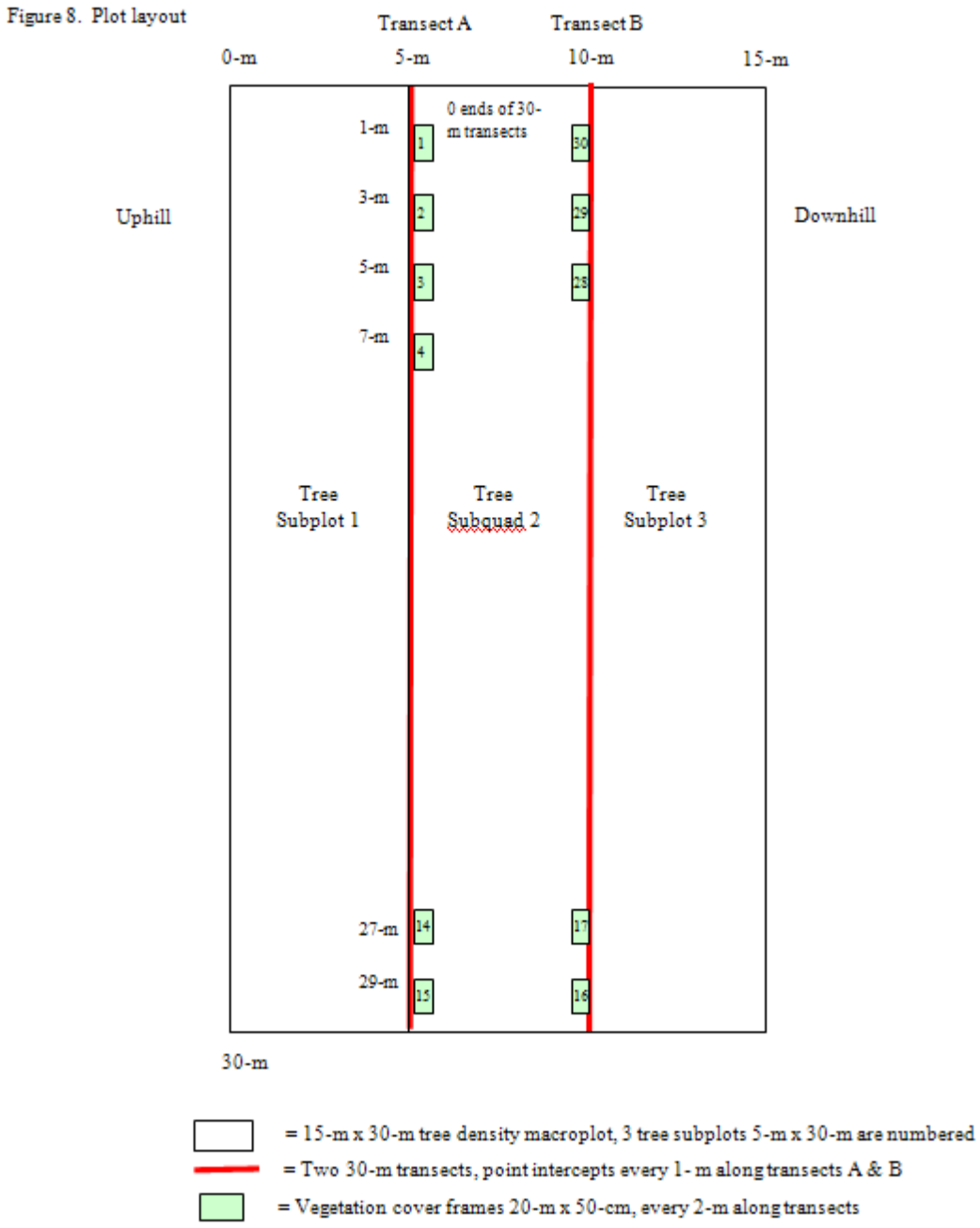


Figure C.4.1 Plot diagram for Paired Plots

Site and General Description: Fire Effects Paired Plots

Unit: _____ Project: _____ Plot ID: _____ Pre or Post ___ yrs

Field Date: _____ Field Crew: _____

Fire Number _____ Fire Date: _____ Fire Name:_____

Transect Azimuth: _____ Transect Slope: _____ Declination used: _____

Slope: _____% Aspect: _____ Elevation: _____ ft Viereck class: _____

Soil (circle): Wet Moist Dry **Disturbance** (circle): Fire Wind Insect Other: _____

Evidence of Fire/ Fire Indicators: Burn Snags Burned Stumps Fire Scars Charcoal (circle all that apply)

Photo numbers: _____ **Time of photos**: _____ **Camera used**: _____

Mark all four corners of the 30-m x 15-m plot and record corner directions (N, S, E, W or NE, SW, SE etc.)

GPS Type: _____ GPS Identification: _____ GPS Datum: _____

Corner Direction:_____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)

Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)

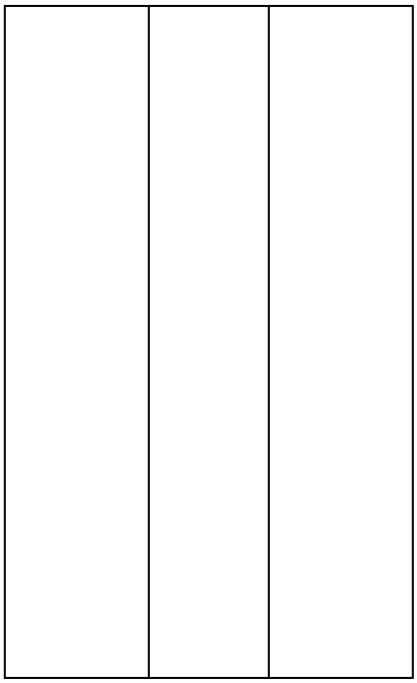
Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)

Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)

Map of Plot Layout: Label direction of daubenmire frames read, tree subplot #, and corner marker directions or numbers.

Provide notes on relocating or LZ, burn information and other plot notes as needed below.

Upslope



Down slope

Plot Notes:

A B

Vegetation Point Intercept: Fire Effects Paired Plots

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post ____ yrs

Field Date: _____ Field Crew: _____ Control or Burn Plot

Record substrate and species codes of trees, shrubs, forbs and groundcover intercepted at each 1-m interval along the two 15-m transects (A and B), for a total of 60 pts. Record plants from tallest to lowest.

PNT	Meters	SPP	SPP	SPP	SPP	SPP	SPP
A 1	1						
2	2						
3	3						
4	4						
5	5						
6	6						
7	7						
8	8						
9	9						
10	10						
11	11						
12	12						
13	13						
14	14						
15	15						
16	16						
17	17						
18	18						
19	19						
20	20						
21	21						
22	22						
23	23						
24	24						
25	25						
26	26						
27	27						
28	28						
29	29						

Plot ID: _____Field Date: _____

PNT	Meters	SPP	SPP	SPP	SPP	SPP	SPP
30	30						
B 31	1b						
32	2b						
33	3b						
34	4b						
35	5b						
36	6b						
37	7b						
38	8b						
39	9b						
40	10b						
41	11b						
42	12b						
43	13b						
44	14b						
45	15b						
46	16b						
47	17b						
48	18b						
49	19b						
50	20b						
51	21b						
52	22b						
53	23b						
54	24b						
55	25b						
56	26b						
57	27b						
58	28b						
59	29b						
60	30b						

0 - 5 % = 1	50 - 75 % = 4
5 - 25 % = 2	75 - 95 % = 5
25 - 50 % = 3	95 - 100 % = 6

Vegetation Cover – Daubenmire Frames: Fire Effects Paired Plots

Park Unit: __________ Project: __________ Plot ID: _______________ Field Crew: ________________ Field Date: _________________

To estimate vegetation cover, thirty 20 x 50 cm microplots (Daubenmire frames) are placed every 2-m along the inner edges of the central 5 x 30-m subplot, starting at the 1-m point. Canopy cover estimates are made for each species of shrub, herb, bryophyte, lichen and for tree species less than 1-m tall. The following class coverages are used: 0-5 %, 5-25 %, 25-50 %, 50-75 %, 75-95 %, 95-100 % using the numbers above.

SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

Active Layer/Burn Severity: Fire Effects Paired Plots

Park Unit: _____ Project: _____ Plot ID: _____

Pre or Post ____ yrs Fire Name/Number: _____ Fire Date: _____

Field Date: _____ Field Crew: _____

Record depth of active layer every 3-m along the transects A & B, for each point record if you hit permafrost (pf) or rock (r). If plot has burned within the last year record the burn severity code for the substrate and vegetation using the descriptions following this data sheet.

Transect A:

Point	Distance	Active Layer Depth (cm)	Burn Severity Code (Substrate)	Burn Severity Code (Vegetation)
1	3-m			
2	6-m			
3	9-m			
4	12-m			
5	15-m			
6	18-m			
7	21-m			
8	24-m			
9	27-m			
10	29-m			

Transect B:

Point	Distance	Active Layer Depth (cm)	Burn Severity Code (Substrate)	Burn Severity Code (Vegetation)
1	3-m			
2	6-m			
3	9-m			
4	12-m			
5	15-m			
6	18-m			
7	21-m			
8	24-m			
9	27-m			
10	29-m			

Noatak Tundra Fire Effects Racine Plots

Field Methods 2005

(Compiled November 2010)

NPS AKRO Fire Ecology Program

Jennifer Barnes, Charles Racine, John Dennis

EXECUTIVE SUMMARY

In July 2005, with support from the National Park Service Arctic Network Inventory and Monitoring program, Dr. Charles Racine and NPS Regional Fire Ecologist, Jennifer Allen, relocated and re-measured plots established in 1981-82 at eight burn sites in Noatak National Preserve to evaluate the long-term (25-30 years) effects of tundra wildfire on vegetation and permafrost. The tussock-shrub tundra sites, originally established by Racine and Dennis, included four sites burned in 1977, one site burned in 1972, one site burned in 1982, and 2 unburned control sites. Stakes placed in the ground in 1981-82 to mark sample plots were relocated at four of the eight sites. At the remaining sites we used photos and field notes to relocate plots as close to the original as possible. Ocular cover estimates were made for each species in each 1m x 1m plot (10 per site). Thaw depths were measured at five points in each plot. To provide for future monitoring, all sites were restaked and GPS coordinates obtained. Our experience relocating and resampling old plots established 23 to 24 years ago indicates that these plots are valuable tools for assessing fire disturbance on tundra ecosystems.

INTRODUCTION

The National Park Service Arctic Network Inventory and Monitoring program (ARCN) seeks to track "vital sign" resources and processes that are indicators of ecological condition of concern to each park (Sanzone et. al. 2005). The Arctic Network is comprised of five large land units in northwest Alaska that includes Noatak National Preserve, Kobuk Valley National Park, Bering Land Bridge National Preserve, Cape Krusenstern National Monument, and Gates of the Arctic National Park and Preserve. Fire affects all of the parks in the Arctic Network; in the past 50 yrs over 300,000 hectares have burned within the five parks. Fire is an important monitoring variable because it not only influences vegetation succession and distribution, but also wildlife habitat, soil parameters (e.g. permafrost and nutrient cycling), hydrology, water quality and air quality. In addition, the natural fire regime (fire frequency, fire extent and severity) and fire succession are likely to respond to local and global climate changes. Both short-term and long-term impacts of fire need to be evaluated through monitoring of plots established on burns. As a complement to establishing new plots on different aged burns it is highly valuable to monitor change on the same plot over time.

Wildfire produces a rapid change in the physical, chemical and biological properties of an ecosystem changing both above and below ground conditions. There is immediate change in the vegetation and soils (organics, nutrients and temperatures and microbial activity). In permafrost terrain, thawing of ice-rich permafrost, subsidence and thermal erosion may result in complete ecosystem change. Ecosystem response begins immediately following fire, involves a great many processes and is dependent on initial fire severity, climate, soils, topography, herbivory etc during this period. Short term response (from 1-15 years) may be different from longer term response (15-30 years) particularly in forests and recovery to prefire conditions may never occur. The criteria used to measure response also vary from functional (i.e. primary production) to structural (growth forms and species composition).

In the northern subarctic, lightning caused wildfires are common and important in the boreal forests but less common in the arctic tundra. However during summer 1977, over 1 million acres of mostly arctic tundra burned in northwest Alaska. Because at this time we were conducting studies of vegetation and disturbance in this area, we became interested in the effects of these fires and visited several fire sites in the Seward Peninsula

in 1978-79 (Racine 1979). Tundra fires also occurred in 1977 north of the Seward Peninsula in the Noatak River watershed, a UNESCO Biosphere Reserve. In 1981-82 we (Racine et al. 1991) obtained a grant from the U.S. Man and the Biosphere program entitled "The Ecological Role of Fire in Tundra Ecosystems of the Noatak River Biosphere Reserve, Alaska" to evaluate the impacts of these fires. We established a base camp (67.96 N 161.84W) near a 1977 tundra fire that burned 12,000 ha along the Noatak River about 80 miles north of Kotzebue (Figs. 1) just downriver from the Noatak Canyon and conducted a broad range of studies including fire history, soils, vegetation and permafrost. Participants included four principal investigators (Charles Racine and Peter Marchand- Johnson State College), William Patterson (U. Mass) and John Dennis (NPS), two graduate students (U. Mass), four undergraduates (Johnson State College) and 10 Earthwatch volunteers. We occupied the camp from July 18 to August 7, 1981 and from July 8 to August 2, 1982.

In July 2005 (July 23-30) with support from the National Park Service Inventory and Monitoring program, we (C.Racine, J.Dennis, M. Racine, J. Allen and A. Stinchfield) relocated and remeasured the vegetation and thaw depths at three sites at our original base camp and in addition resampled three other remote sites by helicopter (Table 1). The 2005 study sought to determine the feasibility and value of relocating and resampling these plots which had been established 4-5 years after a 1977 tundra fire in the Noatak National Preserve. While these plots were not originally established with the purpose of monitoring recovery beyond the two years of the study, our ability to find and resample them suggests they may be useful to the NPS Inventory and Monitoring program for long term monitoring of response to fire.

Table 1. Sites sampled in 1981-82 and resampled in 2005. Table 2 provides all plot locations.

Site Name	***Elev.(m)***	***Fire Date***	***Pre-fire Vegetation***	***Burn Severity[2]***
Noat1	100 m	7/14/77	Shrub tundra	Moderate
Noat2	100	7/14/77	Low centered polygons	Low
Noat3	100	7/14/77	Tussock-shrub	Low
Kungiakrok Ck[1]	100	6/21/82	Tussock-shrub	Moderate
Uchugrak Hills[1]	500	7/14/77	Tussock- shrub	Moderate
Kugururok R.	110	7/13/72	Tussock- shrub	Moderate

[1]Sites with burned and unburned plots sampled. [2] Viereck Fire Severity classes

By relocating and resampling such plots and providing data from earlier visits, we hope to stimulate monitoring of the plots into the future as a contribution to evaluating the long- term effects of fire on tundra ecosystems. The objectives of re-measuring these historic plots were to address the following questions:

1) How does the time since fire affect the species composition, vegetation structure, and ground cover among varying vegetation types?
2) How does the time since fire affect depth of active layer, thermokarst development)?
3) Do the vegetation and soil conditions of today suggest the presence of environmental factors in addition to post fire recovery, such as climate change? Particularly in relation to expansion of shrubs and trees i.e. alder, willow and spruce.

METHODS

Study Area

The Noatak River watershed is one of the major river systems of arctic Alaska draining 33,670 km of the western Books Range just above the Arctic Circle and containing a broad range of lowland and alpine tundra, tussock tundra, shrub tundra and treeline habitats. The study area is located near the confluence of Noatak and Kugururok Rivers (Fig 1). The vegetation in the study area is generally dominated by tussock-shrub tundra, birch-ericaceous shrub tundra or willow shrub types. The study area is at the upriver limit of spruce along the Noatak, however scattered patches of spruce and alder are present in the area. Both spruce and alder appear to have expanded in this area during the past 50 years as shown by Suarez et al. (1999) using age structure, and by Sturm, Racine and Tape (2001) using photos obtained along the Kugururok River less than 10 miles north of our study area.

Fire records indicate that 140 fires and an estimated 173,900 hectares (ha) have burned over the past 50 years (1956-2005) within the Noatak watershed (NPS fire database).These fires burned from 1000 up to 65,000 ha/year at valley elevations below 500 m (Racine et al. 1985). During the summer of 1977 in the Noatak River watershed there were at least nine fires which burned almost 70,000 ha (169,000 acres). One 1977 fire in the lowlands along the Noatak River accounted for nearly two-thirds of the area (52,355 ha). The 1977 fire sampled in this study was the second-largest Noatak fire during 1977, the Loop Fire (BLM Fire # 8657) burned approximately 14,000 ha (35,000 acres) (Fig. 1). Fires have been historically common in this area (Racine et al. 1985) and in addition to the 1977 fire we established plots on nearby 1972 and 1982 burns.

Study Sites

Noatak River Sites

The Noatak River study area and base camp was located on the southwest edge of the 1977 Loop fire at the northeast junction of the Noatak and Kugururok Rivers (Fig 1). This fire burned around several lakes including the very large Lake Narvakrak, Tulugak Lake and several unnamed lakes north of the camp. The fire burned east to the Uchugrak Hills where it was actively suppressed with hand-dug fire lines. In 1981 we (C. Racine and J. Dennis and two field assistants) occupied our camp on the Noatak River from July 18 to Aug 9. At this time we established a 265 m long transect running north from our camp and perpendicular to the Noatak River (Table 2; Fig. 1). Along this transect, we selected three different vegetation types for intensive sampling:

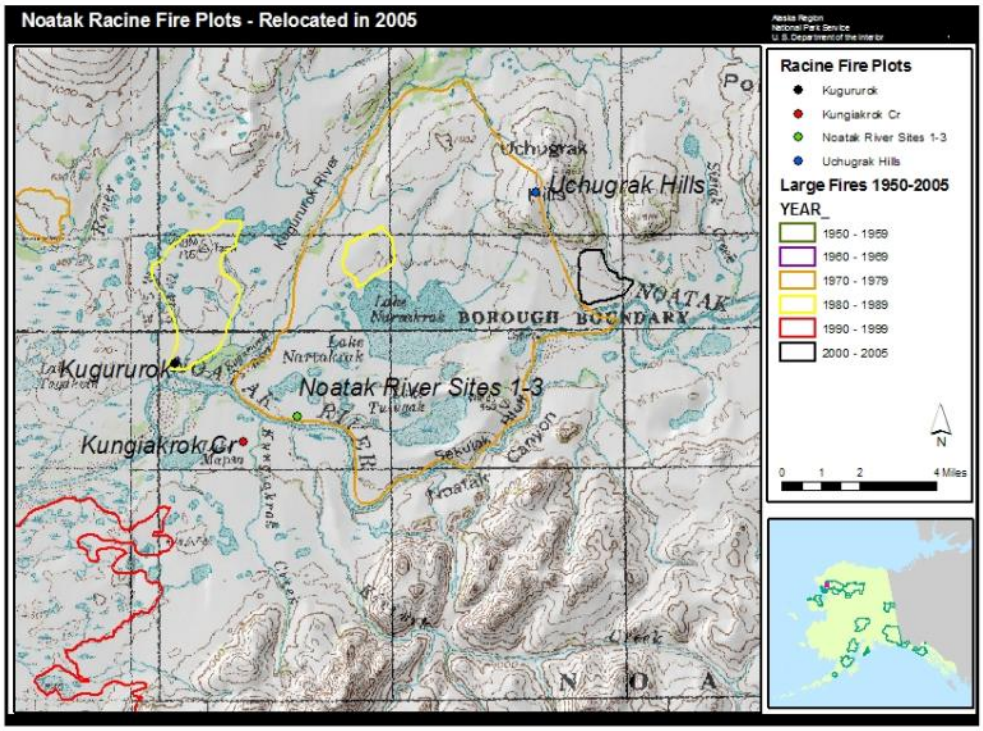
- **Noatak Site 1 (NOAT1)**. This site is at the north end of the transect farthest from the river and appears to be a well-drained sandy beach ridge. In 1981 a 6 cm thick organic horizon was charred to a depth of 0.5 cm suggesting moderate burn severity. Thaw depths were about 90 cm. Based on an unburned patch, the vegetation before the fire was shrub tundra.
- **Noatak Site 2 (NOAT2)**. This site is located on a gentle 1% slope dominated by low-centered polygons of generally low, round or elliptic oblong pans or centers (5-10 m in diameter) outlined by raised hummocky ridges, 1-2 m wide. The 1977 fire appears to have burned along the raised edges leaving the centers or pans unburned or lightly burned. The rims, which were sampled, had a thick (35 cm) organic horizon above sandy mineral soil. The pans had a thin organic horizon of 4-5 cm and the fire appears to have burned mainly the rims where shrubs were common.
- **Noatak Site 3 (NOAT3).** Located on a short slope above a wet swale near the base camp, the organic horizon was 20 cm thick above silts. The vegetation here consists of *Eriophorum vaginatum* tussocks below an open canopy of *Salix glauca* willow. Burn severity was relatively low. On July 31, 1982 average thaw depth was 60 cm.

Remote Tussock- Shrub Tundra Sites

In 1982 we sampled three other burned sites all dominated by tussock- shrub tundra (Table 1; Figure 1):

- **Kungiakrok Creek (KUNG)** -a small 2 ha fire (BLM fire # 8528A) occurred on June 21, 1982 fire across the river from our base camp. The site was dominated by lowland, tussock-shrub tundra, just beyond the base of a low ridge with scattered spruce and alder. Two sites, one burned and one unburned, were established here three weeks after the fire. The soils at the burn site had a 12 cm thick organic horizon.
- **Uchugrak Hills (UCHG)** a higher elevation (500m) site on the east edge of the 1977 Loop fire where a hand-dug fireline stopped the movement of the fire to the east. The soils are rocky and fellfields are common along portions of this ridge; however the less exposed flats support tussock-shrub tundra. Sample sites were established on each sides of this fireline, providing a burned and unburned plot.
- **Kugururok River (KUGUR)** a 1972 burn just down river from our base camp on a plateau above the confluence of the Noatak and Kugururok Rivers. The burn was located using a 1973 Satellite image which showed the fire scar. Fire records indicate the area burned again in 1984. We had no unburned site here but made observations on shrubs and spruce along the edge of this burn in 1982 and again in 2005. Soil pits and textural analysis showed that the soils at the site are sandy even at the tussock-tundra site sampled here. The soil organic layer was 14 cm thick and the mineral soil was a silt-sand.

Figure 1. Site locations for Noatak Racine tundra fire plots.



Sampling Methods

Vegetation and Soils Measurements

Vegetation was sampled in 1-m x 1-m plots outlined with a frame. Ten 1-m x 1-m plots were sampled at each site. Usually two people (to gain consensus) made ocular estimates of percent cover for each vascular and non-vascular species in each plot. Estimates of percent cover, shrub stem density when possible, and maximum height were made for each shrub species. In 2005 a vertical digital photo of the plot was obtained. We measured thaw depths in 1981, 1982 and 2005 with a steel probe pushed to resistance in the four corners and

center of each 1m x 1m plot (5 thaw depth probes per plot) for a total of 50 measurements per site. Data sheets developed for 2005 sampling are provided at the end of the document.

Plot Layout

Three sample sites were established along a 265-m transect at the Noatak base camp site. Each of the three NOATAK base camp sites utilized a staked 35-m x 12-m sample site (macroplot) that was divided into subplots and walkways for access (See Figure 2a). Within the large macroplot, two rows (designated A and B) were established consisting of five 4-m x 5-m areas. In the four corners of each 4-m x 5-m area we established a 1-m x 1-m plot and selected at random one of these in which to estimate percent cover for all living vascular and non-vascular plant species in each of the 1m x 1m plots. These plots are named for example "3A1SW" for Site 3, the first 4-m x 5-m plot in row A and the 1-m x 1-m plot in the SW corner of the 4-m x 5-m plot. Because short wooden stakes (lathe, spruce or willow) had been placed at two to four corners of each of the ten 1-m x 1-m plot when they were established in 1981 and most of these survived until 2005 each of the 10 1-m x 1-m plots were measured in 1981, 1982 and 2005.

At the three remote sites (Kungiakrok -KNG, Uchugrak- UCHU and Kugururok- KUG) the plots were generally arranged contiguously along a 10 m long tape stretched between two rebar or stakes 10 m apart and oriented magnetic east-west. The ten 1-m x 1-m quadrats are read on the north side of the plot transect (See Figure 2b). There is some variation in each of these remote plots. Kungiakrok transects (burned and unburned) were oriented east-west with the 0-m end at the east end of the transect (Transect azimuth 260 degrees true north). Kugururok site was a single transect oriented west to east, with the 0-m end on the west end of the transect. The transect was extended to 60-m and a density of tree seedlings was taken along the full length of the 60-m x 1-m belt transect. (Transect azimuth 110 degrees, true north). At the Uchugrak site, one 30-m transect was established in 1982 that runs perpendicular to the old fire line. The first 10-m of the west end of the transect is the burned plot. The unburned plot runs from the 30-m end to the 15-m end (old fire line). Both ends of this 30-m transect should be marked with rebar. Currently there is wooden lathes on burned end (West) and welding rod on the unburned end (East). (Transect azimuth 98 degrees, true north, declination set at 17 degrees in 2005). *(NOTE: In the technical report published in 2006 on this study, it states that the plots were north-south oriented and read on the west side of the transect, however this is not how they were read in 2005. Based on the GPS points collected and photos, the correct direction of these transects is generally east-west, with plots on the north side of the transect).*

Table 2. Location of Racine Noatak fire plots re-measured in 2005. Coordinates are given for the 0-m end of the transects.

Site Name	Plot ID	Rebar	Plot type-Burn Year	LAT_NAD83	LONG_NAD83
Kugururok	KUG-B	yes	Burned 1972 and 1984	67.98649371	-161.96182796
Kungiakrok Burned	KNG-B	yes	Burned 1982	67.95749903	-161.89485320
Kungiakrok Unburned	KNG-U	yes	Unburned	67.95785844	-161.89507314
Noatak 1	NOA1NE	yes	Burned 1977	67.96900570	-161.84069940
Noatak 2	NOA2SE	yes	Burned 1977	67.96771824	-161.84045264
Noatak 3	NOA3SW	yes	Burned 1977	67.96666682	-161.84125193
Uchugrak	UCHB-W	yes	Burned 1977	68.04991186	-161.60514780
Uchugrak Unburned	UCHU-E	yes	Unburned	68.04987431	-161.60441288

Figure 2a. Noatak River Camp Transect In 1981, four 35-m x 12-m sites were established with ten 5-m x 4-m quadrats spaced along a 265 m transect from the Noatak River beach ridge up to open low shrub tundra. Sampled randomly selected 1-m x 1-m plots in one of the four corners of each 5 m x 4 m plot. 1981 sampled vegetation, biomass, soil pits, and thaw depths.

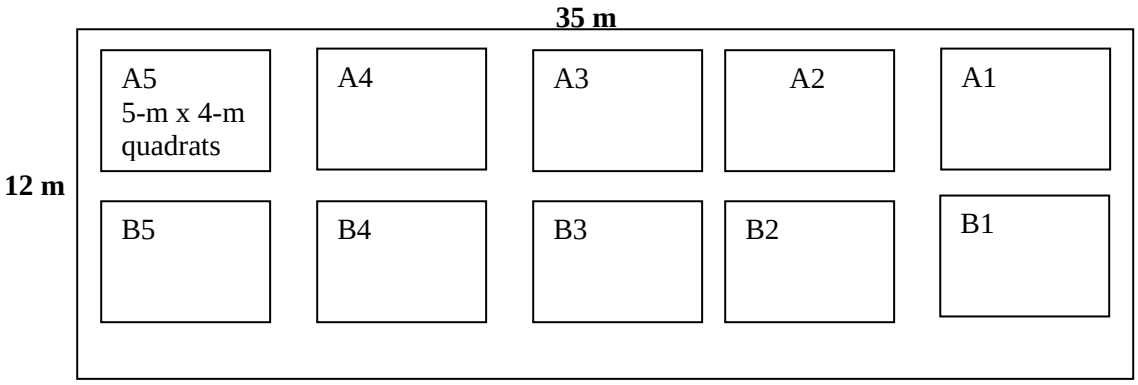
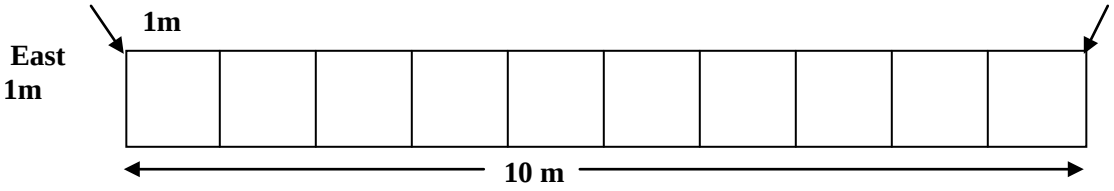


Figure 2b. Racine Remote Sites (cover, stem density, max ht and flower/fruit density by species). Arrows indicate stake locations



Site and General Description

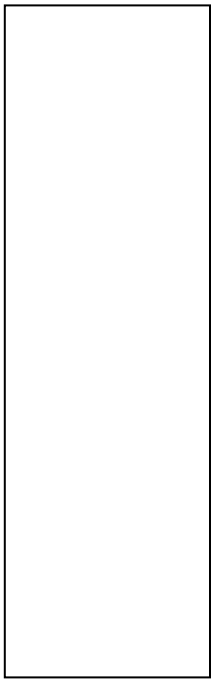
Unit: _____ Project: _____ Plot ID: _____ Pre or Post ___ yrs Fire Number _____ Fire Date: _____
Field Date: _____ Field Crew: _____ Fire Name:_____
Transect Azimuth: _____ Transect Slope: _____ Declination used: _____
Slope: _____% Aspect: _____ Elevation: _____ ft Viereck class: _____
Soil (circle): Wet Moist Dry Disturbance (circle): Fire Wind Insect Other: _____
Evidence of fire: Yes or No Fire Indicators: Burn Snags Burned Stumps Fire Scars Charcoal (circle all that apply)

Estimate of severity: _____

Photo numbers: _____ Time of photos: _____ Camera used: _____

Mark ends of plot and record corner directions
GPS Type: _____ GPS Identification: _____ GPS Datum: _____
Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)
Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)
Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)
Corner Direction: _____ WP No: _____ Latitude: N_____ Longitude: W_____ GPS Error: ___(m/ft)

Map of Plot Layout: Draw layout of plot and provide notes on relocating the plot, burn information and other plot notes as needed below.



Plot Notes:

Active Layer/Burn Severity

Park Unit: _____ Project: _____ Plot ID: _____

Pre or Post ____ yrs Fire Name/Number: _____ Fire Date: _____

Field Date: _____ Field Crew: _____

Record depth of active layer in the four corners and center of each 1-m x 1-m quadrat, for each location record if you hit permafrost (pf) or rock (r). If plot has burned within the last year record the burn severity code for the substrate and vegetation using the descriptions following this data sheet.

Quadrat	Active Layer Depth 1 (cm)	Active Layer Depth 2 (cm)	Active Layer Depth 3 (cm)	Active Layer Depth 4 (cm)	Active Layer Depth 5 (cm)	Burn Severity Code (Substrate)	Burn Severity Code (Vegetation)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Biomass Clipping

Quadrat				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Vegetation Cover/Density/Height – 1-m x 1-m Quadrats

Park Unit: _________ Project: _________ Plot ID: ______________ Field Crew: _______________ Field Date: ________________

Estimate vegetation cover (CV), count the density (DN) and average the height (Ht) of each species within the 1-m x 1-m quadrat. Canopy cover estimates are made for each species of tree species, shrub, herb, bryophyte, and lichen.

SPECIES	Cv/Dn/Ht 1			Cv/Dn/Ht 2			Cv/Dn/Ht 3			Cv/Dn/Ht 4			Cv/Dn/Ht 5			Cv/Dn/Ht 6			Cv/Dn/Ht 7			Cv/Dn/Ht 8			Cv/Dn/Ht 9			Cv/Dn/Ht 10		

Appendix D. AK Regional NPS Fire Ecology Monitoring Quick Reference Sheets

Tree Crown Measurements

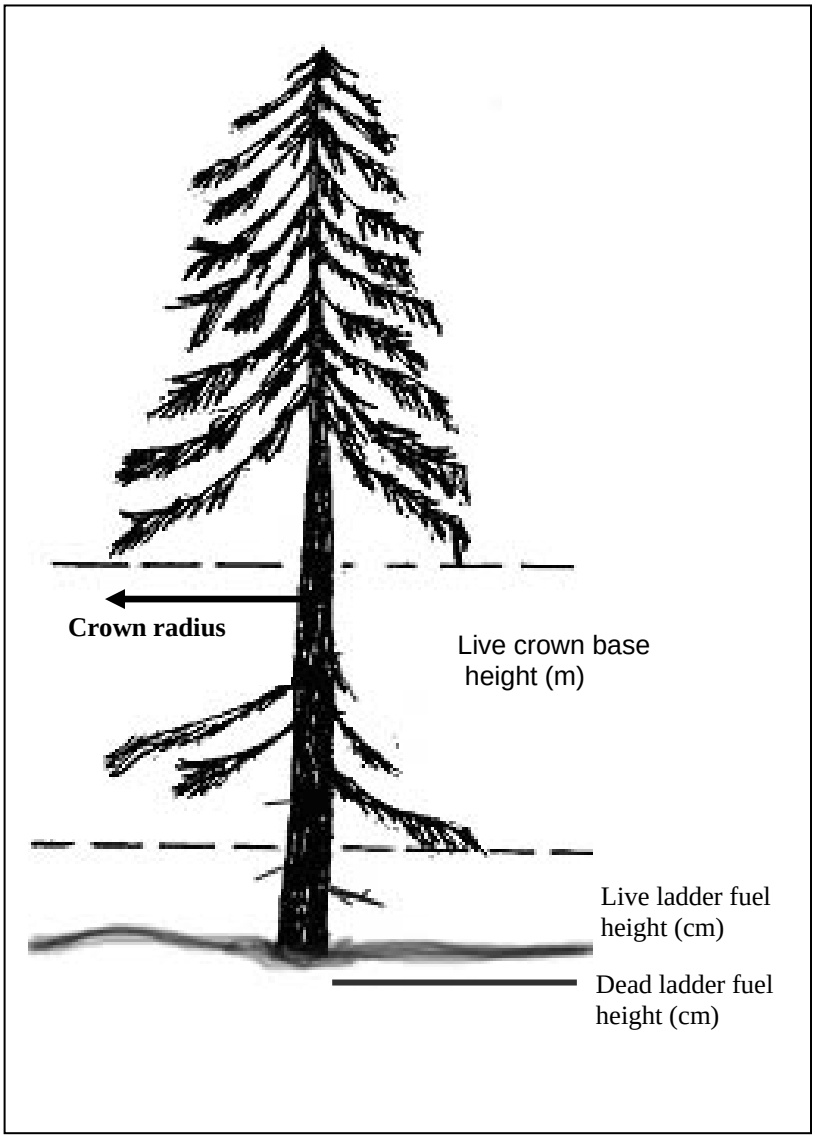


Fig. D.1 Tree crown and ladder fuel measurements. Figure modified from USFS FMH Manual, 2002.

Tree Height Measurements

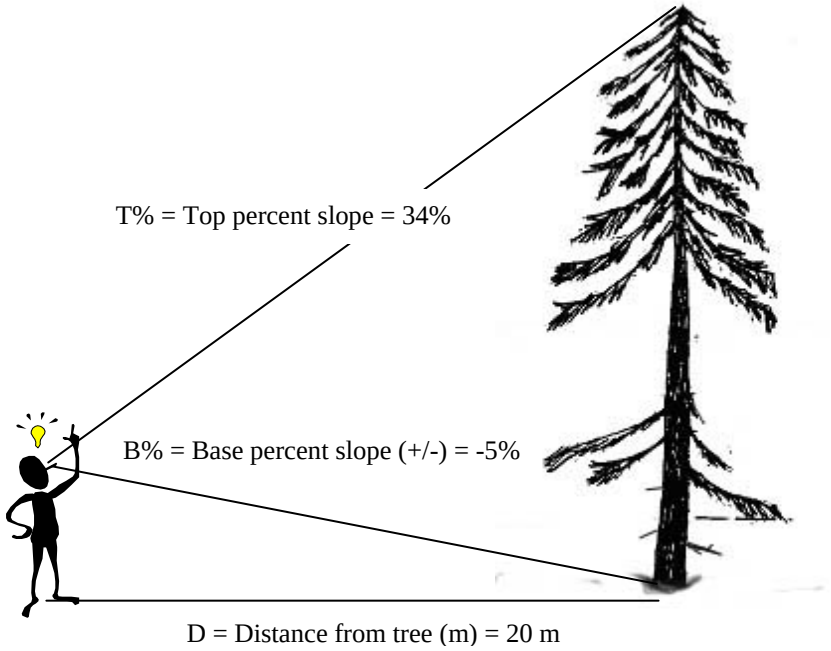


Figure D.2 Tree height equals: Height (m) = D x (T% - B%). If the base percent is negative (reading eye-level to tree or on slope above tree DBH), then add B%, if base percent is positive (on slope below tree DBH) then subtract B%. Ht = 20m x (0.34 + 0.05) = 7.8 m

Remember to use percent side of clinometer (right side scale or look for percentage sign at top or bottom of scale) and to move the clinometer up and down, not your head if possible. *Hint:* 10-m and 20-m distances makes easier math, but you must go back far enough to accommodate tree heights.

Damage codes for trees

Damage Code	Brief Description
FORK	Forked top of a tree, multiple primary leaders in a tree crown.
BROK	Broken tree top.
DTOP	Upper portion of tree is dead
BURL	A hard, woody and often rounded outgrowth on a tree.
DAMG	Mechanical damage to tree
FIRE	Evidence of fire damage or death.
LEAN	Tree is leaning.
MAMM	Damage caused by mammals, such as bear claw marks, porcupine, rabbit or beaver chewing.
REDB	Red belt, winter desiccation. Foliage and buds killed or faded. May be worse on windward side of tree. New growth is green & normal. Pg. **202** AK I &D
RUST	Spruce needle rust. Current year spruce needles are infected leaving the trees with a distinct orange tinge when the rust is fruiting on the needles. Pg.**129**AK I & D
BRM	Spruce broom rust. Branches or twig swelling, large burls on main bole or witches' broom (branch proliferation in tree crown). Rust tints needles in the broom yellow/orange. Pg.**146** AK I & D
HRT	Heart rots. *Phellinus pini* conks are hard and woody, upper surface dark brown, hairy (when young), with concentric ridges and a narrow velvety, light brown margin. Lower surfaces dark brown with pores. Coring shows discoloration of the heartwood, light purplish to gray and later changing to reddish brown. Decay pockets may be empty or filled with a mass of white fibers. Other heart rots would be brown cubicle rots, cores will show brown, yellow crumbly rot. Rots described Pg. **162-193** AK I & D.
ROOTRT	Tomentosa root rot (*Inontus tomentosus*) and Armillaria. Both may have chloritic thin crown, reduced growth, distressed cone crop, resin flow or saturation near root collar. Wind thrown trees lacking major roots. Lose needles oldest to youngest. In Tomentosa roots honeycombed and filled with white mycelium, pink staining. Armillaria has white mycelium and black stringy rhizomorphs under the bark. Rhizomorphs may also be on roots or in soil. Decay in root produces yellow stringy rot w/ fine black lines. Pg. **160** AK I & D
ROT	Unknown cause of rot, try to record if brown or white rot (Br or W).
BUDW	Spruce bud worm, brown head, with a lighter body and ivory spots. Web new foliage together and feed in web. Pg. **24** AK I & D
GALL	Spruce gall aphids, cause the tree to form conspicuous cone shaped galls on spruce twigs. Dark purple to green initially and then turning brown. Pg. **58** AK I&D
BB	Unknown bark beetles, not identifiable as either spruce bark beetle or *Ips* spp. Describe galleries or collect insects.
IPS	*Ips* spp., engraving beetle. Easily confused with spruce bark beetle. They are smaller (1/8 to 1/4 in) with concave wing covers with projections at the rear. Y, H or star shape galleries. Differences from spruce bark beetle; forked egg galleries, lighter (yellow brown to red orange), and finer boring dust, little boring dust in galleries. Pg. **79** AK I & D
SPB	Spruce bark beetle damage. Spruce trees. Pg. **71-77** AK I & D.
BORE	Other boring insect damage – e.g.Carpenter ants, Long-horn beetles, wood wasps, ambrosia beetles
BRNZ	Bronze birch bore damage. Stem swelling on birch or aspen due to larval galleries are winding – 6mm wide filled with boring dust. Adult may feed on foliage. Pg. **94** in AK I &D.
UNKN	Tree is damaged or dead, but cannot determine cause.

Burn severity code matrix (modified from NPS Fire Monitoring Handbook (2003)

	Forest and Shrub Types	
	Substrate (S)	Vegetation (V)
(5) Unburned	Not burned	Not burned
(4) Scorched	Litter/moss partially blackened; duff nearly unchanged; wood/leaf structures unchanged	Foliage scorched and attached to supporting twigs
(3) Lightly Burned	Litter/moss charred to partially consumed; upper duff layer may be charred but the duff layer is not altered over the entire depth; surface appears black; small woody debris is partially burned.	Foliage and smaller twigs partially to completely consumed; branches mostly intact; less than 40% of the shrub canopy is commonly consumed
(2) Moderately Burned	Litter entirely consumed, leaving coarse, light colored ash; duff deeply charred to lower duff or upper /lower duff interface, but underlying mineral soil is not exposed; woody debris is mostly consumed; logs are deeply charred, burned-out stump holes are common	Foliage, twigs, and small stems consumed; some branches (>0.5 – 2.5 cm) still present. 40-80% of the shrub canopy is commonly consumed
(1) Heavily Burned	Litter and duff completely consumed, or within 1 cm of mineral soil; mineral soil may be visibly altered, sometimes reddish; if present, sound logs are deeply charred, and rotten logs are completely consumed. *Marcantia* and fire mosses may be present.	All plant parts less than 2.5 cm in diameter are consumed, leaving some or no major stems or trunks; any left are deeply charred
(NA) Not applicable	Inorganic preburn	None present preburn

Appendix G: Preparedness Activity Elements

Delegation of Authority for Fire Management Officer, Western Arctic Parklands (2013): Maintained on file at Alaska Western Area Fire Management duty station at Denali National Park and Preserve.

Park Superintendent – Fire Management Staff Roles – See Section 4.9 Organizational & Budgetary Parameters and Redbook Chapter 3.

Response Plan:

Response procedures will follow guidelines as established in the Alaska Interagency Fire Management Plan (2010) and the Alaska Interagency Agreement and supplemental Annual Operating Plan.

1. *Initial Response and Notification Plan*

(See Next Page)

To Report a Wildland Fire
Western Arctic Parklands

The National Park Service is not the primary suppression service organization for suppression efforts on wildland fires in the National Parks, Preserves, and Monuments in Alaska. However, the NPS Regional Director and Superintendents are ultimately responsible for fire management actions taken on NPS lands.

To report a fire, first determine the location of the fire (latitude and longitude). Report this location to:

Alaska Fire Service
Galena Fire Management Zone
907-656-1222 (Dispatch)
or
907-356-5626 Fairbanks ONLY (Doug Downs – FMO)
or
907-356-5623 Fairbanks ONLY (Willie Branson -AFMO)

AND

Western Arctic Parklands
National Park Service
Kotzebue, AK
907-442-3890

THEN CALL:

Larry Weddle, National Park Service, NPS Alaska Western Area FMO
(w) 907-683-9548, (h) 907-768-2626, (c) 907-460-1688
or if unsuccessful call:

Keith Mitchell, National Park Service, Assistant Fire Management Officer.
(w) 907-683-9549, (h) 907-683-4415, (c) 907-242-4555
or if unsuccessful call:

TBA, National Park Service, Fire Helicopter Manager
(w) 907-683-6220
or if unsuccessful call:

Dan Warthin, NPS Regional Fire Management Officer
(w) 907- 644-3409, (h) 907-865-5984, (c) 907-444-8788

Listed below is some additional information that would be helpful to the dispatcher and NPS FMO:

1. Estimated fire size
2. Aspect the fire is burning on
3. Slope the fire is burning on
4. Fuel type (vegetation in and around the fire)
5. Smoke color
6. Structures threatened and distance to them
7. Name and phone number of person reporting the fire

Questions? Contact….

1. Larry Weddle, NPS Western Alaska National Parks Fire Management Officer
   (w) 907-683-9548, Larry_Weddle@nps.gov
2. Keith Mitchell, NPS Western Area Assistant Fire Management Officer
   (w) 907-683-9549, Keith_Mitchell@nps.gov
3. Dan Warthin, NPS Regional Fire Management Officer
   (w) 907- 644-3409, Dan Warthin@nps.gov
4. Morgan Warthin, NPS Regional Fire Communication and Education Specialist
   (w) 907-644-3418, Morgan_Warthin@nps.gov

2. Strategic Fire Size-up Procedures

a. Confirm fire report and obtain location
b. Identify FMU (ie. Critical, Full, Modified, Limited)
c. Refer to Table below for "Default" action (Preplanned Response) (See AIWFMP)

PROTECTION CATEGORY	POLICY/RESPONSE	INTENT
Critical	Initial Action - Aggressive suppression of fires within or threatening designated areas. Highest priority for available resources.	Prioritization of suppression actions for wildland fires threatening human life, inhabited property, and/or other designated structures. Complete protection of designated sites
Full	Initial Action - Aggressive suppression of fires within or threatening designated areas, depending upon availability of resources.	Protection of uninhabited cultural and historical sites, private property, and high-value natural resources.
Modified	Before Conversion Date: Initial Action - Suppression (Not necessarily least acres) depending on availability of resources, unless land manager chooses otherwise and documents with the appropriate planning/ decision document. After Conversion Date: Initial Action - Identical to that of Limited zones.	Greater flexibility in selection of suppression strategies when chance of spread is high (e.g., indirect attack). Reduced commitment of resources when risk is low. Balancing of acres burned with suppression costs and with accomplishment of resource management objectives.
Limited	Initial Action - Surveillance. Continued protection of human life and site-specific values. Wildfires allowed to burn within predetermined areas.	Reduction of long-term costs and risks through reduced frequency of large fires. Reduction of immediate suppression costs. Facilitation of bio-diversity and ecological health

d. Determine location of administrative, private, cultural and natural sensitive resources in relation to the fire.
e. Determine point protection needs and risk to the aforementioned sites.
f. Determine likelihood of fire traveling into other FMU's.
g. Modify "Default" action accordingly. In general the goal is to allow fire on the landscape to fulfill its natural role while minimizing risk to sensitive or other jurisdiction resources in a safe manner. Considerations include:
    i. Is there sufficient time for resources to be mobilized and safely be deployed for point source protection?
    ii. Is the fire likely to grow and create sufficient complexity that additional resources beyond the BLM Alaska Fire Service Galena Zone, Region wide available resources, and AWAFM resource are insufficient to meet FMU and point source protection objectives.
    iii. Fire Activity around the state precludes ordering additional resources in a timely manner.
    iv. Political issues.

h. Time permitting, see the Denali National Park and Preserve: Wildland Fire Use Reference Guide and complete the "Relative Risk Assessment in WFDSS" with the Protection Agency.
i. Communicate recommended action with Superintended or delegate.
j. Coordinate response action with BLM Alaska Fire Service Galena Zone Fire Management Officer.

List of Personnel and Qualifications

a. AWAFM
   - Larry Weddle – ICT4, SITL, FEMO, SOPL, HMGB, RXB2, CRWB, FALB
   - Keith Mitchell – ICT5, ENGB, FFT1, FALB, FEMO, FIRB, RXB3
   - Susanna Nancarrow – DOCL
   - Jay Thatcher (Detailer) – ICT4, HEB1t, HMGB
   - TBA (Detailer) – ICT4, HMGB
   - Four Seasonal Staff with various NWCG Qualifications

b. WEAR
   - Frank Hays – Superintendent (CAKR, KOVA, NOAT)
   - Jeannette Pomrenke – Superintendent (BELA)
   - TBA – Fire Coordinator

Step-up Staffing

The Western Area FMO and associated fire staff is responsible for Western Arctic Parklands, Lake Clark National Park/Preserve, and Denali National Park/Preserve. The matrices outlined in Tables 1 and 2 below will be used to assist in the pre-positioning of these personnel and fire management resources.

Table 1: Complexity Level

Fire Indices	0-3 fires	3-6 fires	6+ fires
FFMC=<85	LOW COMPLEXITY LEVEL	LOW COMPLEXITY LEVEL	MODERATE COMPLEXITY LEVEL
FFMC=86-89	LOW COMPLEXITY LEVEL	MODERATE COMPLEXITY LEVEL	HIGH COMPLEXITY LEVEL
FFMC=90+	MODERATE COMPLEXITY LEVEL	HIGH COMPLEXITY LEVEL	HIGH COMPLEXITY LEVEL

Number of Current Fires—A measure of complexity due to the number of fires within or threatening the park regardless of the FMU that is burning. This is also an indication of potential suppression or monitoring resource shortages.

FFMC—the Fine Fuel Moisture Content (FFMC) is a numerical rating of the moisture content of litter and other cured fine fuels (needles, mosses, and twigs). The FFMC is representative of the top litter layer 1-2 cm deep. FFMC fuels are affected by temperature, wind speed, relative humidity, and precipitation. FFMC values change rapidly and reflect the weather conditions that have occurred over the past three days. The FFMC is used to indicate ease of ignition, or ignition probability with the scale ranging from 0-99. Of importance is the fact that fire starts increase exponentially with an increase in FFMC values at the high end of the scale.

Complexity Level

Low: Few fires within or threatening the WEAR park units and relatively abundant resources available. May be early or late in the year, hence fire behavior is reduced and relatively easy to control and extinguish.

Moderate: Several fires within or threatening WEAR park units and resources becoming scarce within the AFS Zone. Fires are difficult to extinguish - carryover fires are occurring.

High: Many fires within or threatening WEAR park units and resources becoming scarce within the state. Fires are difficult to control and extinguish – multiple carryover fires occurring.

Table 2: Preparedness Levels

Values at Risk

Complexity	**Low**	**Moderate**	**High**
Low	Low Preparedness Level	Low Preparedness Level	Moderate Preparedness Level
Moderate	Low Preparedness Level	Moderate Preparedness Level	High Preparedness Level
High	Moderate Preparedness Level	High Preparedness Level	High Preparedness Level

Values at Risk

These values are life and property including historically significant sites. The low values at risk are those under limited protection. The medium values at risk are those under full protection. The high values at risk include sites that are under critical protection (see Chapter XVI Section A. Protection of Sensitive Resources for criteria for protection levels).

Preparedness Levels

Low: The weather and fire danger indices will be monitored daily.

Moderate: Fire staff will be available within the state. The weather and fire danger indices will be monitored daily. AFS will be contacted periodically for tactical and resource updates.

High: The contract helicopter, qualified helicopter manger and two fire staff will available within the park or prepared to travel to the parkland, dependent upon availability due to fire activity. The weather, fire and danger indices will be monitored daily. AFS will be contacted periodically for tactical and resource updates. The Western Area FMO will contact the WEAR Interpretive Specialist and/or the Regional Fire Communication and Education Specialist, as needed to provide information updates.

Minimum impact suppression tactics guidelines: See Section 4.4.1 Minimum Impact Suppression Tactics (MIST)

Fire Danger Rating Operating Plan: Alaska utilizes the Canadian Forest Fire Danger Rating System. Official fire danger rating records are maintained at the Alaska Interagency Coordination Center. Local dispatch offices are responsible for WIMS observation certifications. See the AWFCG Weather Committee, Annual Operating Plan.

Job Hazard Analysis for fire and fire aviation activities: Maintained in hardcopy format in the AWAFM Office in Denali National Park and Preserve.

Agency Administrator's Guide to Critical Incident Management: Maintained in hardcopy format in the WEAR (Kotzebue and Nome) Superintendent Offices in the Western Arctic Parklands.

WEAR current fire cache inventory: Maintained in electronic format in the AWAFM Office in Denali National Park and Preserve on the "Teams/ResMgmt/Fire Management/" network drive. Additional resources are available through the Regional 20 person crew cache and the AWAFM cache located in Denali National Park and Preserve.

Structure Protection Inventory and Needs: Structure protection needs are in development. In 2010, field operations completed a portion of a project to develop a consolidated list of the total number and location of structure/site requiring protection measures.

Location of procedures for park evacuation and closures. See Section 4.1.2 Public Safety, Emergency Evacuation Procedures. The Agency Administrator may issue a Park Unit closure as warranted do to safety considerations.

Cooperative Agreement(s) and Annual Operating Plan: See Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement (2010) and the Alaska Statewide Annual Operating Plan (2014) and the Alaska Interagency Wildland Fire Management Plan (Amended 2010).

Additional Response Information/Considerations:

Location of Geospatial data
All fire related geospatial data is located on park network drives and maintained at the AK NPS Regional Office.

Operational Considerations

a. Aviation Considerations
    i. Park wide radio communication is poor in the eastern region of NOAT.
    ii. Operational Status of Helibase at Kotzebue is currently operational.
    iii. Aviation transportation is likely required for most field operations in the Western Arctic Parklands
    iv. Jet A is only commercially available in Nome and Kotzebue.
b. Water Sources
    i. Multiple water sources available, but incident specific.
c. Staging Areas
    i. TBA – Likely locations are in Kotzebue, Nome, Quartz Creek and Dahl Creek.
    ii. Administrative Cabins throughout the park. Primarily administrative sites with helicopter or fixed wing access.
d. Natural Barriers and Control Lines
    i. Incident and CFFDRS specific. Generally a combination if saw line and wet line is effective in the early summer. As the CFFDRS Drought Code increases above 350, burning off of natural barriers is an effective tactic.
e. Other

Logistical Considerations

a. In addition to the aviation considerations stated above in Section 17 aviation fueling facilities must be planned ahead.
b. Weather may preclude pick up from aircraft. Plan accordingly.
c. Wildlife interactions are likely. Understand how to mitigate these interactions. Plan accordingly.

Planning Considerations

a. Park Base Maps – See Appendix S.2
b. Vegetation and Fuels Maps -- All fire related geospatial data is located on park network drives and maintained at the AK NPS Regional Office. [Landcover Class]
c. Land status map -- All fire related geospatial data is located on park network drives and maintained at the AK NPS Regional Office [NPS Land Status]. Also available on the AICC ArcIMS website.
d. Sensitive Natural and Cultural Resources -- All fire related geospatial data is located on park network drives and maintained at the AK NPS Regional Office [Fire Protection Points]. Also consult the appropriate resources specialist.
e. Restrictions and special concerns by management area. Reference Section III. C. Scope of Wildland Fire Management Program, Fire Management Units.

Designated locations for ICP and Base Camp (TBD) and other facilities:

a. Medical Facilities – Maniilaq Health Center 800-431-3321, P.O. Box 43, #436 5th Avenue. Kotzebue, AK 99752; Norton Sound Heath Corporation 907-562-2211, 306 West 5th Ave/Box 966. Nome, AK 99762
b. Utilities
c. Radio Communications – NPS Headquarters in Nome and Kotzebue (NPS Radio Network Only)
d. Other

Sample Delegation of Authority: See Alaska Interagency AOP (2014) for a sample delegation of authority.

Appendix H: Communication and Education Plan

Western Area Arctic Parklands: Cape Krusenstern National Monument, Kobuk Valley National Park, Noatak National Preserve, and Bering Land Bridge National Preserve are committed to providing high-quality, pro-active and coordinated fire communication and education to target audiences (listed below). Park staff, Western Area Fire Management Program, the Regional Fire Communication and Education Program (RFC&E) and the Regional Fire Management Program, in concert will fulfill the plan outlined below in order to increase internal and external awareness and support. Fire management spans a broad spectrum of programmatic areas including operations, ecology, prevention, GIS, predictive services, fuels, leadership, etc. Based on evolving programs and situations, the park can determine the focus area as appropriate.

Vision
Recognition, acceptance and support of the role of fire in ecosystems and the management of fire and fuels in the National Park Service (NPS).

Mission
To pro-actively support the Alaska NPS Wildland Fire Management Program through a comprehensive communication and education program that emphasizes wildland fire management and the role of fire in ecosystems.

Goals

- Internal and external audiences understand and support the role of fire in ecosystems and the management of fuels and fire.
- As an integral part of the NPS, the Alaska Fire Management Program collaborates with all disciplines.
- Provide accurate and timely fire information for local, regional, and national fire operations as needed.
- Coordinate and collaborate with stakeholders, partners and peers for maximum efficiency and effect.
- Facilitate an effective, two-way dialogue about fire in national parks in order to build trust and understanding with internal and external audiences.

Staffing
The RFC&E Specialist steers the Alaska NPS Fire Communication and Education Program and serves as a resource to parks by coordinating all matters related to the program. The specialist assists parks in using ongoing communication and education strategies, consultation and collaboration to enhance fire management programs. When a fire incident occurs, regardless of the different scenarios that might unfold, the Western Area Fire Management Officer will contact the designated park Public Information Officer (PIO) and the RFC&E Specialist. The RFC&E Specialist then collaborates with the park's PIO through the duration of the incident. If the need arises and pending approval by the superintendent or delegate, the PIO and/or the RFC&E Specialist will recruit personnel for specific duties or outside resources will be requested through dispatch procedures. For further information, review the Information Officer Step-Up Plan (found in Sub-Section C Information Officer Step-up Plan Below). Park staff and Alaska NPS Regional and Western Area Fire Management Program staff actively participates in and supports the FC&E program.

If an incident management team deploys to manage a fire that affects Western Arctic National Parklands, park staff will interact with and support the team's PIO. Park staff and/ or the RFC&E specialist will share NPS messages with the IMT team for inclusion into information dissemination. The Interagency Master Agreement and Interagency Operating Plan and subsequent delegation of authority address specific IMT team procedures.

Key Messages
The cornerstone of any communication effort is a set of consistent, compelling messages for use in all proactive and reactive communication. Messages should be actionable where appropriate so that, in addition to educating, they will motivate the audiences to act on what they have learned. They help the communicator move beyond the

facts and tell the fire story. Refer to the NPS wildland fire key messages tip card for tips on how to tell the story (what, why, and how); contact the RFC&E Specialist for hard copies.

Key messages are general concepts that can be incorporated into discussions, print materials, and other resources used in communication, education, information, and prevention efforts. Key messages are umbrella statements that require additional supporting points and examples for context. These messages are not meant as a script; however, they are intended to provide a foundation for crafting comments in response to inquiries from the public and media. It may also be helpful to review the National Interagency Fire Center (NIFC) themes, as these messages are updated on an annual basis to include pertinent, emerging topics. These themes are part of the PIO toolkit and can be located at http://www.nifc.gov/PIO_bb.html.

The NPS Wildland Fire Management Program key messages are listed below. Details on the messages can be found in the NPS Wildland Fire Management Communication Plan. These messages and the Alaska wildland fire key messages are designed to meet the following criteria:

- **Coincide with *and not contradict* interagency messages.** It is critical that the wildland fire community speak with one voice to the public. The NPS wildland fire messages are designed to complement the interagency messages listed below. The NPS wildland fire messages also are designed to be fluid. These messages do not address specific policy issues. NPS staff will rely on policy-related messages as they are revised.
- **Allow for customization.** These messages are a guide, not a script. Users are encouraged to provide additional, local detail to ensure the messages touch audiences in a relevant, credible way.
- **Include a call to action.** In addition to educating, messages should motivate the audiences to act on what they have learned.
- **Answer the questions what, why, and how.** Categorizing messages in this way will help users recall the messages during appropriate situations.

NPS Wildland Fire Key Messages

What
1. The NPS is a leader in the wildland fire community.
2. The NPS Wildland Fire Management Program is committed to safety, science, and stewardship.

Why
3. Wildland fire is an essential, natural process.
4. *Science tells the story:* Today's environment includes hotter, drier, and longer fire seasons. Research also indicates poor ecosystem health and an increasing number of homes in fire prone areas.

How
5. The NPS works with our neighbors and other partners to preserve and protect park resources and mitigate wildfire risk in the wildland-urban interface (WUI).

The Alaska Wildland Fire Coordinating Group, Wildland Fire Education and Prevention Committee developed Alaska interagency key messages and can be viewed at http://fire.ak.blm.gov/administration/awfcg.php

Alaska Key Messages

1. Public and firefighter safety is our first priority.
2. Wildland fire happens, be ready.
3. Wildland fire is an essential, natural process.
4. Alaskans work together to manage wildland fire.
5. Managing wildland fire in Alaska balances risks and benefits in an ever changing environment.

Western Arctic National Parklands - Cape Krusenstern National Monument, Kobuk Valley National Park, Noatak National Preserve, and Bering Land Bridge National Preserve will provide supporting points and highlight pertinent

key messages on an incident and park-specific basis depending on the details of the fire and the communities affected.

Target Audiences

The park has identified target audiences for fire education and key messages.

1. **Park Visitors** – In-park visitors and special groups
2. **Virtual Visitors** – Website visitors and those who utilize social web such as Twitter for information sharing
3. **Park Employees** - NPS, Alaska Geographic, concessions, and volunteers
4. **Local Communities** – Residents and property owners, local and tribal government, businesses near the park, and special interests such as city councils or advocacy groups.
5. **Student/Teachers** – K-12 students and teachers, college/graduate school students, and elder hostel groups
6. **Professional Peers/Partners –** Federal, state and local agencies, professional associations, and academics
7. **Special Interest and Tourism Related Groups**
8. **Commercial Use Authorizations –** Businesses that operate in the park such as flight services, guide services, and boat charters
9. **Elected Officials** – Federal, state and local
10. **Media** – Print, television, radio, film, and web-based news publications
11. **Incident Management Teams (IMT)** – Type 1, 2, and 3 IMT teams that may be from Alaska or the Lower 48

Communication Methods

The following methods will be used to communicate with the eleven target audiences listed. There are both personal and non-personal methods that will facilitate reaching the largest number of people. The park will continue to improve and expand this list.

Personal

1. **Interpretive Programs** – Park staff will integrate fire messages into the variety of programs offered by the interpretative division.
2. **Education Programs** – Park staff, Regional and Western Area Fire Management staff will incorporate fire ecology concepts into curriculum-based education programs, student field research experiences and in-class programs.
3. **Employee Training** – Western Area Fire Management Program and park staff will coordinate employee training sessions to improve staff understanding of the fire management program.
4. **Presentations** – Regional and Western Area Fire Management staff will give peer presentations at conferences about current fire research, planning, or operations.
5. **Special Events** – Park staff, Regional and Western Area Fire Management staff will participate in local events (festivals, July 4th celebrations) to promote the fire management program.
6. **Public Meetings** – As needed, regional, Western Area Fire Management staff and park staff will conduct special public meetings related to a specific fire event, planning effort or to share general program information
7. **Workshops** – With help from interagency and educational partners, RFC&E Specialist and the park staff will offer in teacher workshops that incorporate fire ecology and management issues. Regional and Western Area Fire Management staff and park staff will participate as needed.
8. **Interagency Meetings** – Park staff, Western Area Fire Management and RFC&E Specialist will participate in interagency work groups to collaborate with statewide and national partners to share information and complete special projects. One example is the pre-season meeting to discuss the *Annual Operating Plan*. Currently a draft plan, this document can be reviewed in the spring to help inform park staff of expected fire management operations. It will help define the role of information during the fire season and the collaboration between jurisdictional and protection agencies. A final version will be complete in late 2010.
9. **Media Interviews** – Park PIO and/or RFC&E Specialist will facilitate or complete in-person or phone interviews for print, radio, and television outlets. When necessary, the RFC&E Specialist will facilitate

special media projects (books, documentaries etc.) by guiding research, scheduling interviews with appropriate staff, and coordinating filming schedules.

10. **Fire Interest List** – RFC&E Specialist maintains a listserv of individuals interested in receiving e-mails on all aspects of wildland fire.
11. **Recorded Phone Message** – Park PIO and/or RFC&E Specialist will maintain a recorded "Fire Information" message.
12. **Social Web** – Currently, Twitter is the main social web tool utilized by parks in Alaska. Park PIO (or designee) will update the CAKR, KOVA, and NOAT Twitter pages as necessary and the RFC&E Specialist will update the Alaska NPS Twitter page. Maintained year-round, these "tweets" will serve as brief updates on park information including fire. The RFC&E will coordinate with the park designee to disseminate information as necessary. This method of communication is two-way, allowing both the park and the public to make comments on the park page and providing the opportunity for the park to respond.

Non-Personal

1. **Webpage** – Park staff will maintain a fire management webpage that is linked to the main park webpage. RFC&E Specialist can assist as needed.
2. **Fire News, Inciweb** – Western Area Fire Management staff, park PIO, and/or park staff with support from RFC&E Specialist will update Fire News throughout the duration of an incident. Update InciWeb as an incident warrants.
3. **AK2day and Inside NPS** - Park PIO and/or RFC&E Specialist will submit information regarding fire management activities on these internal websites.
4. **Press Releases/ Updates** – Park PIO and/or RFC&E Specialist will use email, fax, and bulletin boards to distribute press releases/updates, photos and public fire maps for all target audiences as needed.
5. **Public Fire Maps** – Western Area Fire Management staff will produce internal and external fire incident maps. Regional Fire staff may provide some assistance.
6. **Press Kit** – RFC&E Specialist and park PIO will compile and annually update a fire information press kit.
7. **Fire Education Trunks** – RFC&E Specialist will supply the park with fire educational materials. Park staff, with assistance from the RFC&E Specialist, will resupply the materials as needed. Trunks are available; please contact RFC&E to discuss.
8. **Visitor Center Exhibits, Wayside Exhibits, Bulletin Boards, and Displays** – Park staff will maintain and update the interpretive information in visitor centers and wayside exhibits on fire management. RFC&E Specialist will provide support as needed.
9. **Portable Displays and Banner Stands** – RFC&E Specialist will store and organize several portable displays and banner stands for use at trainings, internal meetings, public events and conferences. These portable displays are kept in an area cache or can be shipped from the Anchorage office as needed.
10. **PIO Supplies** – Fire information banners, nametags, and vehicle magnets are available at the regional office and area program.
11. **Publications** – Park staff will include fire management information in regular park publications. Western Area Fire Management Program will engage with the park staff in development of park publications. RFC&E Specialist and/or Western Area Fire Management staff with park support will research, write, and design additional handouts specifically about fire management such as newspapers, fire stories, brochures, posters, and templates. The area fire management program and RFC&E Specialist maintain a variety of fire brochures available for the park.
12. **Scientific Papers** – Park researchers and/or Regional and Western Area Fire Management staff will publish park papers in scientific journals and/or periodicals regarding new information from the park's fire management program.

Emerging Tools

This plan provides recommendations for regional and park level fire communication and education programs. Digital communication tools will continue to emerge. It is important to stay abreast of new technology in order to

relay the NPS safety and educational messages about wildland fire. Currently, Twitter is the main social web tool used in parks; it is very likely that this will evolve and more tools will be used in the near future.

Guiding Documents

- The *NPS Wildland Fire Management Strategic Plan* represents input from all levels and disciplines within the NPS Wildland Fire Management Program, from parks to the national office, as well as the NPS Natural Resource Program and our interagency partners. It is intended to establish key strategies that should be applied at all levels of the NPS Wildland Fire Management Program to achieve critical management objectives in support of the mission. This plan is current through 2012; view the plan at http://www.nps.gov/fire/download/fir_wil_strategic_plan_2008-2012.pdf.
- The *NPS Wildland Fire Management Communication Plan* was written by the NPS Division of Fire and Aviation Management in coordination with the 20th anniversary of the 1988 fires in Yellowstone National Park and the Northern Rockies. This plan has developed a communications initiative to reach internal and external audiences with a clear, consistent message about the role of wildland fire management in NPS units and surrounding communities. The purpose of this initiative is to reinforce the National Park Service's position as a resource for fire management information and to better inform internal and external audiences about the role of wildland fire and the role of NPS Fire and Aviation in managing it. A subsequent goal is to reinforce the cultural significance of the NPS and its historical leadership in land management. View this plan at http://inside.nps.gov/waso/custommenu.cfm?lv=3&prg=777&id=8080.
- The draft *Alaska Region Fire Communication Strategy and Guide* introduces the duties and responsibilities of the NPS Alaska Regional PIO and is located at www.nps.gov/akso/Fire/firehome.htm.
- NPS *Social Media Handbook*, written by NPS Alaska Region provides guidance to parks and programs in the use of Social web including multimedia sharing websites, blogs and microblogs, social networking websites, document sharing repositories and third party widgets. The handbook describes many types of technologies but does not provide an endorsement for their usage. Available on the NPS SharePoint site located at http://inpakroms16sp:37964/AKRWM/Shared%20Documents/Forms/AllItems.aspx.

The Western Area Arctic Parklands Fire Communication and Education (FC&E) Program, while tailored to the local level, complements the aforementioned plans in its vision, mission, and goals.

Other Important Fire Information References

While these documents provide the philosophy and general direction for the FC&E Program, there are two other important references for fire information work. Specific operational procedures (checklists, fax numbers, email lists, community contacts, etc are outlined in Standard Operating Procedures: Fire Communication and Education. The Information Officer Step-Up-Plan, (found in X. Section C) provides Public Information Officer (PIO) recommendations during a park fire incident.

Evaluation

To maintain a successful program, the NPS Wildland Fire Management Program will seek evaluation opportunities such as independent surveys of visitors/residents/employees. Staff will conduct program reviews for the regional and park fire management programs. After action reviews are a part of the fire culture and will be used as appropriate.

Education Annual Plan by Season

The table describes the FC&E education annual plan which gives year-round recommended guidelines for the FC&E program. Educational elements and communication methods are emphasized according to season. The table highlights these emphasis areas and links them to communication methods and target audiences. It is important to remember that this plan is general and will not prevent the program from engaging in new, innovative methods in the future.

Table 1: Communication/ Education Annual Plan by Season (recommended guidelines): Western Area Arctic Parklands (Cape Krusenstern National Monument, Kobuk Valley National Park, Noatak National Preserve, and Bering Land Bridge National Preserve)

Season	Communication/ Education Emphasis	Communication Methods	Target Audiences										
			Park Visitors	Virtual Visitors	Park Employees	Local Communities	Students /Teachers	Professional Peers	Tourism Groups	Commercial Use Authorizations	Elected Officials	Media	Incident Management Teams
Spring	Pre-Season Information	Interagency meetings Fire interest lists Social web Webpage Press releases /updates Portable displays Publications Brochure distribution	*		*	*		*	*			*	*
	Key messages	Employee training Special events/ public meetings Interagency meetings Media interviews/ press kit Social web Webpage Portable displays Publications	*	*	*	*	*	*	*	*	*	*	*
	Student/ Teacher Education	Education programs Workshops					*						
	Employee Education	Employee training Presentations Special events/ public meetings Fire interest lists AK 2day and Inside NPS			*								
	Restock Comm. Ed Cache	Publications			*								
	Interagency Cooperation	Presentations Interagency meetings Fire interest lists Scientific papers			*			*					*
	Recruitment	Interagency meetings Fire interest lists Webpage			*	*	*						*
Summer	Incident Information	Special events / public meetings Media interviews/ Press kit Recorded phone messages Social web Webpage Fire News/ Inciweb Press releases / updates Public fire maps Exhibits/ bulletin boards Portable displays/ banner stands	*	*	*	*		*	*	*	*	*	*
	Key messages	Special events/ public meetings Media interviews Social web Webpage Press kit Portable displays Publications	*	*	*	*		*	*	*	*	*	*
	Interpretation	Interpretative programs Fire education trunks Exhibits/ displays	*			*						*	
	Employee Education	Fire interest lists AK 2day and Inside NPS Presentations Scientific papers			*								
	Interagency Cooperation	Fire interest list Press releases / updates Fire News/ Inciweb			*			*					*

Season	Communication/ Education Emphasis	Communication Methods	Target Audiences										
			Park Visitors	Virtual Visitors	Park Employees	Local Communities	Students /Teachers	Professional Peers	Tourism Groups	Commercial Use Authorizations	Elected Officials	Media	Incident Management Teams
Fall	Post-Season Information	Special events / public meetings Media interviews Webpage Press releases / updates Publications	*		*	*	*	*	*			*	*
	Employee Education	AK 2day and Inside NPS Publications/ scientific papers			*								
	Interagency Cooperation	Interagency meetings Fire interest lists Press releases / updates Publications/ scientific papers			*			*					*
	Student/ Teacher Education	Education programs					*						
Winter	Post-Season Information	Webpage Publications	*	*	*	*							
	Development of New Materials	Exhibits/ displays Portable displays Printed publications Publications/ brochures	*		*	*	*	*				*	*
	Key message review	Employee training Interagency meetings			*			*					*
	Restock Comm. Ed cache	Publications											
	Employee Education	AK Today and Inside NPS Publications/ scientific papers			*								
	Interagency Cooperation	Presentations Interagency meetings Fire interest list						*					*
	Student/ Teacher Education	Education programs				*							

Alaska Media Contacts for Parks - Updated March 2010

*Due to rapid changes and turnover in the media, this list should be updated after major incidents and at least on an annual basis.

WESTERN & WESTERN INTERIOR ALASKA (McGrath, Galena, Seward Peninsula)						
Station	**Website**	**Contact position**	**Contact name**	**email**	**Phone**	**Notes**
Radio - Western & Western Interior Alaska						
KIYU-AM 910 and FM 97.1	www.kiyu.com	Main contact	Varies	raven@kiyu.com	907-656-1488	Galena, Ruby, Koyukuk, Nulato, Kaltag, & Huslia
KSKO-AM 870	N/A	Main contact	Varies	kskonews@mcgrathalaska.net	907-524-3001	Anvik, Shageluk, Grayling, Holy Cross, Galena, Ft Yukon:

STATEWIDE						
Web Based Publications - STATEWIDE						
Station	**Website**	**Contact position**	**Contact name**	**email**	**Phone**	**Notes**
Alaska Dispatch	www.alaskadispatch.com	Editor	Editor	editor@alaskadispatch.com	907-743-0744	The Alaska Dispatch is statewide, based in Anchorage
Alaska Dispatch	www.alaskadispatch.com	Managing Editor	Maia Nolan	maia@alaskadispatch.com		
Alaska Dispatch	www.alaskadispatch.com	Staff Writer	Jill Burke	jill@alaskadispatch.com	907-433-4304	
Alaska Dispatch	www.alaskadispatch.com	Staff Writer	Craig Medred	cmedred@alaskadispatch.com	907-743-0744	
Delta News Web	www.deltanewsweb.com	Editor		webeditor@deltanewsweb.com	907-895-4919	
Gebbie Press	www.gebbieinc.com					
National Parks Traveler.com				kurt@nationalparkstraveler.com		
Alaska Newspapers		Statewide editor	Alex DeMarban	alex@alaskanewspapers.com	907-348-2424	
Radio - Statewide						
APRN-NPR	www.aprn.org			news@aprn.org	907-550-8400	

Appendix I: Fire Prevention Plan

Western Arctic National Parklands does not meet the threshold of human caused fires to require fire prevention plan. Fire prevention programs and messages will be coordinated through the NPS Alaska Regional Office.

Appendix J: Duty Officer Manual

Fire Duty Officer Guidebook: See the Redbook Chapter 3 for NPS Duty Officer roles and responsibilities. In addition to the duties/responsibilities as identified in the Redbook the AWAFM Duty officer will ensure that all incident operations are follow the guidelines as established in the Alaska Interagency Master Agreement and Supplemental AOP and procedures as outlined in the Response Plan (Appendix G). Effectively the Duty Officer for AWAFM is the Fire Management Officer. However occasions will occur when another authorized Duty Officer will be identified. The authorized duty officer will be communicated to all parties (ie, Agency Administrator, NPS Regional FMO, Protection Agency FMOs and dispatch centers).

Appendix K: Standards for MIT, BAER and Rehabilitation

See Section 4.4 Burned Area Emergency Response.

Appendix L: Cooperative and Interagency agreements

The following documents are on file in the Fire Management Officer's office at Denali NP/P

1. Inter-park Agreement Between: National Park Service Alaska Western Area Wildland Fire Management and Denali National Park & Preserve, Lake Clark National Park & Preserve, Bering Land Bridge National Preserve and Western Arctic Parklands

2. 2010 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2014 Alaska Statewide Annual Operating Plan.

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Appendix M: Contacts for Wildfire and Prescribed Fire Resources

Alaska Interagency Coordination Center (AICC):

Center Manager	Ray Crowe	356-5677
Tactical Resources Coordinator	Jon Gregg	356-5690
Galena Fire Management Zone:	**All Galena Station Employees**	**656-1222**
Fire Management Officer (Acting)	Doug Downs	356-5626(FBK)
Assistant FMO	Willie Branson	356-5623
Fuels Management Spec.	Vacant	356-5617
Galena Zone Dispatch	Hudson Plass	656-1222

National Park Service:

Superintendent, CAKR, NOAT, KOVA	Frank Hays	442-8301 (Office)
Superintendent, BELA	Jeanette Pomrenke	443-2522 (Office)
Fire Management Officer, Alaska Region	Dan Warthin	644-3409 (Office) (907) 444-8788 (Cell)
Fire Management Officer, Alaska Western Area Fire Management	Larry Weddle	683-9548 (Office) (907) 460-1688 (Cell)
Assistant Fire Management Officer, Alaska Western Area Fire Management	Keith Mitchell	683-9549 (Office) (907) 242-4555 (Cell)
Helicopter Manager, Alaska Western Area Fire Management	Vacant	683-6220 (Office) (907) (Cell)
Fire Program Management Assistant, Alaska Western Area Fire Management	Susanna Nancarrow	683-6215(Office) (907) 750-5648 (Cell)

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Appendix N: Notification Procedure

See the 2011 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2011 Alaska Statewide Annual Operating Plan Section 24 for notification procedures.

Appendix O: Serious injury or Death Procedure

All person assigned to a wildfire shall be under the operational control of the Protection Agency. Serious injury or death procedures will follow the guidelines as established by the 2011 Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement and the 2011 Alaska Statewide Annual Operating Plan. In general, procedures will be conducted jointly between the Protection and Jurisdiction Agencies for serious injury or death procedures that occur associated with a wildfire incident. Serious injury or death procedures for non wildfire incidents will follow the local SOP process, or Regional process.

Appendix P: Safety Program/Plan

See Section 4.1 Safety. Additional Safety information can be found through the NPSafe Program.

Appendix Q: Smoke Management Plan

See Section 4.7 Air Quality/Smoke Management.

Appendix R: WFDSS Objectives and Requirements

See Sections 3.1 Park-wide Fire Management Considerations and 3.2 Fire Management Unit Specific Characteristics.

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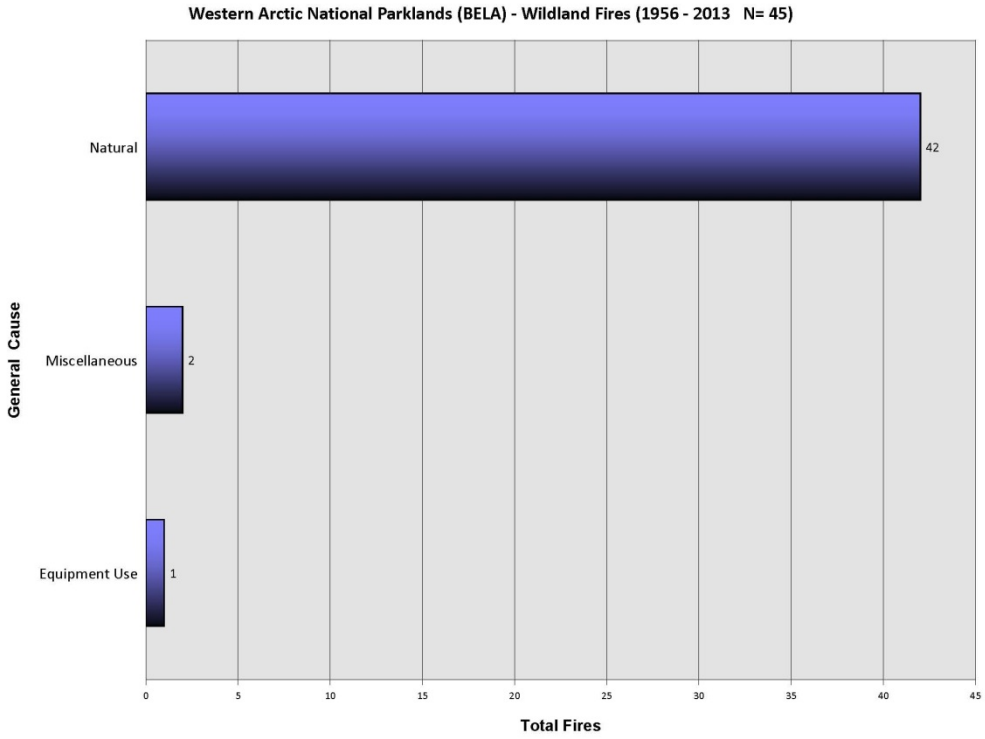
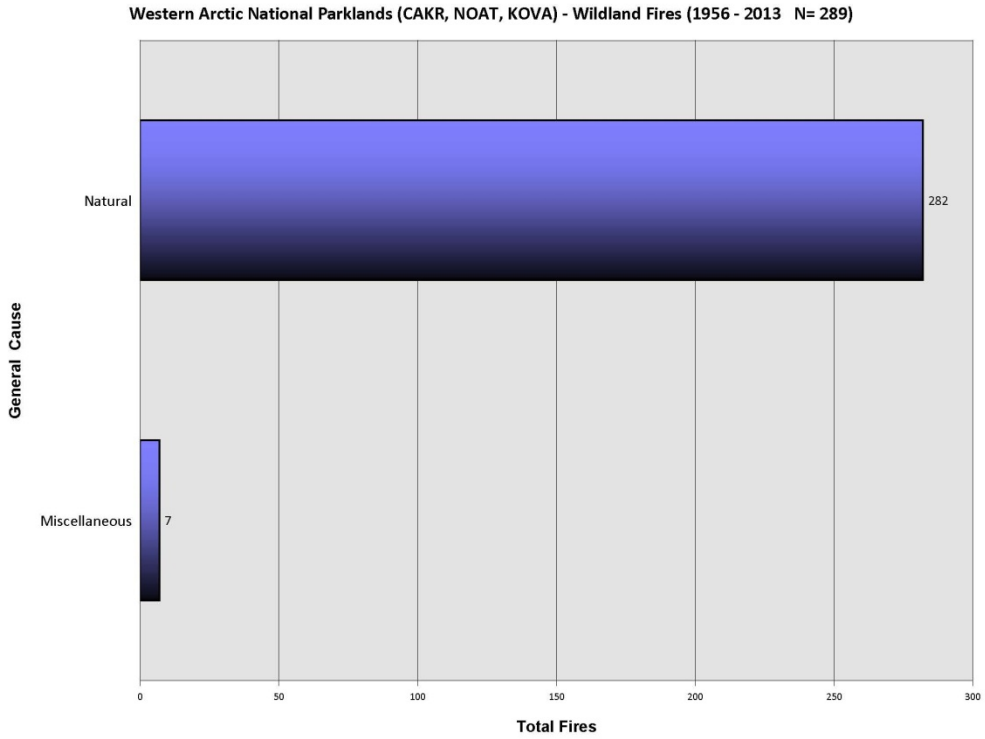
Appendix S: Unit specific supplemental information

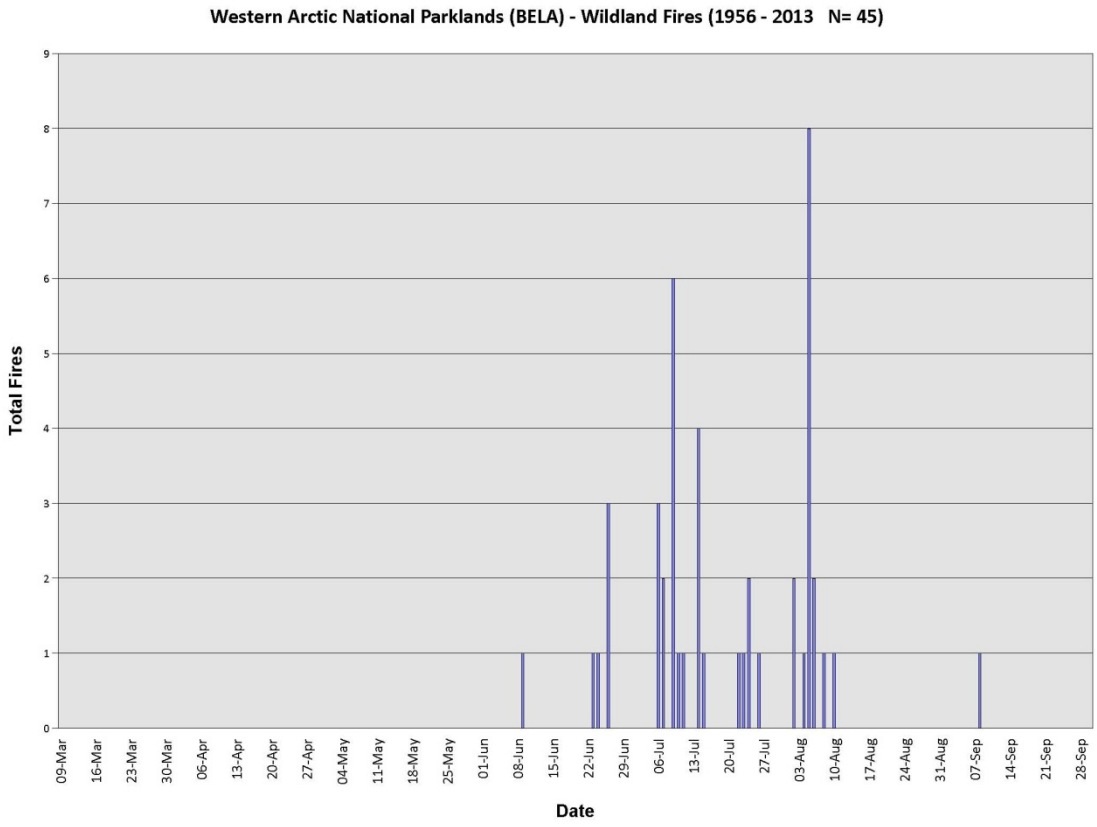
Appendix S.1: Fire Statistics and Graphs

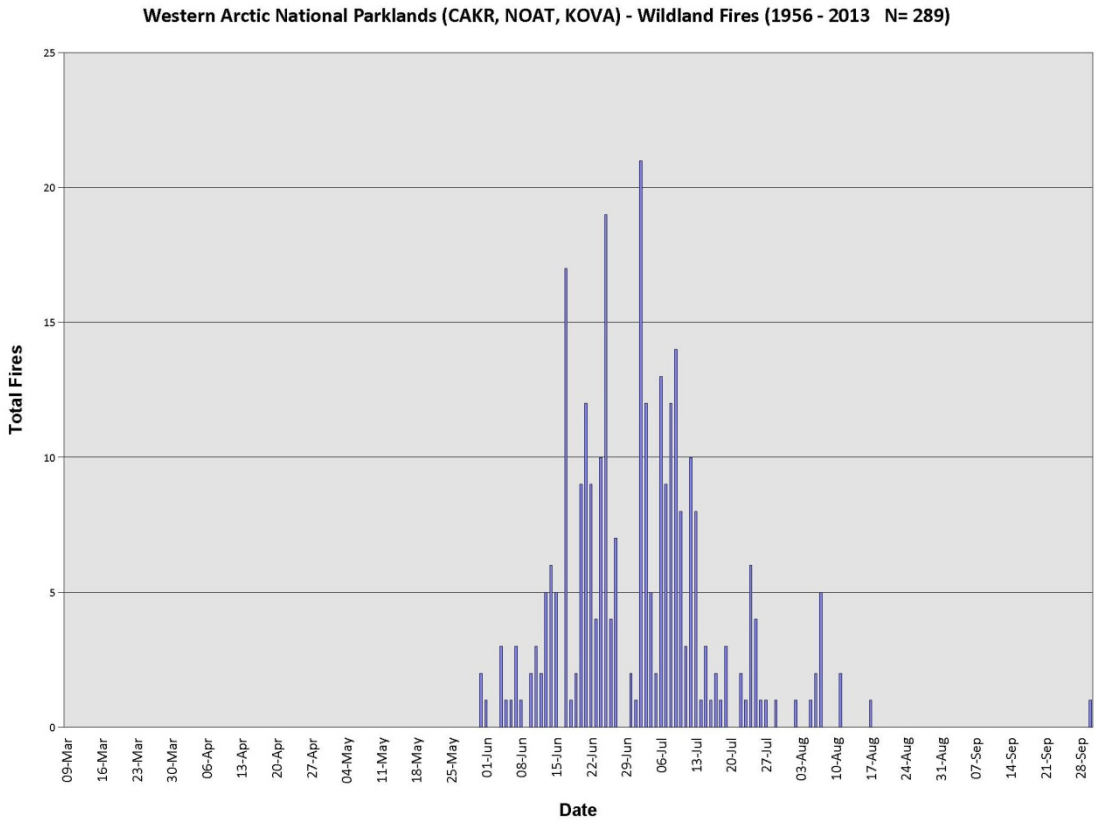
Fire Statistics and Graph 1: General Cause of Fires



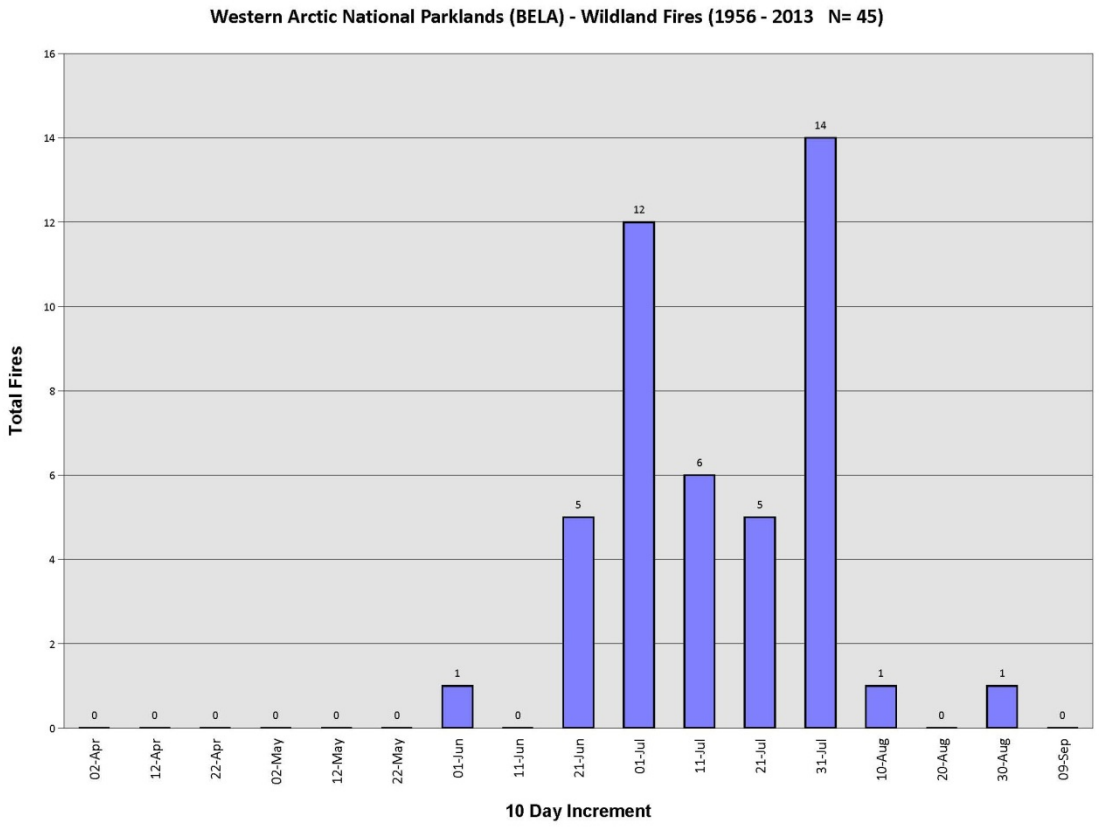


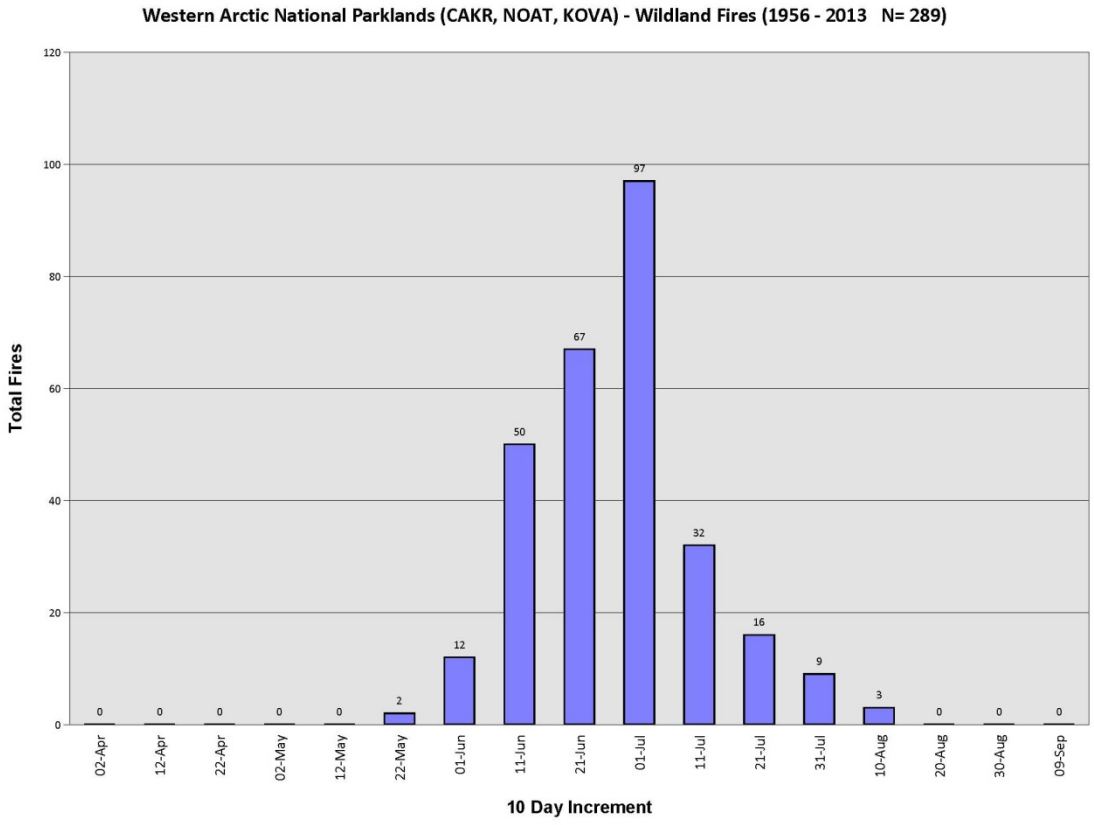
Fire Statistics and Graph 2: Wildland Fire Occurrence by Start Date



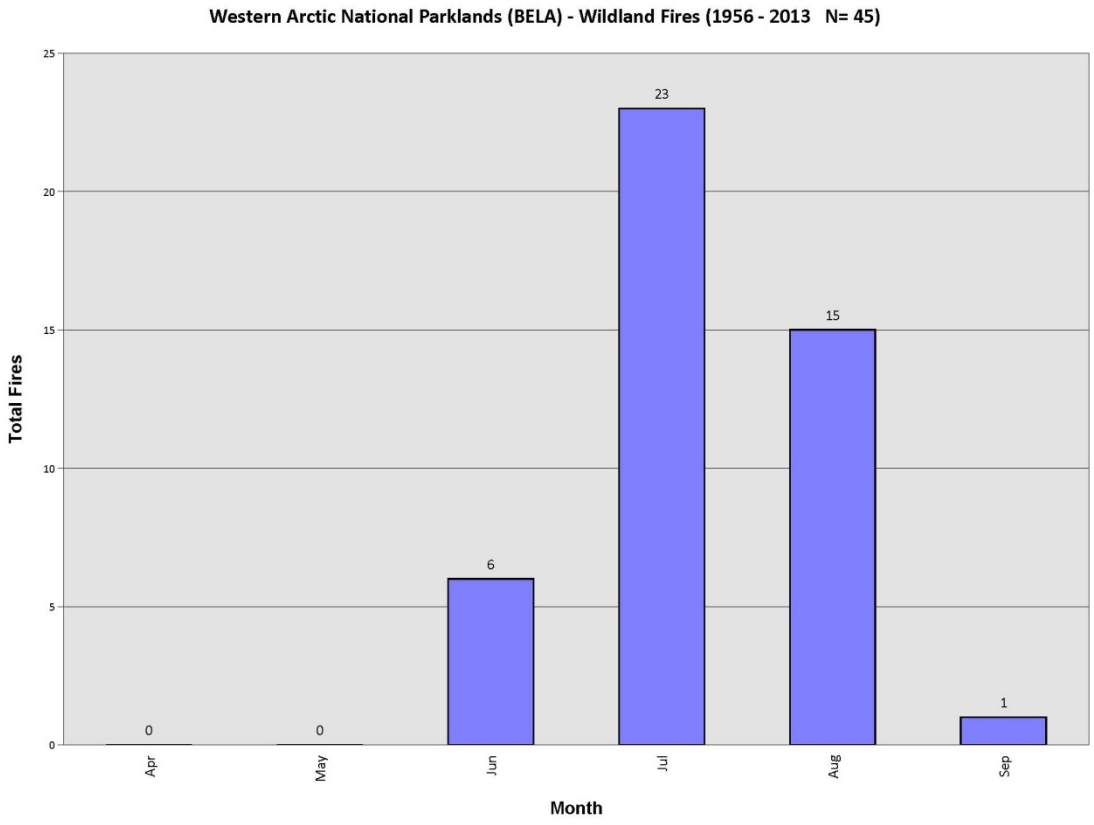


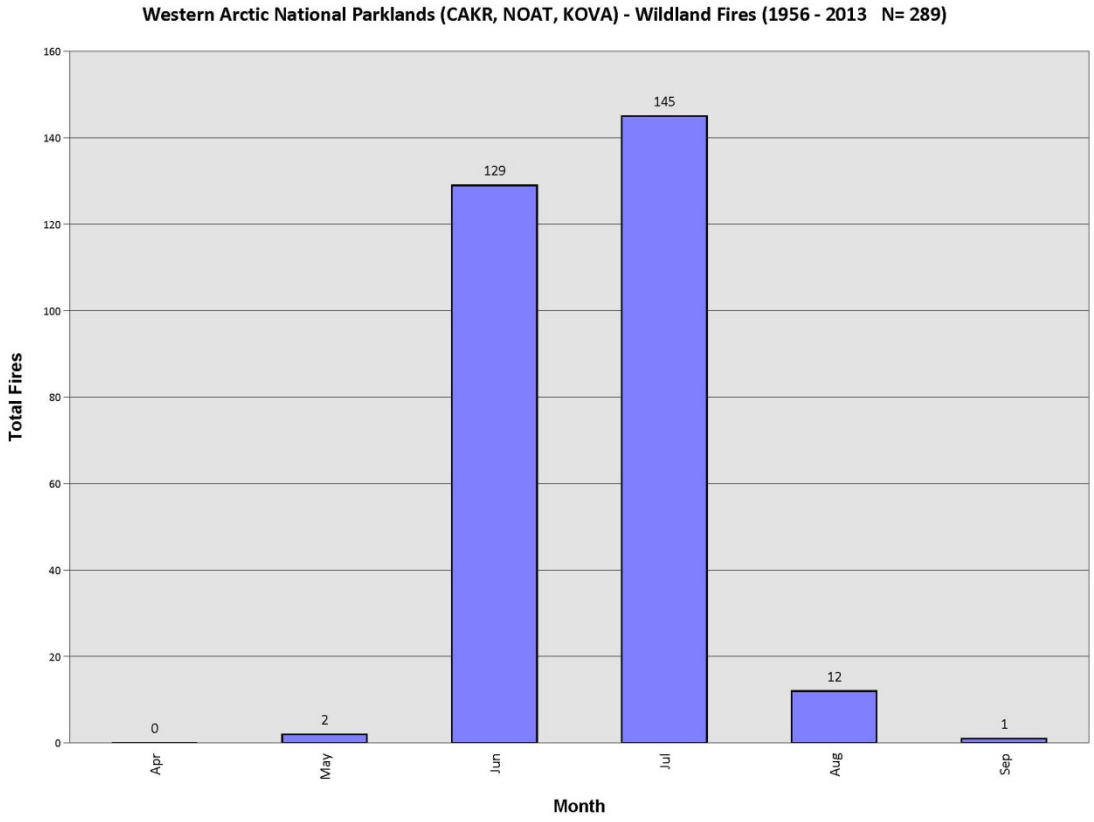
Fire Statistics and Graph 3: Wildland Fire Occurrence (10 Day Increment)



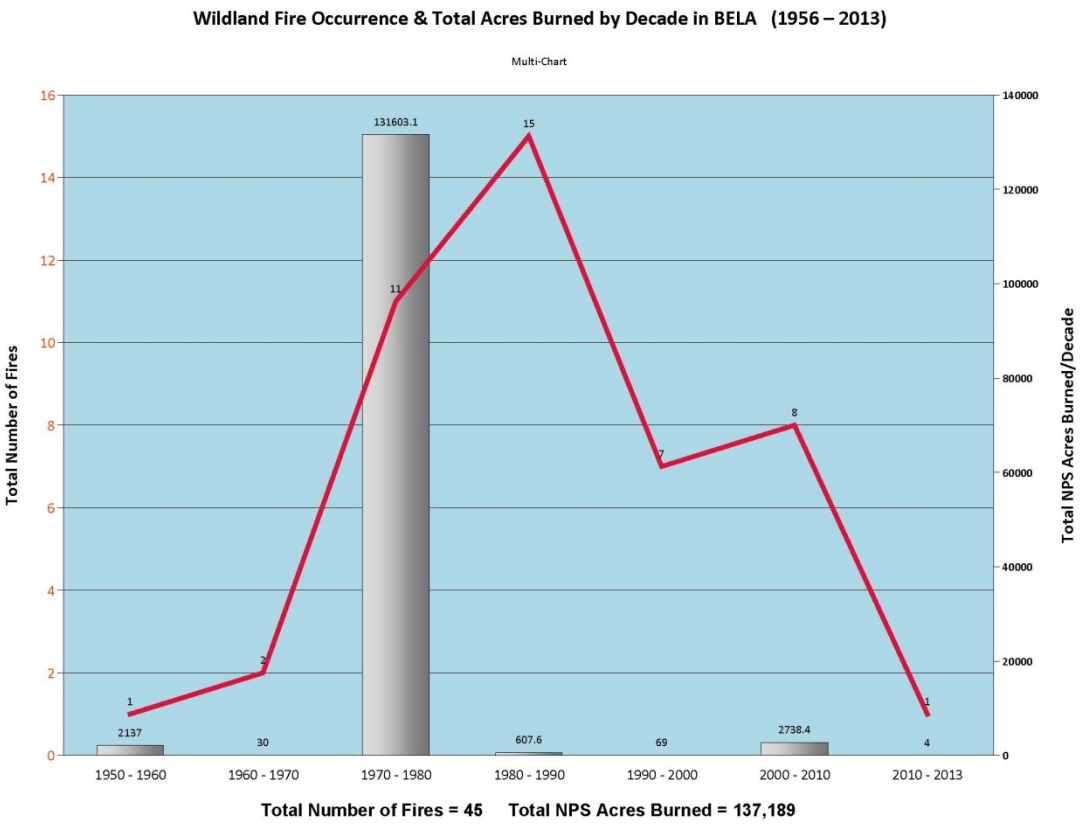


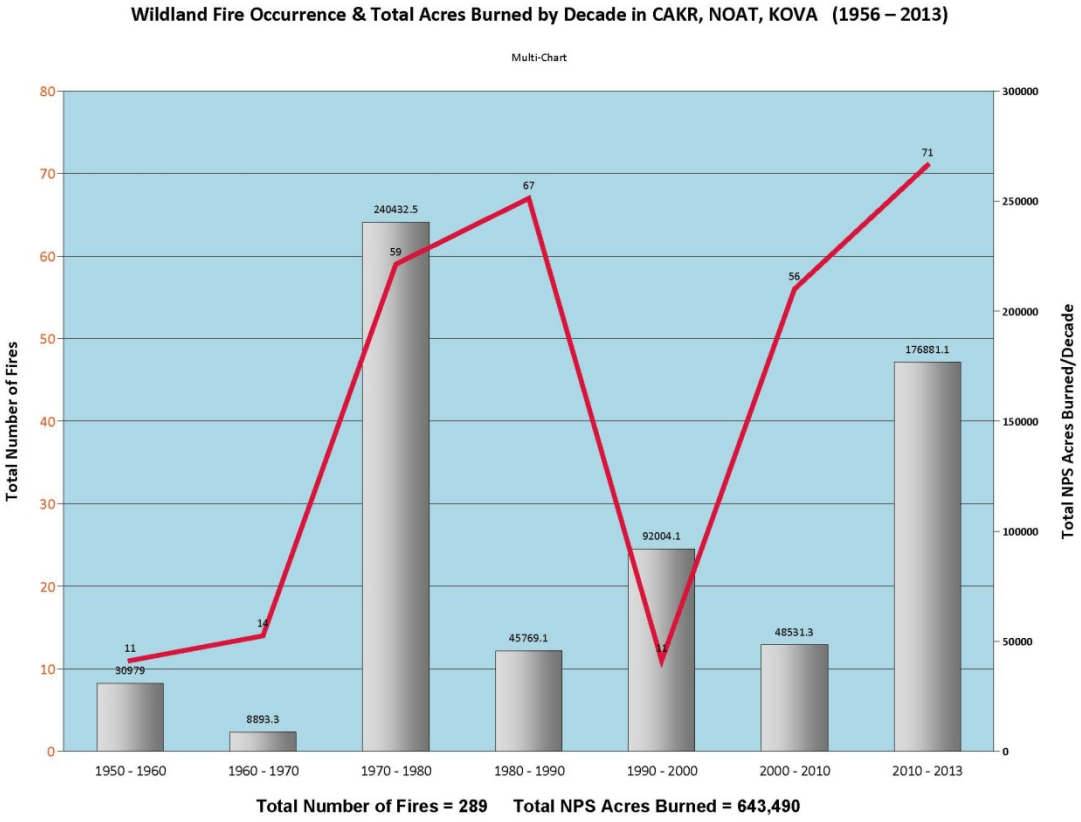
Fire Statistics and Graph 4: Wildland Fire Occurrence by Month





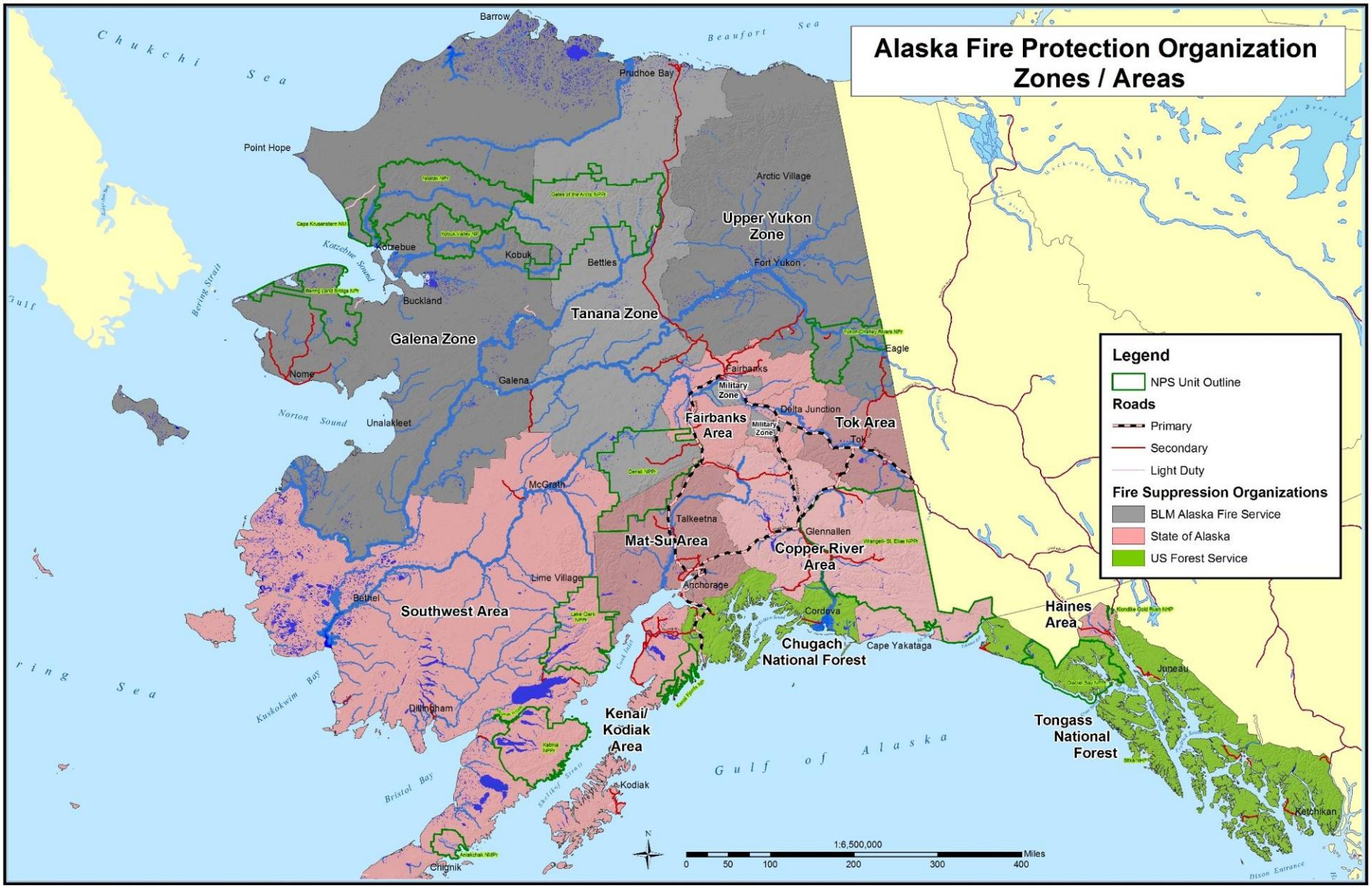
Fire Statistics and Graph 5: Wildland Fire Occurrence & Total Acres Burned by Decade



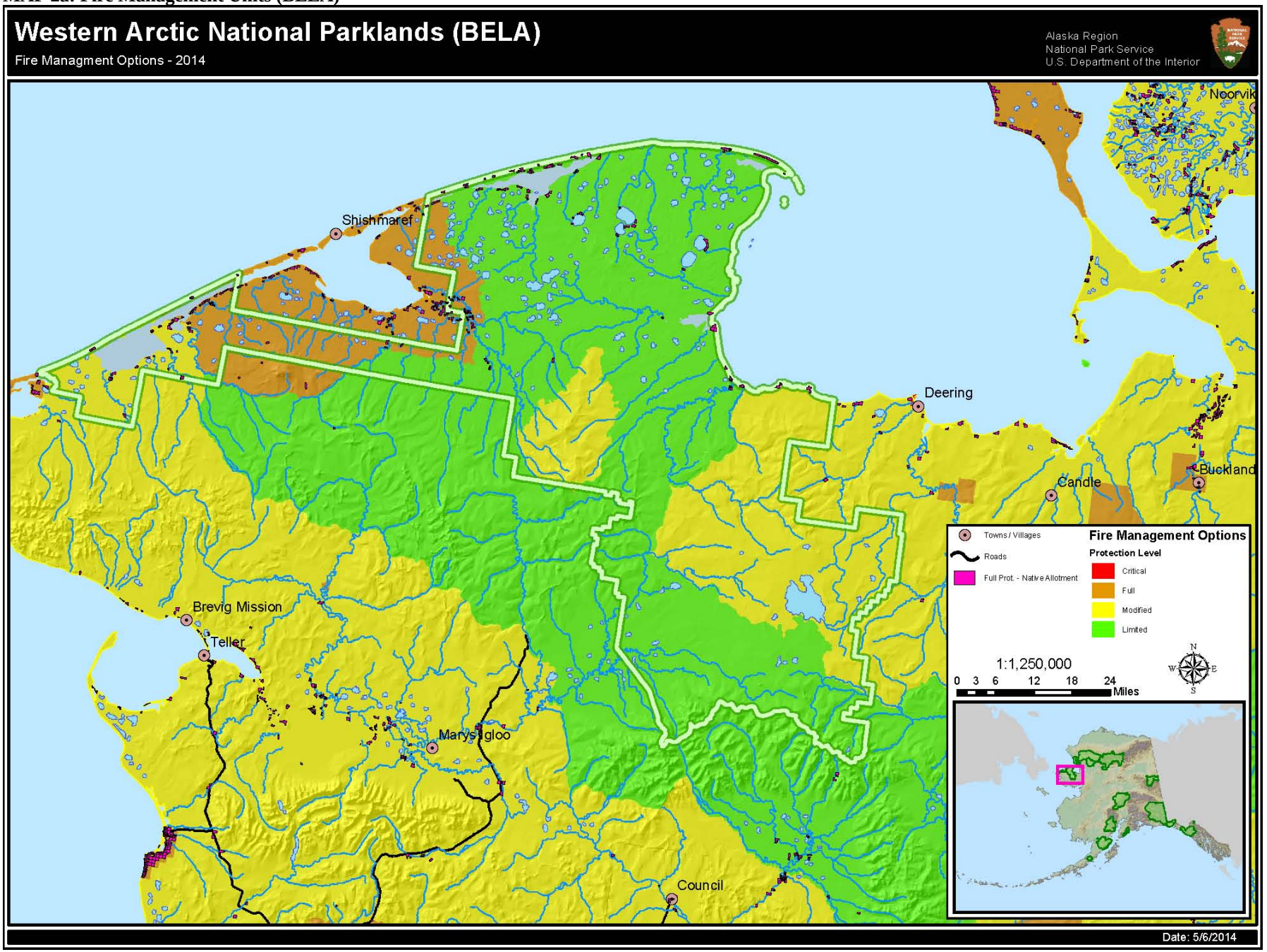


Appendix S.2: Maps

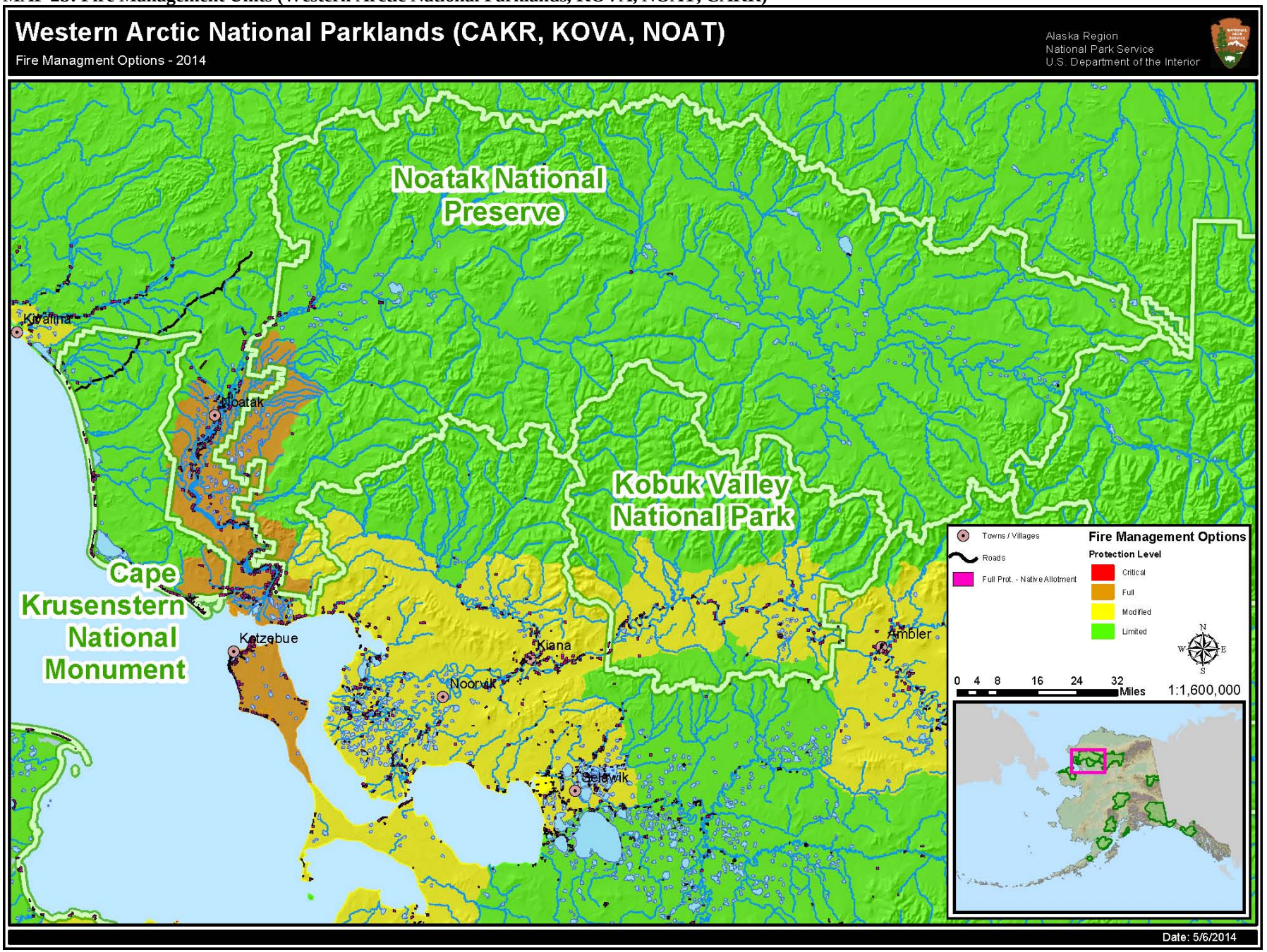
MAP 1: Protection Organizational Boundaries



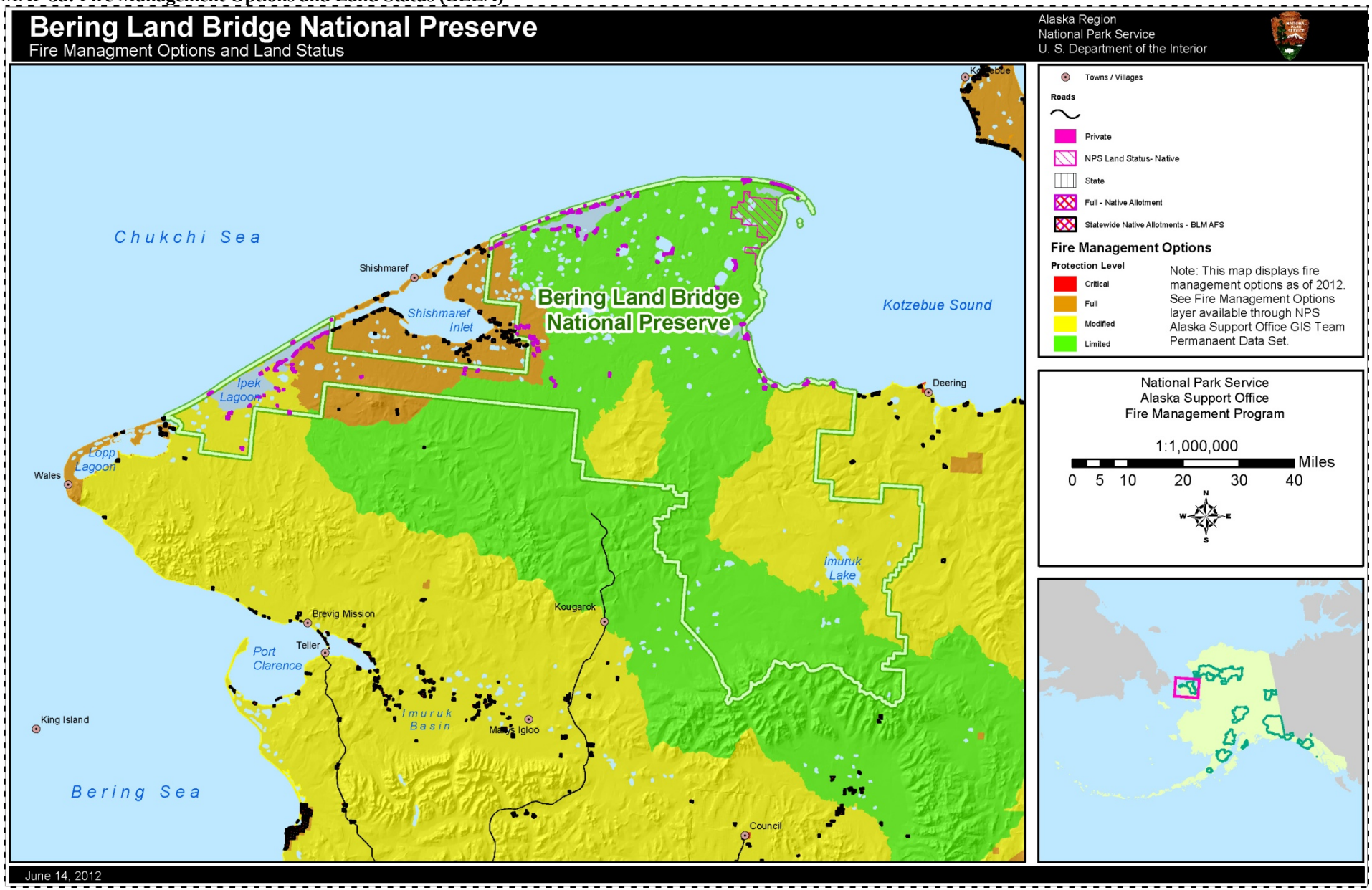
MAP 2a: Fire Management Units (BELA)



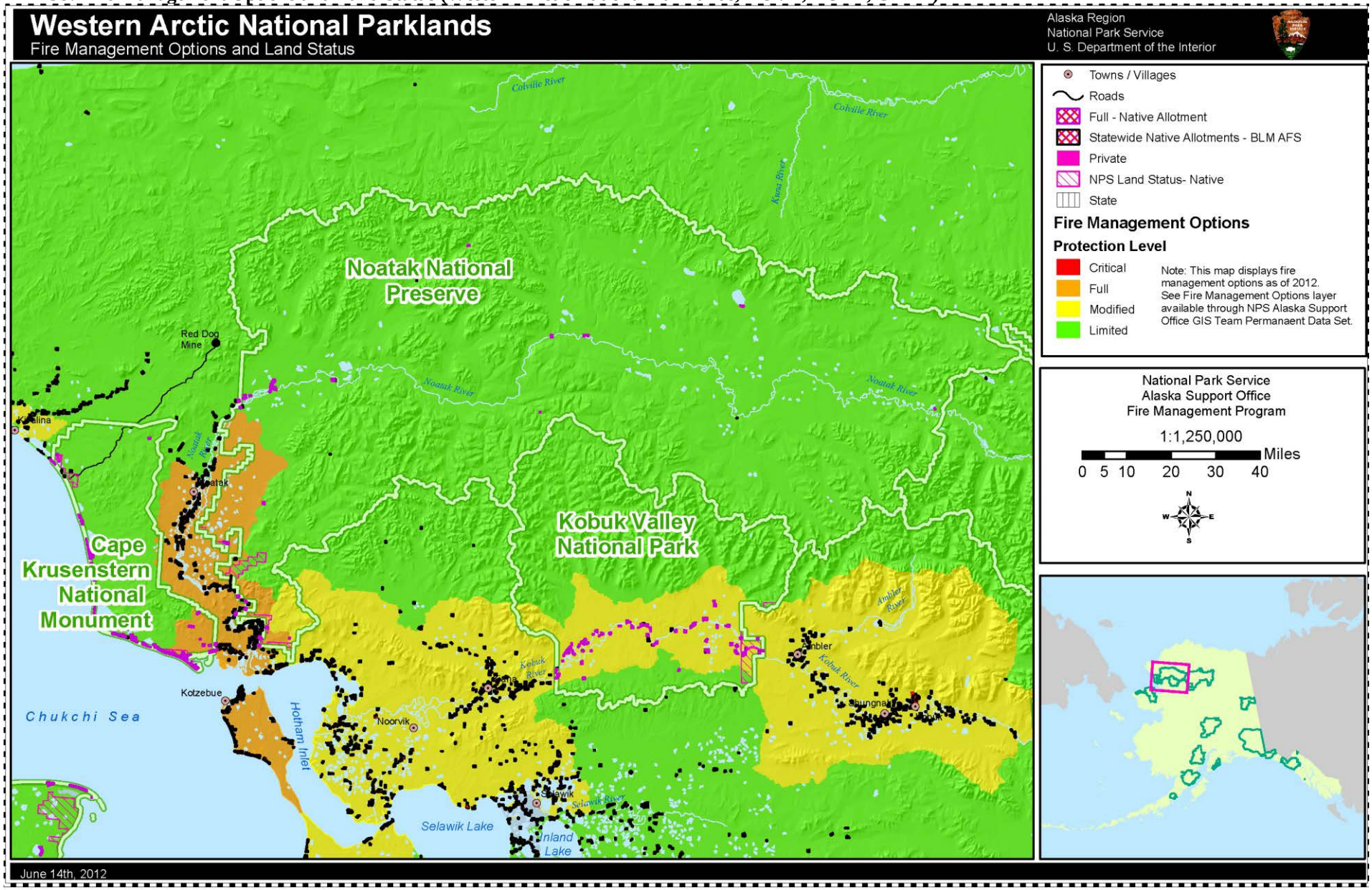
MAP 2b: Fire Management Units (Western Arctic National Parklands, KOVA, NOAT, CAKR)



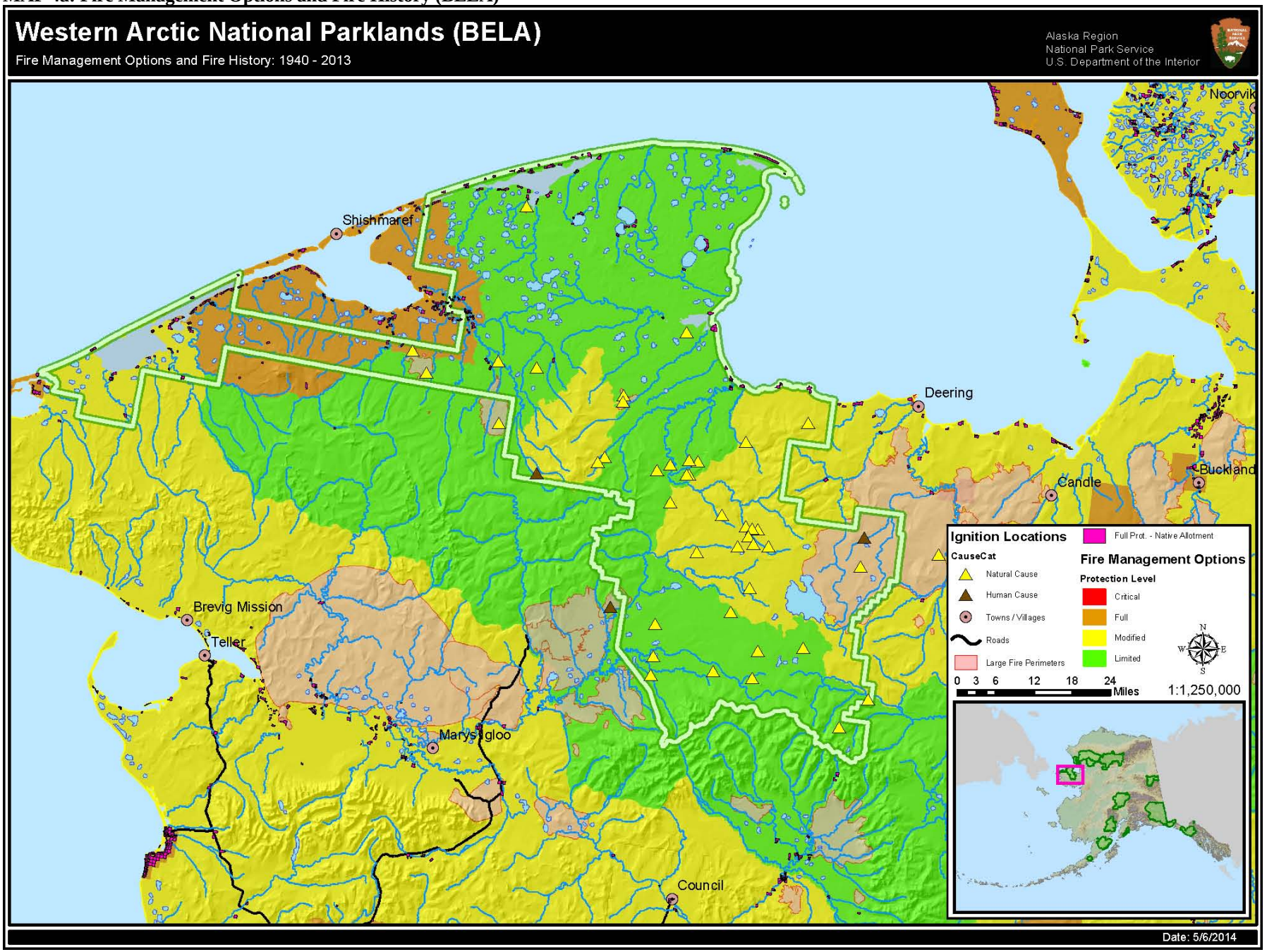
MAP 3a: Fire Management Options and Land Status (BELA)



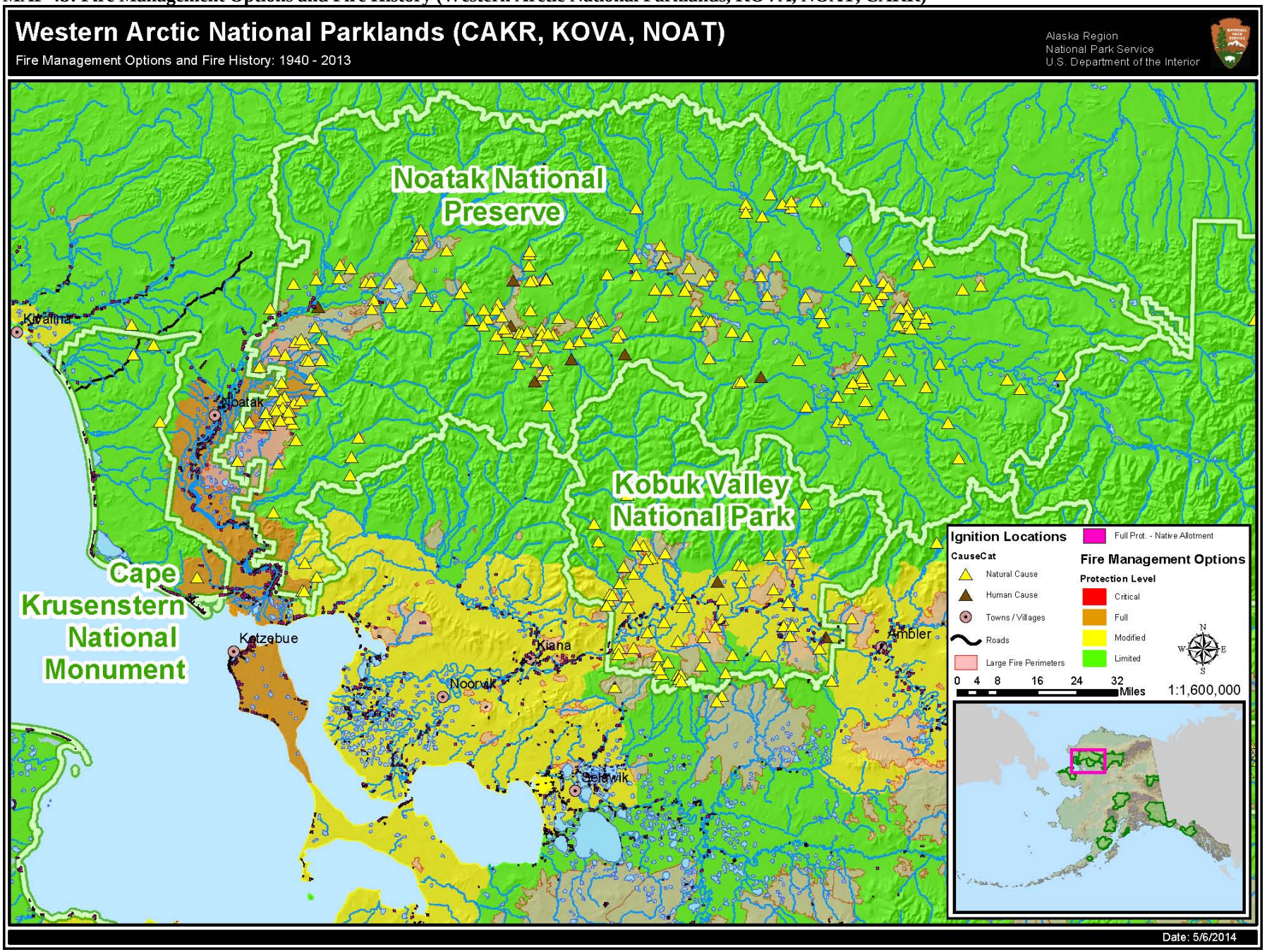
MAP 3b: Fire Management Options and Land Status (Western Arctic National Parklands, KOVA, NOAT, CAKR)



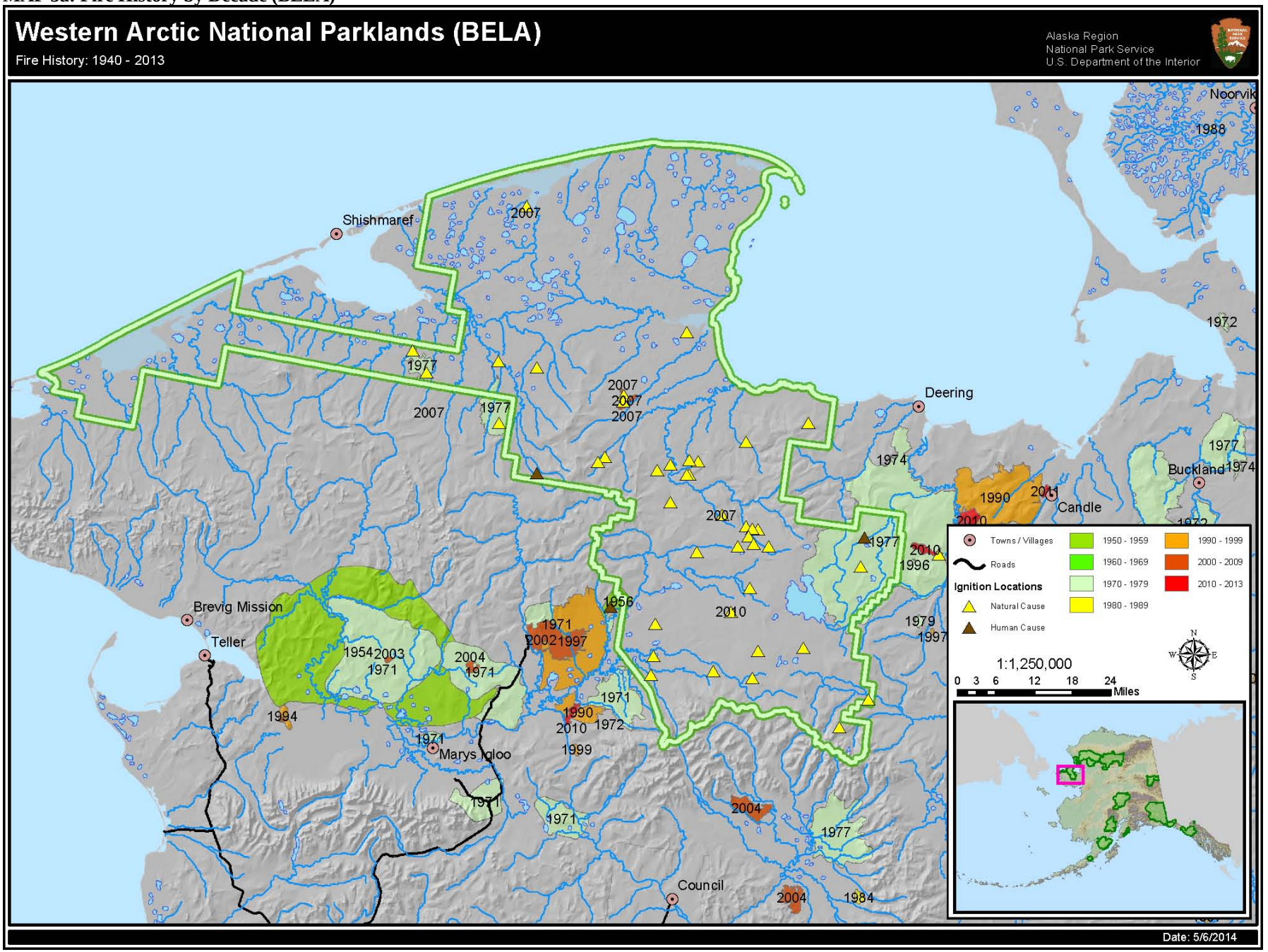
MAP 4a: Fire Management Options and Fire History (BELA)



MAP 4b: Fire Management Options and Fire History (Western Arctic National Parklands, KOVA, NOAT, CAKR)



MAP 5a: Fire History by Decade (BELA)



MAP 5b: Fire History by Decade (Western Arctic National Parklands, KOVA, NOAT, CAKR)