Bristol Bay Native Association

Forest and Fire Management Plan For Native Allotments in the Bristol Bay Region of Alaska

May 21, 2014

The Nushagak River in the Bristol Bay region of southwestern Alaska

Dearlove Consulting
Natural resources consulting and management services
for Southwest and Southcentral Alaska

Bristol Bay Native Association

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EXECUTIVE SUMMARY

The Bristol Bay Native Association service area covers 1,762 certified Native allotment parcels. These parcels total 132,281.47 acres located throughout the Bristol Bay region of southwest Alaska. This forest and fire management plan has been prepared to serve as an initial assessment of forest resources on these Native allotments and to serve as a regional programmatic plan to direct forestry and fire management programs of BBNA as a recognized Bureau of Indian Affairs service provider.

Key Findings and Recommendations

- Of the 1,762 Native allotment parcels, approximately 21% of parcels are forested; the total acreage of these forested parcels is estimated at 18,098 acres within an area of over 40 million acres within the Bristol Bay region.
- A large percentage of the region's Native allotments are clustered along the Wood River – Tikchik drainage within the Nushagak Bay Sub-region which also contains the majority of the timbered allotments and contains the largest communities of the Bristol Bay region.
- Forest inventory data collected by Tanana Chiefs Conference in 2006 within the sub-regions of Nushagak Bay (Dillingham Subunit), Nushagak River (Nushagak Subunit), and Iliamna Lake (Kokhanok Subunit) presents that these sub-regions have an estimated net forest volume of 7,731,036 cubic feet (77,310 cords) with the Nushagak Bay Sub-region (Dillingham Subunit) - the source of a majority of this timber volume at 65 percent.
- The average annual yield in white spruce forests in Alaska is estimated at 10 cubic feet per acre per year; this approximates to 1/10th of a cord per acre per year. Poor quality stands with lower growth rates on cold wet soils and/or higher volume losses due to disease, decay, or infestations could be nearer to 5 cubic feet per year or 1/20th of a cord per acre per year.
    - Estimated Annual Allowable Cut: 1 cord per 10 acres per year.
    - Conservative Estimated Annual Allowable Cut: 1 cord per 15 acres per year.
- The 2013 report by BBNA, '*Home Heating... Wood Harvest Practices: Current Conditions in Aleknagik and Dillingham'* presents that survey respondents on average burned 5.5 cords annually as a secondary source for home heating. Extrapolating this data, if only one-half of the 880 households just in the Nushagak Bay Sub-region burned 5.5 cords per year, this annual harvest calculates at 2,400 cords. This rate of annual consumption would need to be spread over at least 24,000 acres to stay within the estimated annual allowable cut per acre.
- Concerns expressed over apparent depletion of forest resources and increasing distances to secure wood is anecdotal evidence of the annual cut exceeding the average annual yield.
- Further implementation of renewable energy systems and improvements in energy efficiency and energy conservation measures are advised throughout the forested areas of the BBNA region or risk degradation of the limited forest resource and risk possible increases in trespass and timber theft from its Native allotments and Native corporation lands.

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I. INTRODUCTION

A. Authority

The requirement for forest resources planning and management on Indian trust lands is cited under the United States Code of Federal Regulations Section 25.163 'General Forestry Regulations'. These regulations cite that the Bureau of Indian Affairs maintains an obligation for the management of Indian forest lands while title to such lands are held in trust or restricted fee status by the Federal government. The policy which provides specific instruction to implement regulation is documented in the Bureau of Indian Affairs Manual, 53 BIAM Supplement 2, and further defined in various supplements, addendum, and directives.

As a recognized Bureau of Indian Affairs service provider and through provisions of the Indian Self-Governance Act of 1994 and the Self-Governance Compact with its member Tribes, the Bristol Bay Native Association has assumed management responsibility for the Indian trust lands as Native allotments within its service region. In furtherance of this trust responsibility, the Bristol Bay Native Association has also assumed management responsibility to provide and maintain a forest management plan for the forested Native allotments within its service area within the Forestry Program Compact.

B. Purpose and Need

The Bristol Bay Native Association, Incorporated (BBNA) is a consortium representing 31 Tribes within the Bristol Bay region in southwest Alaska. Organized as a non-profit corporation and as a Bureau of Indian Affairs (BIA) recognized service provider, BBNA provides a variety of educational, social, economic, and related services for its member Tribes and Native allotment landowners. The Land Management Services of BBNA provides specific assistance to Native allotment landowners to address issues of trespass, gravel sales, partitions, subdivisions and easements, as well as assistance in forest resources management and fire hazard reduction.

This '*Forest and Fire Management Plan for Native Allotments in the Bristol Bay Region of Alaska'* has been done as an initial assessment of forest resources on Native allotments occurring within the Bristol Bay region. This plan has been done at the landscape level to give the broad perspective of issues and concerns impacting the region's forest resources while also analyzing data at the sub-region level. This plan will serve as the initial forest and fire management plan for Native allotments in order to guide future individual Native allotment owner's forest management plans and/or future decisions affecting forest land uses, natural resources conservation, sustainable harvesting levels, silvicultural practices to improve forest production, and wildfire fuel reduction.

This Forest Management Plan will analyze data from the 2006 forest inventory conducted under contract for BBNA by Tanana Chief Conference (TCC), analyze information available from other

programs of BBNA, and analyze natural resources data available for the Bristol Bay region. This plan will also identify critical forest management issues, recommend sustainable harvesting levels, identify opportunities for additional forest management planning at the individual allotment parcel level, and identify goals and objectives to address various resource concerns. It is noted, however, that detailed natural resources data and forest management references are extremely limited from conventional programs of state and Federal resource management agencies.

This plan will serve as a programmatic plan to guide BBNA in fulfilling its trust responsibilities to Native allotment owners and will serve as the forest and fire management plan for Native allotments within the BBNA service area. In addition, this document will serve as an Environmental Assessment for proposed BBNA forest and fire management programs and practices on Native allotments for the requirements of the National Environmental Policy Act (NEPA).

C. BBNA Service Region

The region of BBNA corresponds to the boundary of the Bristol Bay Native Corporation (BBNC) established by the Alaska Native Claims Settlement Act of 1971. The BBNA Service Region encompasses over 40 million acres in southwest Alaska – an area larger than the state of Ohio.

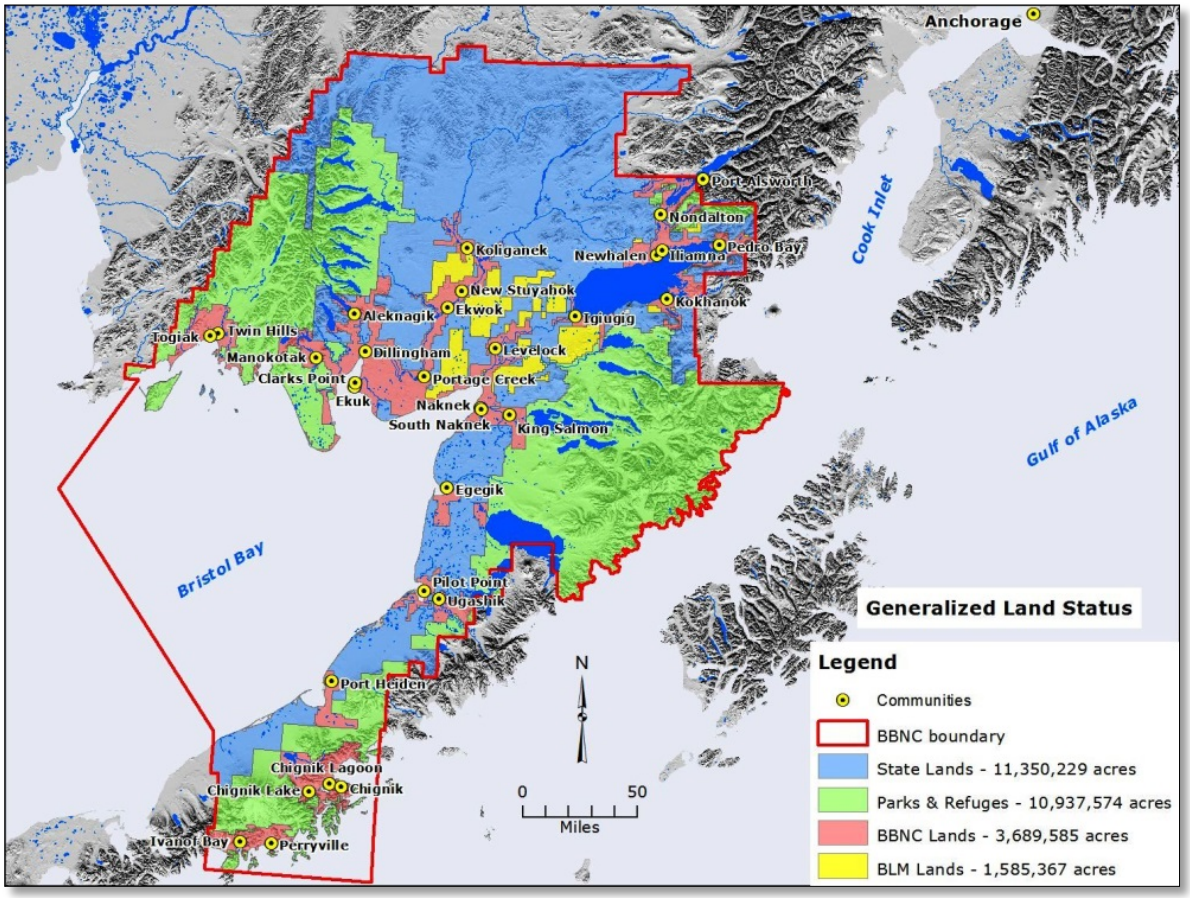

Figure 1. Generalized Land Status Map of BBNC Region and BBNA Service Area

The BBNA Service Region covers the following 31 Tribes by the following Forest Management Sub-regions. The Peninsula and Kvichak Bay sub-regions were combined for common resources issues for purposes of this Forest and Fire Management Plan (Figure 2):

Togiak Bay
- Togiak
- Twin Hills
- Manokotak

Nushagak Bay
- Aleknagik
- Clarks Point
- Curyung
- Ekuk

Nushagak River
- Ekwok
- Koliganek
- New Stuyahok
- Portage Creek

Iliamna Lake
- Igigig
- Iliamna
- Kokhanok
- Levelock
- New Halen
- Nondalton
- Pedro Bay

Peninsula/Kvichak Bay
- Chignik
- Chignik Lake
- Chignik Lagoon
- Ivanof Bay
- Perryville
- Egegik
- Kanatak
- King Salmon
- Naknek
- Pilot Point
- Port Heiden
- South Naknek
- Ugashik

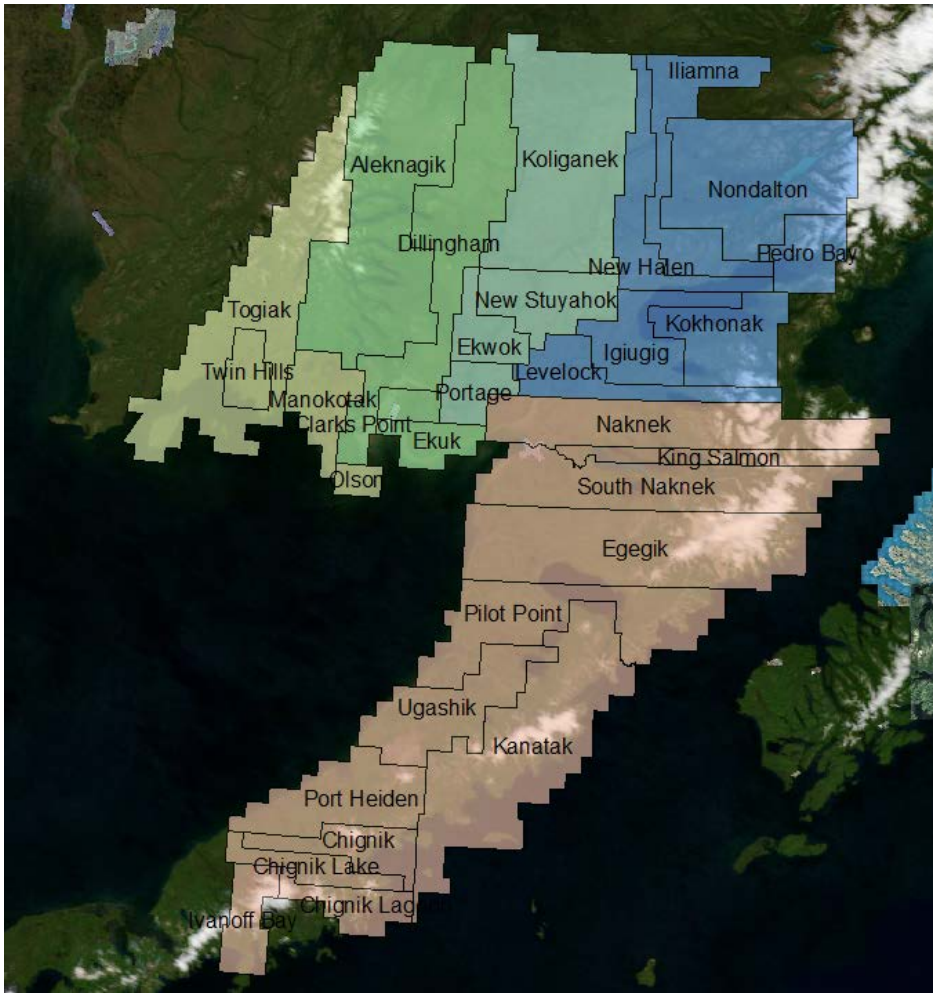

Figure 2. BBNA Forest Management Sub-Regions

The BBNA region is bounded by the waters of Bristol Bay to the west, the Wood River Mountains to the northwest, Illiamna Lake and the Katmai National Park to the east, and the beginnings of the Alaska Peninsula to the south. There are eight major river systems that provide for the highest densities of human population and the predominance of Native allotment locations: Wood River, Nushagak River, Naknek River, Egegik River, Ugashik River, Meshik River, and the Chignik River (Figure 3).

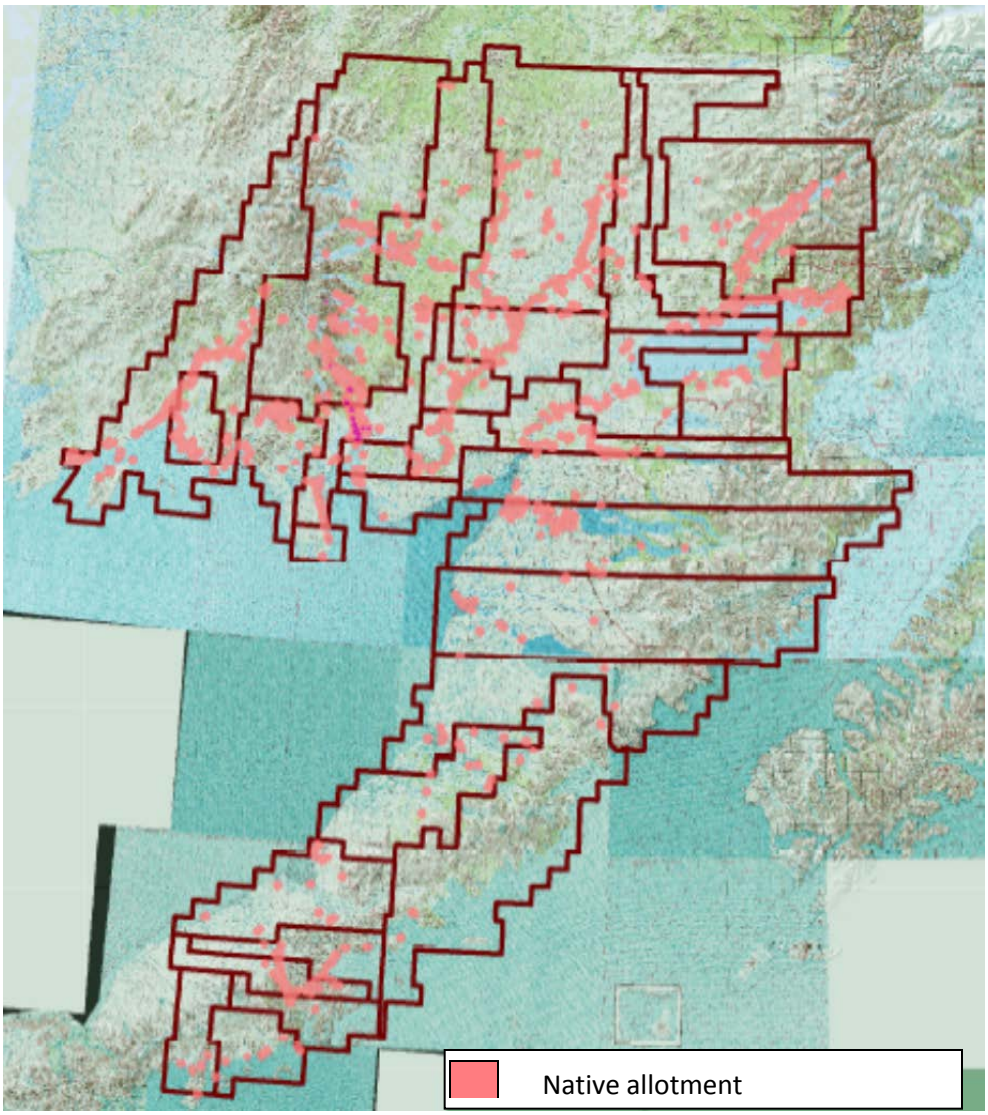

Figure 3. BBNA Service Region - Spatial Distribution of Native Allotments

Togiak Bay Sub-region:	249 Allotments	Sub-Total Acres: 28,344.78
Nushagak Bay Sub-region:	473 Allotments	Sub-Total Acres: 33,718.48
Nushagak River Sub-region:	274 Allotments	Sub-Total Acres: 23,180.91
Iliamna Lake Sub-region:	440 Allotments	Sub-Total Acres: 23,911.19
Peninsula/Kvichak Bay Sub-region:	326 Allotments	Sub-Total Acres: 23,126.11
	1,762 Allotments	**Total Acres: 132,281.47**

D. Goals and Objectives: Native Allotment Owners

In an effort to engage Native allotment owners as to their concerns, goals, and objectives on forest and fire management issues, a survey was sent out by the BBNA Forestry Program to Native allotment owners and heirs in 2011. Of the 1148 surveys mailed only 45 responses were received for a response rate of four percent. The summary of responses was as follows:

Table 1. Survey Responses of Native Allotment Owners

Use of Native Allotment by owner/heirs	
Home site: 18	Recreation: 13
Seasonal fishing/hunting camp: 27	Future home site: 15
Subsistence: 32	Firewood source: 20
Do you harvest or plan to harvest any forest products from your Native Allotment?	
House Logs: 10	Medicinal plants: 15
Firewood: 32	Other: 11
Trees killed by insects, wildfire, or disease on your Native Allotment?	
Yes: 7	No: 18
Participated in Firewise Program around home or Native Allotment?	
Yes: 9	No: 36
Have ever had firewood stolen or timber theft on Native Allotment?	
Yes: 5	No: 40
Would like to have FMP done on property as plan for timber and wildlife improvements?	
Yes: 23	No: 22

II. SUMMARY OF ALTERNATIVES

There are a variety of potential forest land management activities that fall within the scope of this plan. They fall into one or more broad alternatives in terms of how the process of this plan would either be handled independently of other resource management services within the Bristol Bay region, or within the context of other planning or NEPA documents if they exist. The alternatives possible regarding the implementation of this Forest and Fire Management Plan include:

1. **Plan Not Implemented (No-action alternative)**

The No-Action alternative in this case means that a Forest and Fire Management Plan is not implemented. Any management activities would be evaluated on their own merits with regards to potential impacts, NEPA compliance, and compliance with other statues and regulations, or are not evaluated at all. Any past activities, having been executed in the absence of a plan, would fall into this category. Among other considerations, this alternative is at odds with BIA requirements for implementation of Forest and Fire management Plans on Native allotments.

2. **Proposed Actions with No Significant Impact**

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and are permitted to occur if they are deemed to pose no significant impact on the affected natural or human environment. Many proposed activities would, in and of themselves, qualify for a categorical exclusion under NEPA guidelines implemented by the BIA, but would additionally be evaluated for potential cumulative impacts by considering other activities occurring in the same time and/or area. Those actions not immediately qualifying for a categorical exclusion would require the generation of an Environmental Assessment (EA) with much of the discussion and analysis tiered from this plan.

3. **Proposed Actions with Mitigation Impacts**

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and potentially significant impacts are mitigated though modification of the activities or appropriate application of the best management practices as discussed in this plan. A Finding of No Significant Impact (FONSI) could be appropriately generated, and the activity could be permitted to occur. A proposed action would generate its own site-specific and action-specific EA, but the discussion and analysis could be tiered from this plan.

4. **Proposed Actions Resulting in Significant Impacts**

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and potentially significant impacts are determined to be possible even with the inclusion of mitigation strategies in the application of the actions. Costs represented by negative impacts would be weighed against the benefits represented by the positive impacts. If the benefits outweigh the costs associated with the proposed action, an EA is prepared and the proposed action may be approved. If the benefits do not outweigh the costs or the proposed action

involves some level of controversy, the process may be driven to a required Environmental Impact Statement (EIS) with a final Record of Decision (ROD). With either an EA or an EIS, much of the required discussion and analysis could be tiered from this plan.

III. DESCRIPTION OF THE REGION

In that few natural resource assessments have been done in the relatively remote region of Bristol Bay, much of the conventional public data sets, maps, and related analyses are not available for this region and thus not available as reference for the development of this Forest and Fire Management Plan, such as U.S. Department of Agriculture, Natural Resources Conservation Service soil surveys; forestry site indices for indicators of site productivity for white spruce, paper birch; and forest regeneration studies and related forest analyses by state or Federal forestry agencies or universities. Fortunately in this regard, the extensive research conducted by the U.S. Environmental Protection Agency for their publication, '*An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay*' (USEPA 2014), provides for consolidation of the information that does exist on the natural resources of the Bristol Bay region, though much of this information dates from 40 to 50 years ago. Therefore and in acknowledgement, the bulk of the description of the affected environment within this section of this Forest and Fire Management Plan has been derived from that publication: USEPA 2014. *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska.* Region 10, Seattle, WA. EPA 910-R-14-001.

A. Description of the Region

Bristol Bay is a large gulf of the Bering Sea in southwestern Alaska. The lands draining into Bristol Bay are principally of public land ownership of the State of Alaska, as well as State and Federal lands as parks, refuges, or preserves within the six major watersheds of the following rivers: Togiak, Nushagak, Kvichak, Naknek Egegik, and Ugashik (Figure 4).

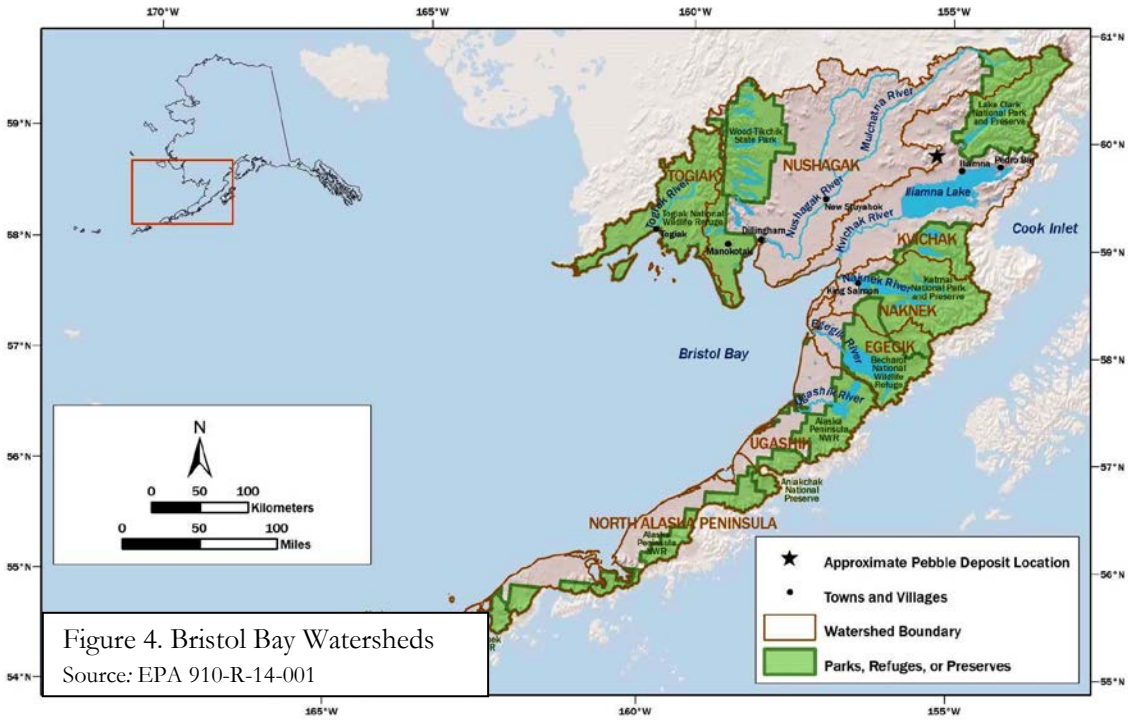

Figure 4. Bristol Bay Watersheds
Source: EPA 910-R-14-001

B. Natural Resources

a. Soils

Except for three soils studies and a number of archaeologically-related soils investigations, no detailed soil resource inventories are known to have been done in the Bristol Bay area. However, soils in the planning area have been surveyed on a very broad scale (USDA SCS 1979). The soil resources within the planning area are generally considered pristine or unaltered by human activity, except in areas adjacent to villages and urban areas. Most of the soils in the Bristol Bay region are underlain with isolated deep relics or shallow lenses of permafrost, thus soils have low temperatures as one of the limiting factors to forest stands, tree growth, and related forest productivity.

Permafrost: A dominant factor in defining soils is the presence or absence of permafrost. Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32 degrees Fahrenheit for two or more years (Muller 1945). Intermittent throughout the region (Figure 5), permafrost can exist as massive ice wedges and lenses in poorly drained soils or as a relatively dry matrix in well-drained gravel or bedrock. During the short arctic summer, these soils thaw, forming a shallow unfrozen zone termed the active layer. Permafrost forms a confining barrier that prevents infiltration of surface water and keeps the active layer of soils saturated. Permafrost also provides the structural integrity to hillsides and stream channel banks.

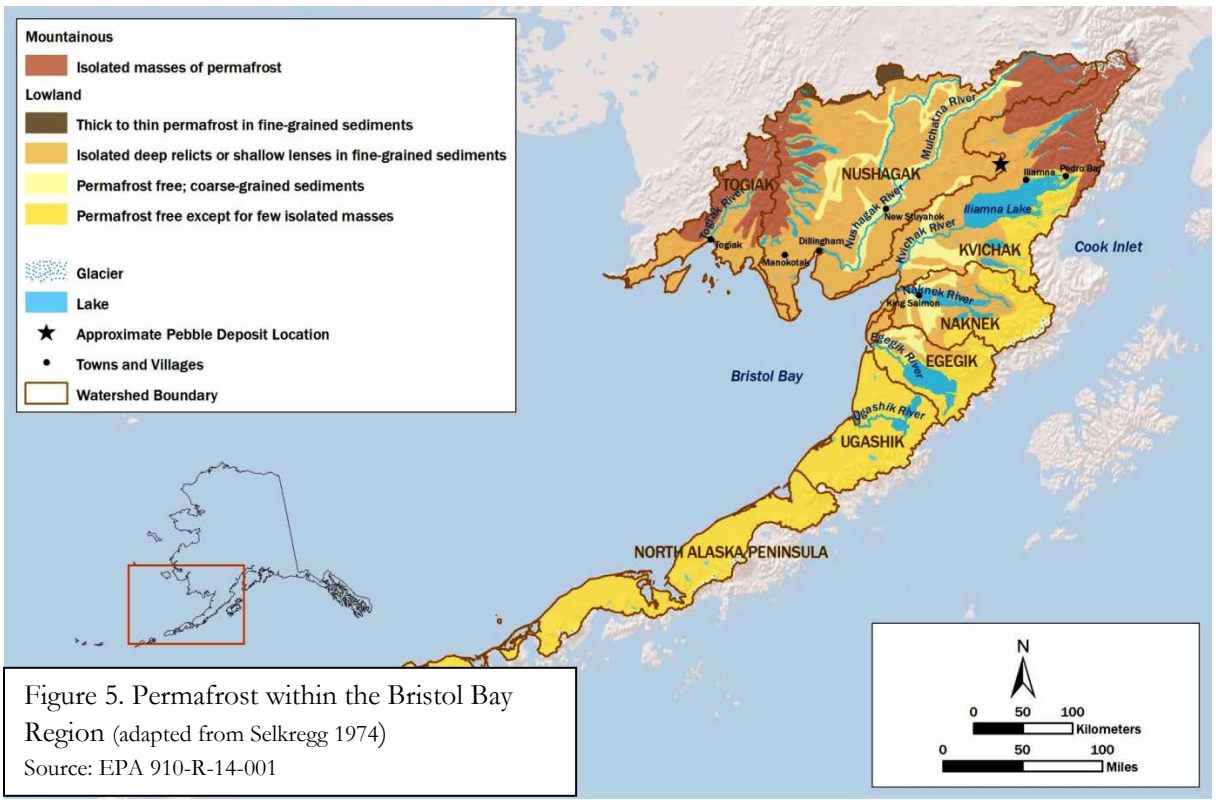

Figure 5. Permafrost within the Bristol Bay Region (adapted from Selkregg 1974)
Source: EPA 910-R-14-001

Soil Types: Soils types within the Bristol Bay region fall into four soil orders as established by U.S. Department of Agriculture's system of soil taxonomy: Inceptisols, Spodisols, Histosols, and Entisols

(Figure 6). Additional soil types found within the region are Rough Mountainous Land and Cinder Lands.

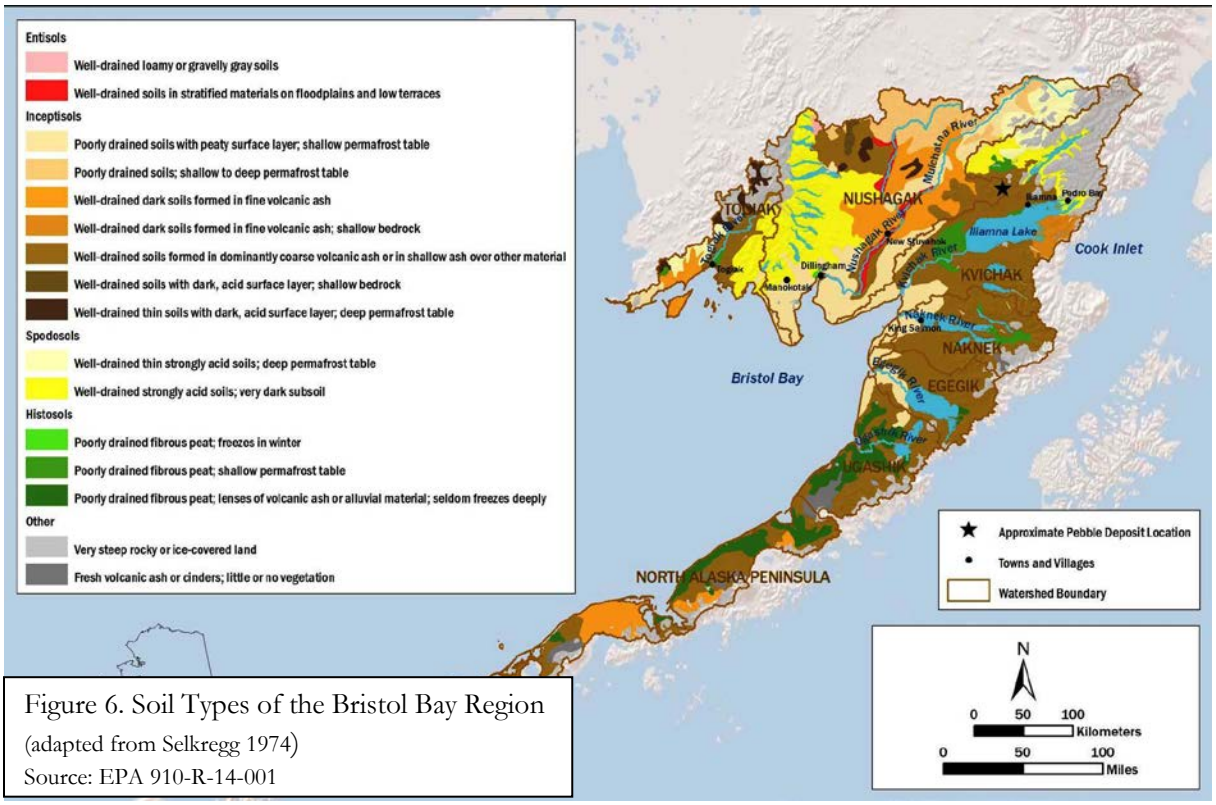

Figure 6. Soil Types of the Bristol Bay Region
(adapted from Selkregg 1974)
Source: EPA 910-R-14-001

- **Inceptisols**: Sixty-four percent of the region's soils are Inceptisols. An Inceptisol is a type of soil in which there has been only relatively minor modification of the parent material by soil-forming processes. There has been enough modification to be able to tell an Inceptisol from an Entisol, but not intense enough to form the kinds of soil horizons (soil layers) that are required for classification in other soil orders. Generally, poorly drained soils with permafrost are considered to be Inceptisols even though they have no diagnostic horizon other than an epipedon. Most soils in Alaska are Inceptisols (USDA SCS 1979).

- **Spodosols:** Nineteen percent of the region's soils are Spodosols. In Spodosols organic carbon, aluminum, and in most places, iron, have been leached by percolating water from the upper part of the soil and deposited or precipitated at greater depth to form a spodic horizon. Most Spodosols in Alaska have a surface mat of organic litter, which is at least partially decomposed and a gray mineral horizon (an albic horizon) above the spodic horizon. Spodosols are dominant on uplands in areas with high precipitation, where moisture in excess of that required by the natural vegetation moves completely through the soil. Except in very coarse material and in tundra areas, Spodosols in Alaska normally occur only where mean annual precipitation exceeds 15 inches. Spodosols are most common in forested areas (USDA SCS 1979:46).

- **Histosols:** Only two percent of lands within the region contain soils known as Histosols, which are made up completely or in large part of organic material. The organic material accumulates under wet conditions, in depressions or other low areas that are nearly always inundated, on slopes affected by

seepage, or as a blanket on rolling hills in areas of very high rainfall. Examples of this type of soils can be found at Brooks Lake in Katmai National Park (USDA SCS 1979).

- **Entisols:** Only one percent of soils within the region are classified as Entisols. In Entisols there is little or no evidence of change as a result of soil-forming processes. Most of them have few diagnostic horizons. Wet mineral soils are classified as Entisols. In Alaska, Entisols occur most commonly on flood plains and outwash plains which receive new deposits of sediment at frequent intervals, on uplands adjacent to major rivers where new material from the river beds is deposited, and in very cold or steep areas where vegetation is sparse, where soils are unstable, or where parent material is exceptionally resistant to chemical weathering (USDA SCS 1979).

- **Rough Mountainous Land & Cinder Land**: Fourteen percent of the region's soils consist of Rough Mountainous Land and Cinder Land. Rough mountainous land is made up of steep rocky slopes, ice fields, and glaciers. Some slopes in the mountains support sparse shrubby vegetation, but most are barren. Thin soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or boulder deposits (USDA SCS 1979).Cinder lands can be found on the Alaska Peninsula and on the western Alaska coastal plains and deltas. These areas have little or no vegetation except for willows and grasses in deeply incised drainage ways, such as the Valley of Ten Thousand Smokes in Katmai National Park (USDA SCS 1979).

Erosion Potential: A predominant amount of the lands within the region have a medium rate of erosion potential as presented in Figure 7, with much of the region's soils between low to medium.

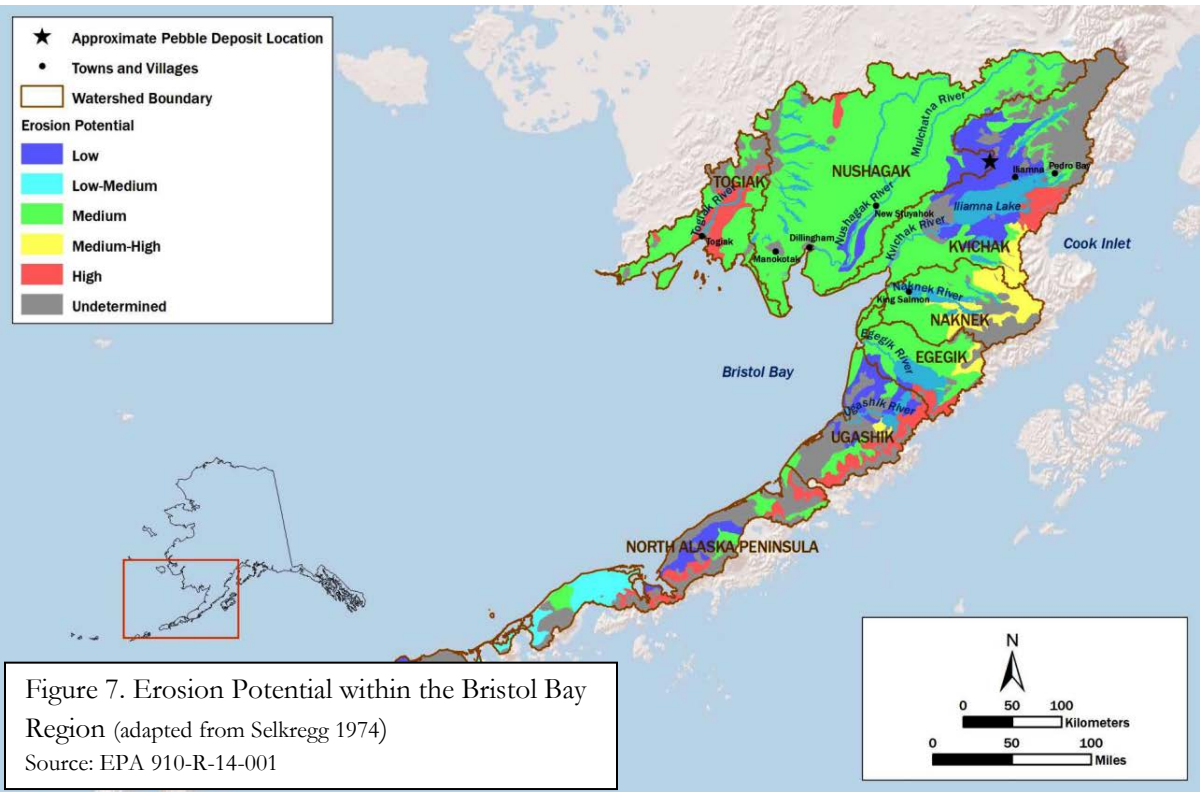

Figure 7. Erosion Potential within the Bristol Bay Region (adapted from Selkregg 1974)
Source: EPA 910-R-14-001

b. Air Quality

The Bristol Bay region has excellent to good air quality due to the remoteness of the region and lack of high population densities. There is little pollution due to extremely few industrial or commercial facilities. The particulates in the air in large part are due to the burning of diesel fuel for the municipal generation of electricity and burning wood as a primary or secondary source of heat in homes in the region's communities. There are occasions of localized dust from roads and beaches due to high winds in the winter and spring. Some pollution from counties on the Asian continent has the possibility to settle in this region due to the jet stream air currents.

c. Water Quality

The streams and rivers in the Bristol Bay area support 50 percent of the world's salmon and 40 percent of these are caught for the world's commercial sockeye and pink salmon markets. These river systems are used by the local residents for transportation, subsistence fishing, recreation, and other uses. The rivers and streams are relatively free of manmade pollution other than areas of higher concentrations of people in communities or some sections of rivers during the summer commercial driftnet and set-net fisheries. Freshwater habitats range from headwater streams to braided rivers, small ponds to large lakes, side channels to off-channel alcoves.

Extensive glacial deposits provide for extensive connectivity between groundwater and surface waters in the region (Power et al. 1999). This groundwater–surface water connectivity has a strong influence on the hydrologic and temperature qualities of streams in the Nushagak and Kvichak River watersheds, and provides a moderating influence against extremes of both summer heat and winter cold in streams where this influence is sufficiently strong. Notably, the Nushagak and Kvichak River watersheds also encompass an abundant and diverse array of aquatic habitats containing over 33,000 miles of streams, 14 percent of which have been documented as anadromous fish streams (Johnson and Blanche 2012). Because salmon rely on clean, cold water flowing over and upwelling and downwelling through porous gravels for spawning, egg incubation, and rearing (Bjornn and Reiser 1991), areas of groundwater exchange create high-quality salmon habitat. For example, densities of beach spawning sockeye salmon in the Wood River watershed were highest at sites with strong groundwater upwelling and zero at sites with no upwelling (Burgner 1991).

d. Wildlife Resources

Bristol Bay is well known for its fisheries resources – notably the world's largest wild salmon return, but the region also contains spectacular scenery and unmatched bird and wildlife habitat. Within the region are two national parks, five national wildlife refuges, and eight state protected areas. In addition to pristine habitats for dozens of marine mammal species, the region is home to a full array of Arctic land mammals, waterfowl, and migratory birds, and one of the world's greatest concentrations of seabird colonies. The Bristol Bay region is home to at least 283 species of wildlife, including 33 kinds of fish,

201 birds, 31 land mammals, 17 marine mammals, and 1 amphibian – the wood frog (USFWS Togiak Refuge 2013).

Birds: Some of the world's most important habitats for birds are found along the shorelines of Bristol Bay (Figure 8). The region's many coastal lagoons, wetlands, and bays are important for migrating waterfowl and shorebirds including much of the world's population of black brant and emperor geese, and two threatened species: Steller's and spectacled eiders. Four migratory flyways overlap here, with birds from Africa, Asia, North America, South America and the Central Pacific islands all migrating to and from the region. The region's terrestrial birds include bald eagles, rock ptarmigans, Arctic terns, sandhill cranes, golden-crowned sparrows, Arctic warblers, and other songbirds.

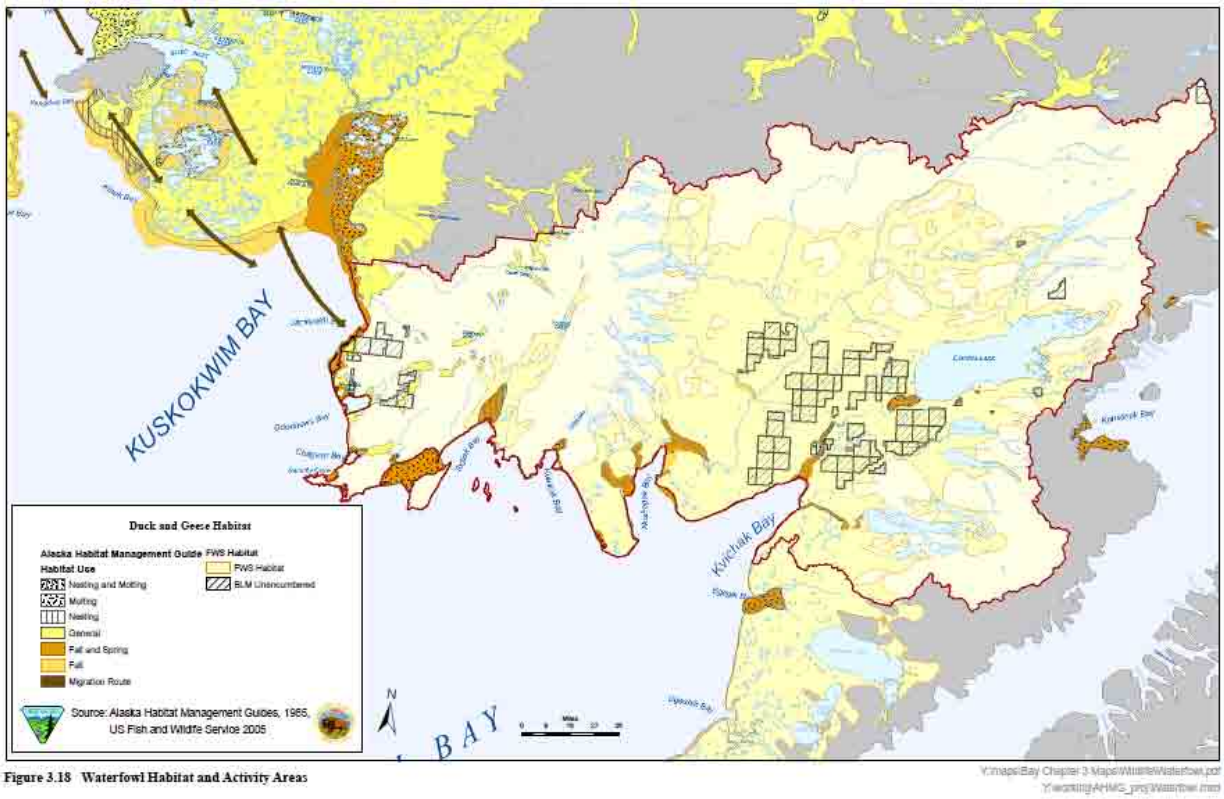

Figure 8. Waterfowl Habitat and Activity Areas

Land Mammals: The pristine landscapes of the region support a full array of Arctic wildlife including moose (Figure 9), caribou, brown and black bears, beaver, wolverine, lynx, porcupine, fox, and wolves. A population of seals lives at Lake Iliamna, Alaska's largest freshwater lake. The Nushagak Peninsula, in the southeastern portion of Togiak Refuge, was the site of a 1988 caribou reintroduction (Figure 10). The region's wildlife is vitally important to Native people who rely on subsistence fishing, hunting, and trapping to feed their families and carry on social and cultural traditions. Sport fishing, sport hunting, and wildlife viewing are also important to the region, attracting visitors and accounting for many of the local jobs.

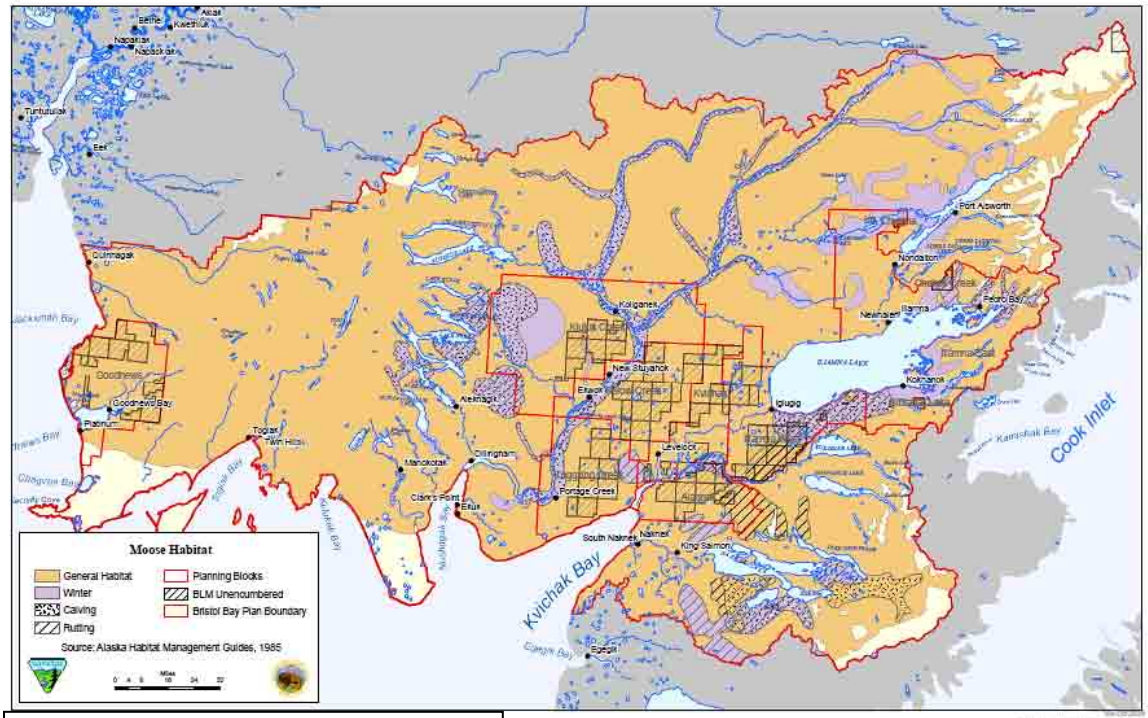

Figure 9. Moose Habitat Areas

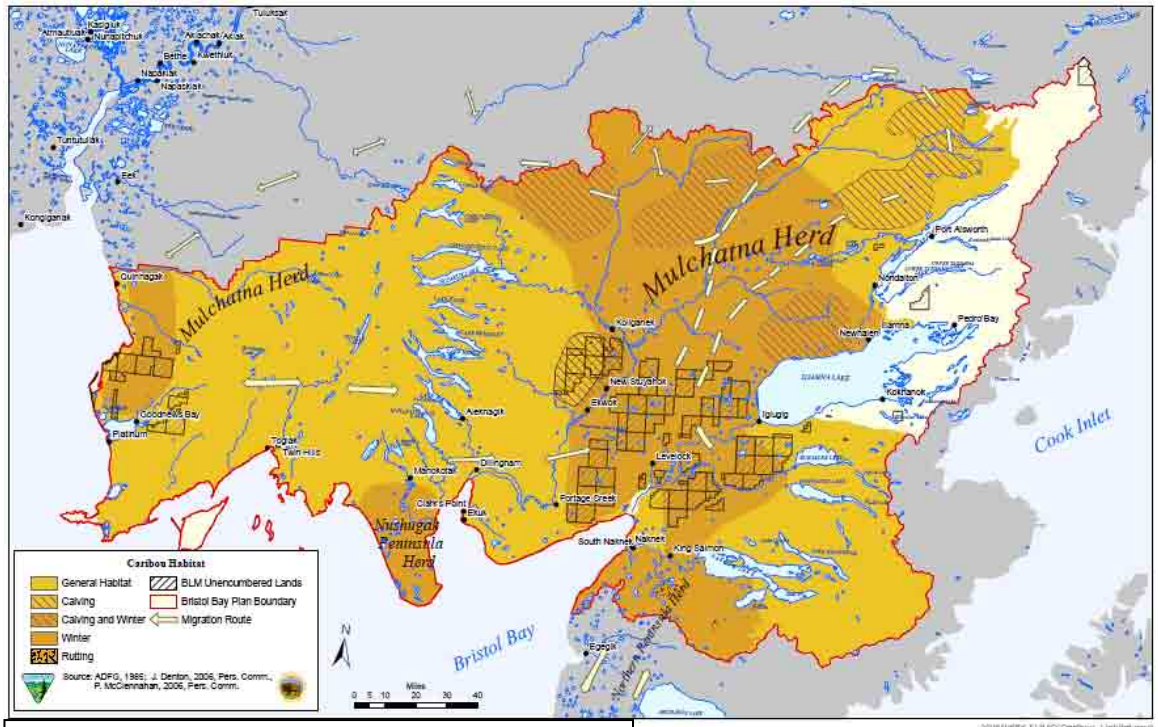

Figure 10. Caribou Range and Migration Patterns

Marine Mammals: Seventeen species of marine mammals are found along the coastline of the Bristol Bay region. The Togiak National Wildlife Refuge has haul-out sites that provide animals a place to rest after feeding forays in the Bering Sea with Cape Peirce, on the southwestern tip of the refuge, one of

only two regularly used land-based haul-outs for Pacific walrus in North America. Up to 12,000 male walrus may haul out here at one time. Endangered Steller's sea lions use haul-outs within the Refuge, as do harbor and spotted seals (USFWS Togiak Refuge 2013).

e. Fisheries Resources

The Bristol Bay region supports some 450 species of fish, crustaceans and mollusks, and contains some of the most productive salmon, rainbow trout, Arctic grayling, Arctic char, and Dolly Varden waters in the world (ADFG, 2013). Commercially important species such as salmon, pollock, Pacific cod, black cod, Pacific halibut, herring, and red king crab harvested in Bristol Bay contribute to a $2 billion annual renewable fisheries economy (Alaska Marine Conservation Council, 2013). Commercial fishing and associated fish processors have been the major industries in the region for many decades, accounting for nearly 75 percent of local employment. The world's largest wild salmon runs also provide essential subsistence food for area residents, support a multi-million dollar sport fishing industry, and are a key element of the culture of the Native peoples. All five species of Pacific salmon – pink, chum, sockeye, coho and king – spawn in Bristol Bay's rivers. The Kvichak River, which runs from Lake Iliamna to Bristol Bay, is home to the single largest salmon run on the planet, and the Nushagak River hosts the largest king salmon run in Alaska.

There is growing evidence that headwaters can strongly affect stream productivity by providing diverse habitats and exerting a strong influence on downstream physical and chemical water properties. In Alaska, the combined contribution of headwater streams may be especially large. Research conducted by the Kachemak Bay Research Reserve has shown that headwater streams can be critical rearing habitat for juvenile salmon, Dolly Varden, and other fish species. Groundwater inputs are an important contributor to headwater stream flows, which are clearly an important aspect of overall fish habitat (KBRR, 2013). Thus, careful conservation of headwaters and their habitats for juvenile fish becomes a key aspect of forest and fire management activities in these areas.

f. Forest Resources

More than 500 kinds of plants grow in the Bristol Bay region in a variety of habitats that include fresh and saltwater wetlands, open water, meadows, mountains, tundra, and forests of spruce, birch, and cottonwood. The vast amount of lands within the region are comprised of moist and wet tundra with forest lands concentrated in the watersheds of the Nushagak and Kvichak Rivers predominantly as lowland spruce-hardwood forests comprised of white and black spruce, paper birch, cottonwood, alder and willow (Figure 11). In the lands of the Wood River Mountains, the forests are primarily upland spruce-hardwood forests of white spruce and paper birch.

Under contract by BBNA Forestry Program, a forest inventory of the BBNA region was conducted during 2006 by the Tanana Chiefs Conference (TCC) Forestry Program staff. The forest inventory report was completed and submitted to BBNA in April of 2007 and is contained in Appendix A. Timber

volume estimates for the entire inventory are at 7,731,036 cubic feet, with 65 percent of the estimated cubic foot volume in the Dillingham Subunit, 20 percent in the Kokhanok Subunit, and 15 percent in the Nushagak Subunit. This inventory documented that the predominance of forested Native allotments occurs in the Nushagak Bay Sub-region (Dillingham Subunit) totaling 12,548 acres of Native allotments with forested acres being 56.2 percent of the vegetation cover type with wetlands comprising 19.8 percent while shrublands comprised 6.4 percent. The Nushagak Sub-region (Nushagak Subunit) contains 7,280 acres with forested acres being 48.6 percent of the vegetation cover type with shrublands comprising another 37.6 percent and wetlands comprising 9.4 percent. The Iliamna Sub-region (Kokhanok Subunit) contains 5,937 acres with forested acres being 38.7 percent of the vegetation cover type with shrublands being the predominant cover type at 52.6 percent. For the total of these primary forested subunits, over an area of 25,765 acres, forest lands comprised 50 percent of the vegetative cover type. Of this, poletimber comprises 30 percent and sawtimber 20 percent of the forested acreage.

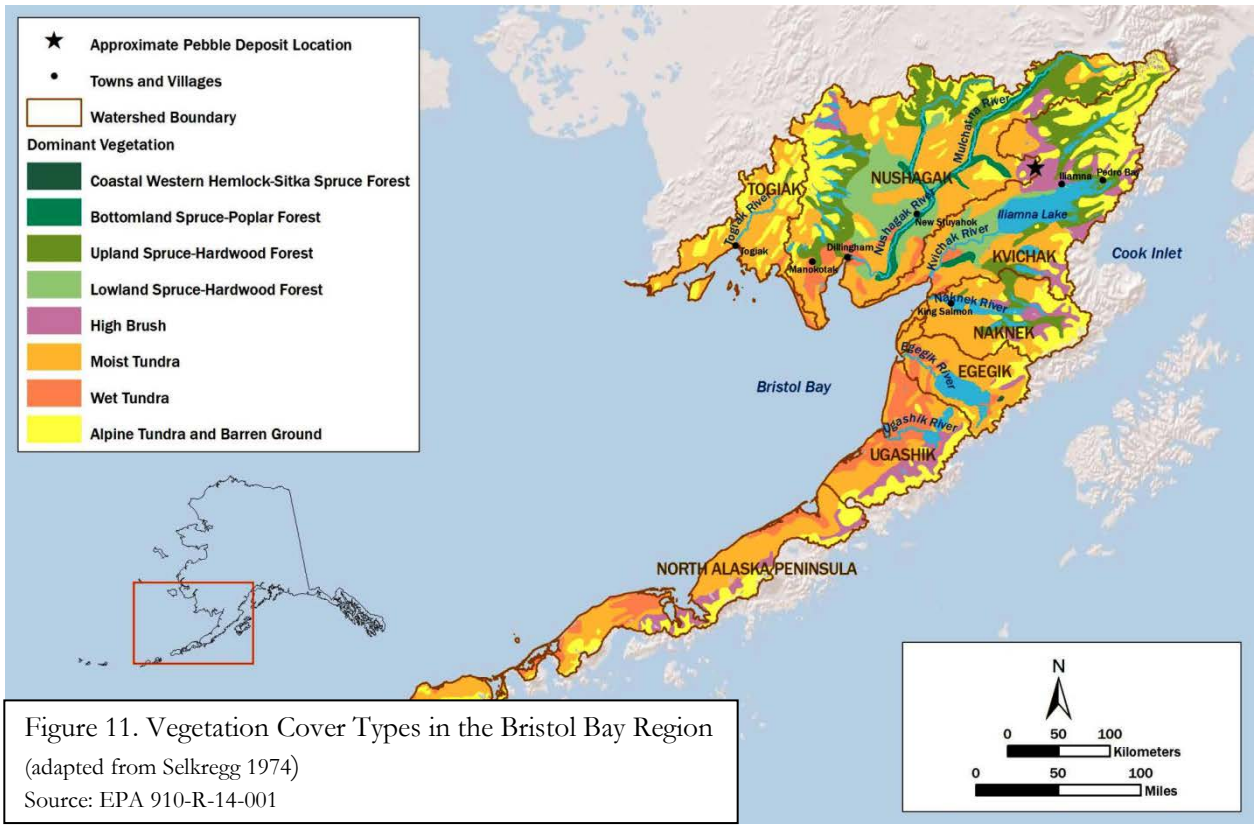

Figure 11. Vegetation Cover Types in the Bristol Bay Region
(adapted from Selkregg 1974)
Source: EPA 910-R-14-001

Invasive species: There are a variety of invasive species of plants identified throughout the Bristol Bay region and documented through the Alaska Exotic Plants Information Clearinghouse (AKEPIC). AKEPIC is a database that provides geospatial information for non-native plant species in Alaska and neighboring Canadian Territories as the result of an ongoing cooperation among the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Alaska Department of Natural Resources' Plant Material Center, and Alaska Natural Heritage Program in support of the Alaska Committee for Noxious and Invasive Plants Management (CNIPM). A list species and a sheet of the most common invasive plants are provided in Appendix E.

C. Cultural Resources

Many of Bristol Bay's year-round residents are descendants of Aleut-Alutiiq, Athabascan, and Yup'ik Eskimo heritage. These Alaska Natives live in villages along the shores of the bay and the region's many rivers and lakes. Subsistence activities remain an essential element of life. Seasonal food-gathering rituals are shared across regions and generations, bringing families together and shaping social and cultural traditions (Figures 12, 13, 14). Salmon is one of the more important subsistence foods, comprising nearly half of the average Bristol Bay Native family's diet, and the focus of many traditions. One important tradition is the summer fish camp where families gather to catch and preserve their supply of salmon for the year. Traditional customs of the Yup'ik, Aleut, Alutiiq, and Athabascan are still evident in this region. Each of the Native peoples of the Bristol Bay region has their own distinct Native language and dialect that distinguish them from one another.

The Aleut and Alutiiq who live on the ocean side of the Alaska Peninsula were confined to the coasts because of rugged mountainous terrain. Skilled kayakers subsisting mainly on fish and sea mammals made two types of sea vessels: one a small canoe known as the kayak or baidarka, and the other a large open boat called the angyat or baidar. The main food sources were seals, whales, salmon, halibut, shellfish, and other sea creatures. These resources were not only harvested for food, but also for clothing, boats, and as oil for lamps. Land mammals such as caribou were taken by spear or bow and arrow. Large nets were used to capture birds such as cormorants, ducks, and sea parrots for use in making parkas. Whales were obtained mainly by use of poisoned spear blades.

The Dena'ina Athabascans occupied lands around Iliamna Lake and Lake Clark and subsisted primarily on the abundant runs of red salmon, moose, caribou, bear, beaver, porcupine, and waterfowl. Canoes were made of birch bark, moose hide, and cottonwood. To the Dena'ina, creation began with raven, known as the trickster and as a mischief-loving deity and their oral history is filled with stories of raven to teach and entertain.

The Yupiit (plural for Yup'ik) on the Bristol Bay side of the peninsula were primarily hunters and fisherman, subsisting on caribou, moose, bear, and other land animals as well as waterfowl and ptarmigan. Salmon was harvested with the use of gill nets made of spruce root, while smaller fish were taken with scoop nets. Fish traps, harpoons, weirs and bone hooks were also used to take fish. Caribou were prized not only for their meat, but for their skins which were used to make clothing and or to trade. Caribou were hunted with bows and arrows, and snares. Brown bear skins were prized for bedding and as hangings at entrances in place of doors. Brown bears still outnumber people in the Bristol Bay region.

The Natives of Bristol Bay were, and still are, gatherers of berries and plants such as greens, mushrooms, and seaweed while other plants and berries were gathered for medicinal purposes. Today, many Alaska Natives of the Bristol Bay region continue to live in the areas settled by their ancestors. They weave a rich culture filled with dancing, songs, stories, Native food gathering, hunting, and fishing (BBNC, 2013).

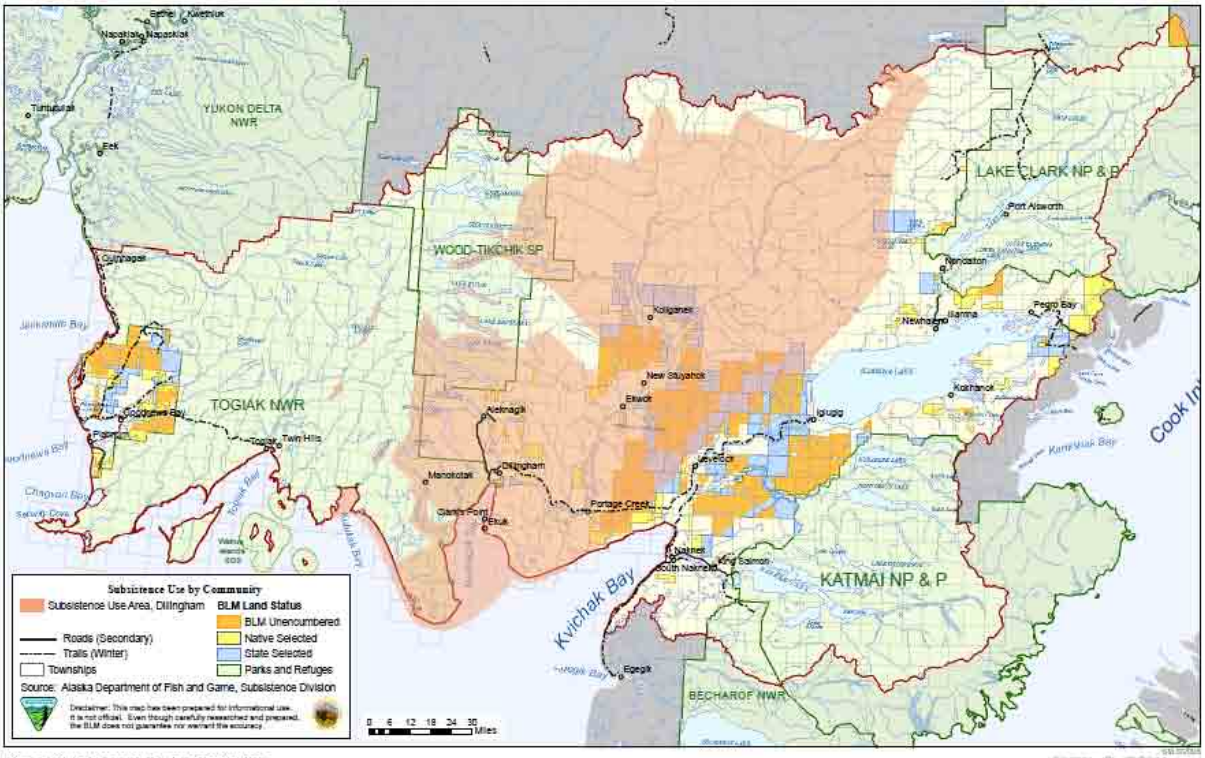

Figure B.2 Subsistence Use Area, Dillingham

Figure 12. Subsistence Use Area by Community: Dillingham

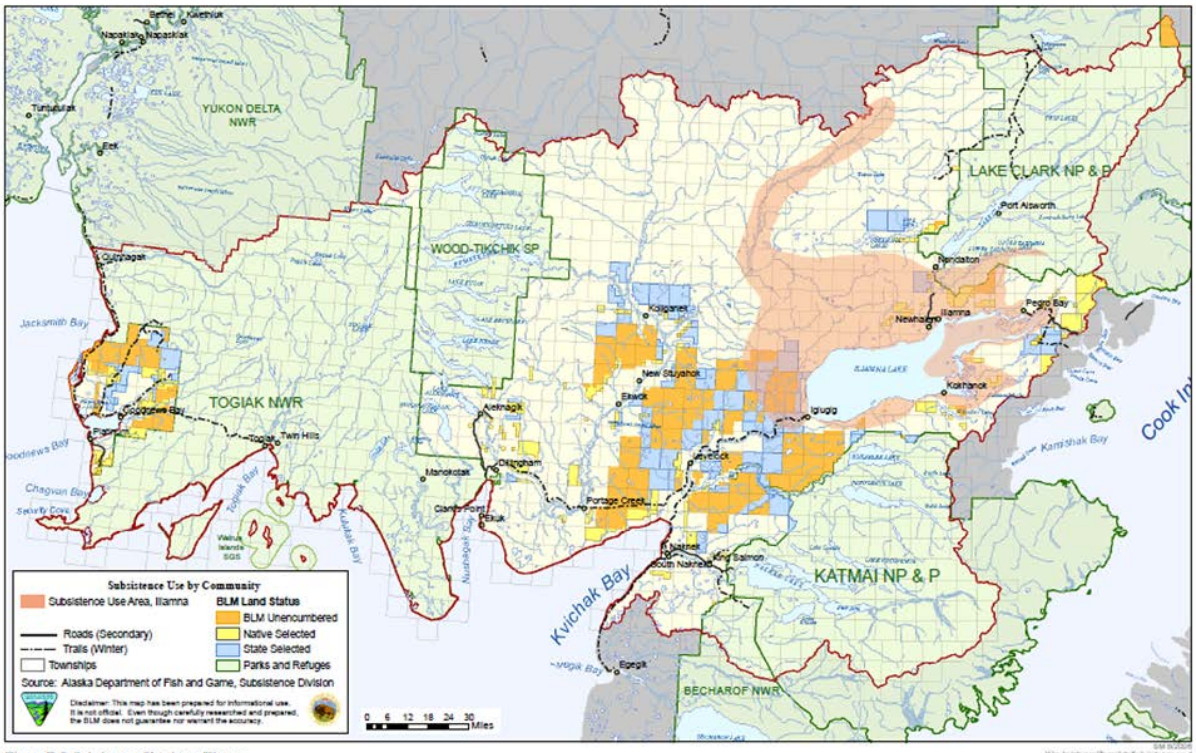

Figure B.5 Subsistence Use Area, Iliamna

Figure 13. Subsistence Use Area by Community: Iliamna

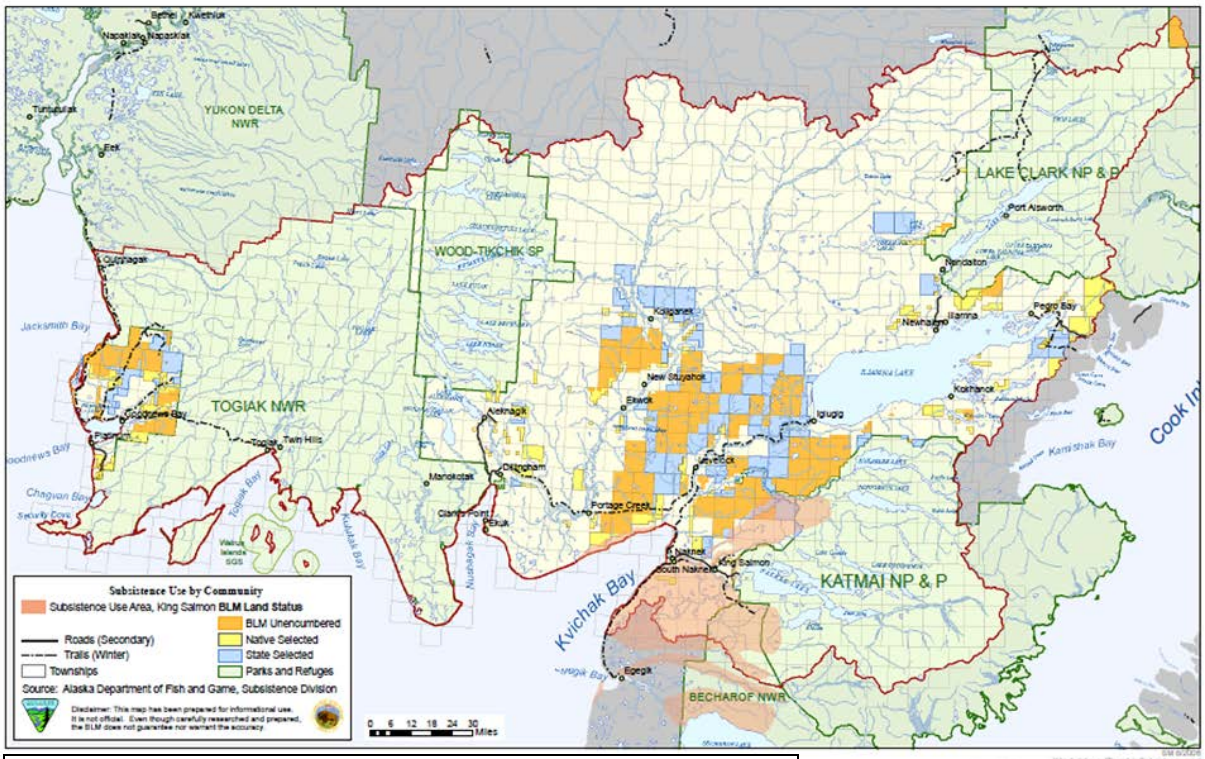

Figure 14. Subsistence Use Area by Community: King Salmon

D. Fire and Fuels

This area of southwest Alaska is within the maritime climatic zone with precipitation relatively evenly disbursed throughout the year with wetter periods during July through September. Maritime climates in general do not have the extremely dry summers of continental climates, such as Interior Alaska, or the incidents of lightening. Average high temperatures in the summer months range in the low 60-degree Fahrenheit range. Annual precipitation averages 26 inches, with more than half as summer rains.

The predominant fuel models in Alaska are black spruce/feathermoss, white spruce, hardwoods (aspen, birch, and cottonwood), mixed spruce/hardwood, tall shrub, tussock tundra, and grass. The fire behavior can range from a creeping slow-burn ground fire to a wind-driven running crown fire.

Black spruce/feathermoss forests often contain a flammable low shrub layer of Labrador tea, mountain cranberry and bog blueberry that can carry a flame one to three feet above the surface. From that point, ignition into the black spruce crown is frequent because of numerous dead and live branches that grow near to the ground. Black spruce trees have resinous needles and contain extremely low moisture content that contributes to its high fire susceptibility. Black spruce trees growing in wet soils are generally underlain by permafrost leaving the trees unable to absorb the available water. All these factors enable this forest type to be quite flammable with a tendency to produce crown fires with spotting potential. The permafrost areas also can contain deep organic mats that may allow fires to holdover under the surface for a year or more.

White spruce forests usually are not as flammable as black spruce but can contain similar problems of fuel laddering into the crown, holdover fires in the organic layer, and crown firing especially when the spruce grows in dense stands. Due to greater tree heights, spotting ahead of the main fire can be a problem when the embers are lofted during crown burning and carried by the wind. These stands are commonly mixed with significant amounts of birch and balsam poplar. Within the three primary forested sub-regions, the white spruce type is present on 19 percent of the Native allotment areas while the mixed spruce/hardwood type is present on 26 percent of the Native allotment areas.

In mixed stands, fire intensity, the amount of heat released at the flame front, generally increases in relation to the amount of spruce in the stand. Hardwood stands and tall shrub vegetation types usually do not burn as readily as spruce forests and crown fires are rare. Fuels under these types are generally of low density and flammability. Fires may occur in these types before green up in spring and again in the fall after leaf drop. Within the three primary forested sub-regions, the hardwood type is present on 3.7 percent of the Native allotment areas. The tall shrub type is present on 25.8 percent of the Native allotment areas.

From a fuels and fire standpoint, tussock tundra is similar to grassland vegetation types. Most of the flammable material is fine fuels and includes small low shrubs and loosely packed dead grass. The fuel moisture content fluctuates rapidly. Because the fuel content can be high with few breaks in ground coverage, fires can be intense when burning under dry and windy conditions. Fires in this vegetation type can be difficult to contain. Fire line building is sometimes ineffective because of deep layers of organic matter and mop up is slow. Because dead grass is retained on the tussock mounds, this type can burn whenever the ground is snow free. Tussock tundra and low shrub vegetation types occur on 4 percent of the Native allotment areas while it is assumed that the allotments not classified for vegetation are mostly covered with tussock tundra and low shrub.

The Bureau of Land Management Alaska Fire Service (AFS) located at Fort Wainwright, Alaska, provides wildland fire suppression services for all Department of the Interior and Native Corporation Lands in Alaska. In addition to suppressing wildland fires, AFS has other statewide responsibilities, including: interpretation of fire management policy; oversight of the BLM Alaska Aviation program; planning, implementing, and monitoring fuels management projects; disposing of hazardous materials; and operating and maintaining advanced communication and computer systems such as the Alaska Lightning Detection System. AFS operates on an interagency basis - cooperators include the Bureau of Land Management, State of Alaska Department of Natural Resources, USDA Forest Service, National Park Service, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and the U.S. Military in Alaska.

The Alaska Interagency Coordination Center and BLM/AFS document fire occurrences in Alaska. As shown in Figure 15, historically there have been limited major fires within the Bristol Bay region.

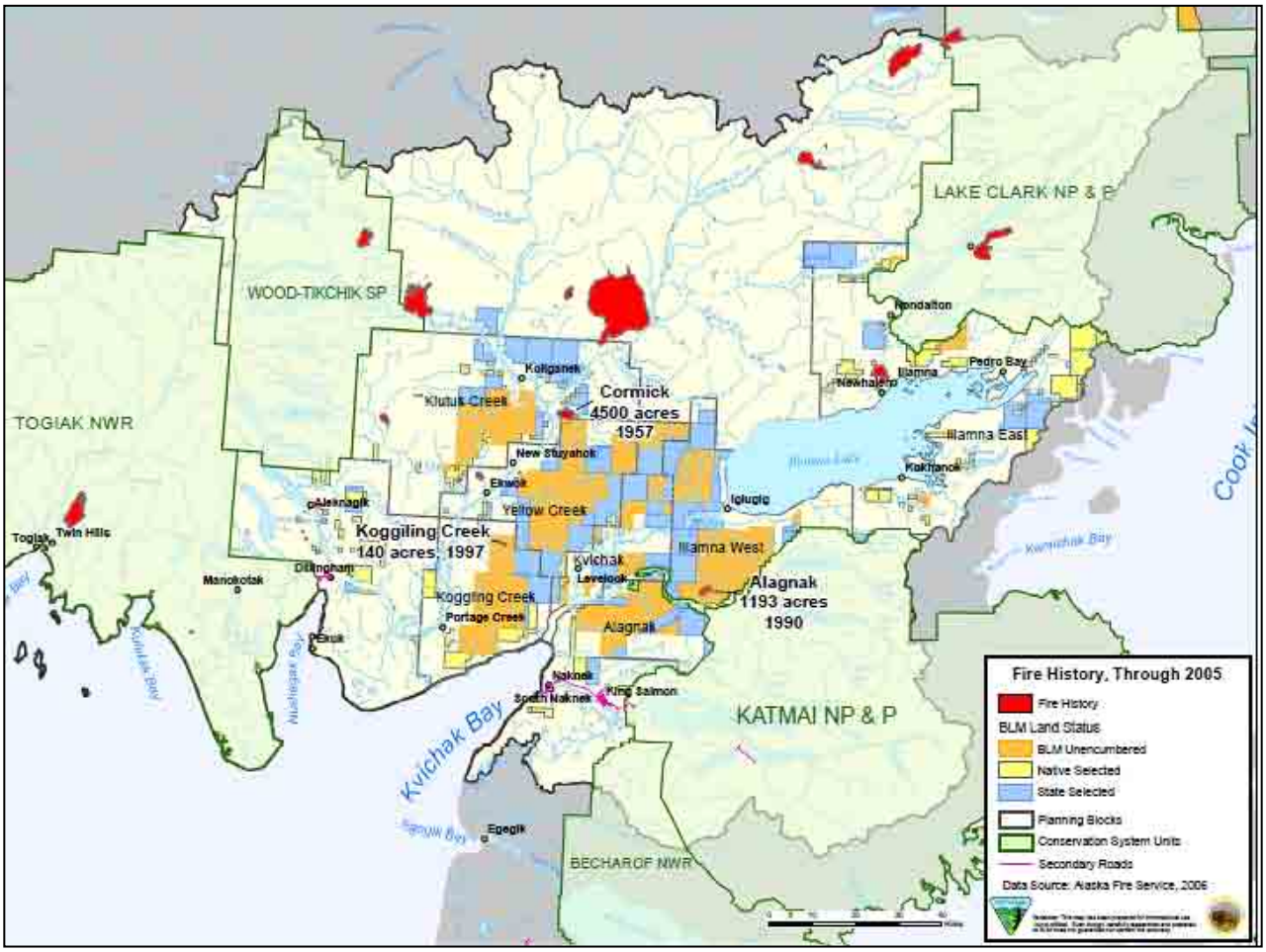

Figure 15. Bristol Bay Region Fire History Through 2005

E. Other Land Uses

Beyond village or community population centers and subsistence resource uses discussed, there are few other land use patterns in the vicinity of Native allotments in the region with the exception of historic fish canneries as an outgrowth of the Bristol Bay salmon fishery. There is little agricultural activity in the region with small garden plots and small-scale livestock and poultry operations scaled as subsistence activities rather than as commercial agricultural operations. There is and has been mining activity in the region, but not in significant amounts in the vicinity of forested allotments other than the historic Red Top Mercury Retort. This site is east-southeast of Aleknagik on the north shore of the Wood River where cinnabar rich in mercury was mined from 1943 to 1955 and later processed at a retort facility from 1952 to 1955. There are very limited road networks centering out of villages and communities.

There are brownfield sites noted on the BBNA Brownfield Program webpage as possibly contaminated sites and/or under-used or abandoned facilities in the areas of Chignik, Ekwok, Manokotak, New Stuyahok, Pilot Point, and Ugashik.

There have been 223 reported spills or sites of contamination as presented by the Alaska Department of Environmental Conservation's Division of Spill Prevention and Response with many of these related to petroleum storage as heating oil or diesel fuel.

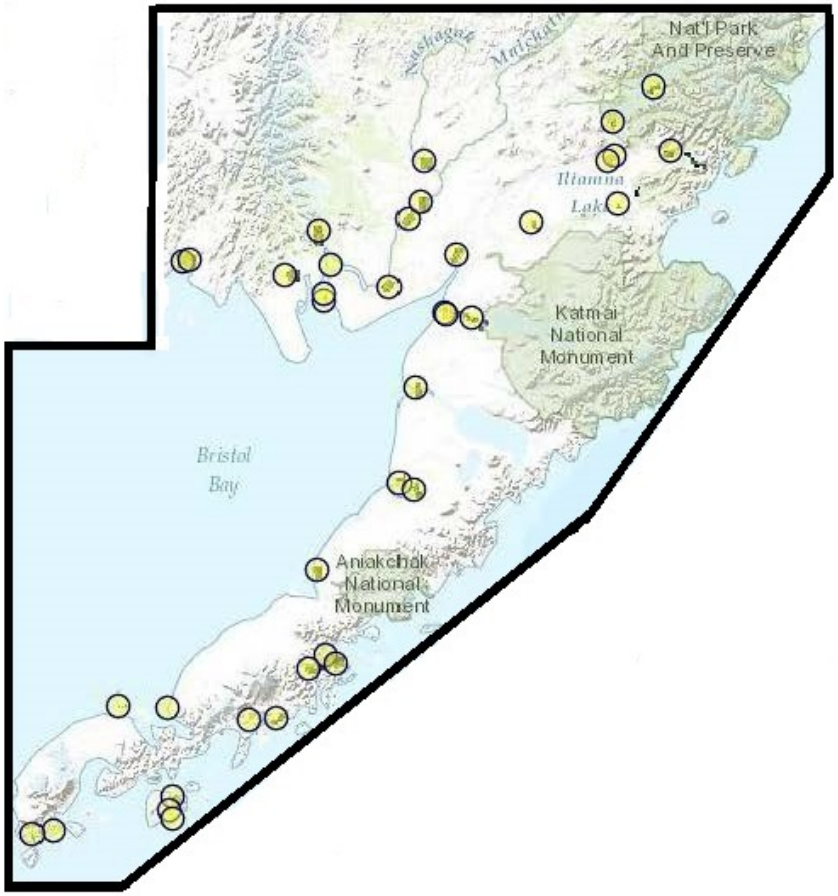

Figure 16. Spatial Distribution of Spills and Contaminated Sites in Bristol Bay
Source: AKDEC Division of Spill Prevention and Response

IV. REGIONAL GOALS AND OBJECTIVES

Goals reflect issues or concerns and also provide program direction and focus on the outcomes of an activity. Objectives are clear, specific, measurable statements of actions which if successfully implemented move the program or process forward. In other words, objectives describe action steps to meet a goal. Though individual Native allotment owners will have varying goals and objectives for their allotment, there will be overarching regional concerns and thus regional goals and objectives that can be identified and acting upon. As the region's BIA service provider for their compact Tribes, BBNA has in its mission the fundamental responsibility to the Native peoples of this region to manage a variety of services for their health and well-being, as well as manage the lands and natural resources. While managing Native allotments individually as separate parcels for those owners and heirs, a landscape approach to forest and fire management is necessary to cover a broad array of issues that are most effectively addressed at a regional or sub-regional level.

The scope of this plan does include proposed forest and fire management activities. It is therefore recognized that forest and fire management actions may have not only direct and indirect effects, but these effects may be either positive or negative as to impacts on the human and natural environment.

The State of Alaska Forest Resources Protection Act (FRPA) and the Best Management Practices (BMPs) produced to assist with implementation of the Act provide a useful set of guides in the selection of practices to prevent or mitigate negative effects of forest management practices on other resource values. Though the FRPA does not apply to Native allotment lands, the voluntary application of the regulations and BMPs as guides is a beneficial approach to selecting forest management practices appropriate for meeting a variety of resource management goals. Selected BMPs are presented in the appendix for reference and consideration.

The following are goals and objectives to be considered at the sub-region and regional level by BBNA while planning for individual Native allotment owner goals:

1. **Air Quality**
   Goal: Maintain air quality and visibility customary to the pristine nature of Bristol Bay.
   Objectives:
   1. Limit the burning of brush piles and prescribed burns to those days when winds are favorable for both fire control and smoke management.
   2. Secure written approval from the Alaska Department of Environmental Management (ADEC) prior to igniting any prescribed burn.
   3. Promote clean-burning and efficient wood stoves to minimize particulates and related air pollution from low efficiency wood-burning systems.

2. **Cultural Resources**

   Goal: Protect cultural and historic resources both on and off Native allotments from adverse effects.

   Objectives:

   1. Comply with Section 106 of the National Historic Preservation Act (NHPA) by conducting archaeological reviews and on-site inspections prior to any ground-disturbing activities.
   2. Comply with other mandates as applicable under other Federal laws: Native American Graves Protection and Repatriation Act (NAGPRA), The American Indian Religious Freedom Act (AIRF), and the Archaeological Resources Protection Act (ARPA).
   3. Assist Native allotment owners in the retention and management of their lands to minimize the acreage of allotment lands that are sold in order to generate revenues, particularly sales to non-Native individuals and incorporated entities.

3. **Water Resources**

   Goal: Protect, manage and maintain water resources to maximize water quality, fish habitats, and related natural values.

   Objectives:

   1. Promote Alaska Forest Resources Practices Act (AFRPA) regulations and riparian standards as guidelines for Best Management Practices (BMPs) for all forest management activities.
   2. Incorporate buffers immediately adjacent to anadromous streams and water bodies for all ground-disturbing forest management activities.
   3. Revegetate slopes abutting streams and other water bodies after fires and/or forest management activities with native plant species.

4. **Soil Resources**

   Goal: Prevent soil erosion resulting from fire or forest management activities.

   Objectives:

   1. Contact the US Department of Agriculture, Natural Resources Conservation Service for information on soil erosion prevention.
   2. Select silvicultural and harvesting methods for the maximum amount of sunlight to reach the forest floor, subject to desired forest management conditions.
   3. Implement BMPs for all forest operations including harvesting, silvicultural treatments, and construction of access roads.
   4. To cross wetlands or permafrost soils to access forest resources, construct temporary winter roads rather than all-season permanent roads and utilize the winter months and alternative vehicles (snowmachines) to reach these areas.
   5. Do not start winter roads until frost depth reaches at least 12 inches and there is sufficient snow cover.

5. **Wildlife Resources**
   Goal: Conserve, protect, and enhance important wildlife habitats.
   Objectives:
   1. Pursuant to Section 7 of the Endangered Species Act providing for interagency cooperation, request a list of threatened and endangered species and designated critical habitats prior to beginning and significant forestry or fire management project on Native allotments.
   2. Identify critical habitat areas found on Native allotments or in areas nearby.
   3. Favor selection of silvicultural systems that enhance early successional stages for vegetation that are used as browse by moose when conducting timber harvesting or wildlife habitat enhancements.
   4. Where and when feasible, mechanically scarify soils to expose bare mineral soil as a part of forest management operations to assist with regeneration of most woody tree and shrub species.
   5. Where suitable to the site conditions and silvicultural prescription, cut, crush, or girdle deciduous trees and shrubs to encourage root and stump sprouting for enhanced moose forage. Crushing or cutting during the dormant season produces the best response.
   6. Maintain snags and woody debris that provide vertical structure and nesting cavities for wildlife species during harvesting operations or silvicultural practices.
   7. Post Native allotments with no trespassing signs to establish allotment boundaries and legal status of these trust lands to deter non-Native, non-local guides, hunters, fishers, and others.
   8. For land clearing activities, follow U.S. Fish & Wildlife guidelines to avoid the period from April 10 – July 15 as the primary time period of nesting birds (Appendix B).

6. **Fisheries Resources**
   Goal: Protect anadromous streams, rivers, and water bodies and their riparian areas as key spawning and rearing habitats.
   Objectives:
   1. Implement Alaska Forest Resources and Practices Act (AFRPA) regulations and BMPs as key guidelines with selected provisions identified as:
      a. No-cut buffer of 150 feet along anadromous rivers, or 225 feet along actively eroding outer bends.
      b. Along streams and rivers with stable channels and along lakes, a no-cut buffer of 100 feet, and the harvest of timber may not be undertaken within 100 feet of a water body.
      c. For all small streams, a buffer of 50 feet.
   2. Evaluate private driveways and related road culverts for the potential of blocking safe fish passage. Work with State, Federal, and/or non-profit agencies for potential cost-share or grant funds to address barriers to safe fish passage for the waterways of the Bristol Bay region.

7. **Forest Resources**

Goals:

1. Manage forest resources on a sustained yield basis.
2. Manage forest resources to maintain and enhance wildlife habitats while also conserving and protecting fisheries resources.
3. Maintain or improve the health and productivity of forested stands.
4. Prevent unauthorized access and timber trespass.
5. Manage Native allotments under the goals and objectives of the owner while providing for the conservation of the forest resource for future generations.

Objectives:

1. Continue updates on forest inventory data within the BBNA GIS system.
2. Continue to collaborate with other programs of BBNA to assess annual wood use and distances traveled to procure firewood for residential uses.
3. Collaborate with major landowners within the region to discuss forest resource management issues and concerns particularly regarding sustainable harvest levels.
4. Expand collaborative efforts in public information campaigns to include information on forest resources and sustainable harvest levels as a part of outreach underway on energy efficiency, energy conservation, home heating efficiencies, and alternatives to low-efficiency wood stoves and biomass boiler systems (hydronic systems) dependent upon local forest resources.
5. Identify and rank Native allotments that have forest stands that have timber development potential and solicit funding from the Bureau of Indian Affairs to provide for individualized forest management plans to actively manage these lands. Also research the applicability of conservation contracts from the US Department of Agriculture, Natural Resources Conservation Services for implementation of forest management practices.
6. Continue and expand identification and ranking of Native allotments at the greatest risk of wildland fire and further implement programs to prevent loss of timber and property from uncontrolled wildland fire.
7. Incorporate Alaska Forest Resources Protection Act (AFRPA) regulations and Best Management Practices (BMPs) as guidelines for all forest management activities, forest road construction, and silvicultural treatments as valuable guides for effective forest management.
8. Annually evaluate insect surveys and forest health analyses by the U.S. Forest Service and the State of Alaska as to potential threats to forest resources. Establish communications with agency personnel to request surveys as necessary.
9. Winter firewood or logging operations may not scarify the soil sufficiently to enable natural regeneration, especially if snow depth is deep. Mechanical scarification may

need to be prescribed followed by replanting harvested areas with seed collected in the same general locale as the harvested area.

10. For timber harvesting and land clearing activities, follow U.S. Fish & Wildlife guidelines to avoid the period from April 10 – July 15 as the primary time period of nesting birds in the Bristol Bay region (Appendix B).

8. Fire and Fuels

Goals:

1. Reduce the danger from accumulated fuels while providing for the natural role of fire in the ecosystem.
2. Minimize the potential damage to natural resources, human infrastructure, and human life from unwanted wildland fires.
3. Expanding training opportunities and seasonal employment in firefighting positions within the BBNA region.
4. Minimize impacts on air quality from prescribed fire and controlled burns.
5. Foster cooperation with other agencies for wildland fire management through advanced planning and sharing of resources.

Objectives:

1. Update and expand the ranking of allotments according to threat of wildland fires based on fuel load present, forest stand condition, topography, location, etc.
2. Provide updated allotment information to the Bureau of Land Management for purposes of wildland fire response and planning.
3. Use mechanical treatments and/or prescribed fire to reduce fuel loads while providing for the beneficial effects of fire in the ecosystem.
4. Based on ranking of allotments according to threat of wildland fire, fire-proof allotments by creating defensible space around structures. Establish fuel breaks and conduct hazard fuel treatments.
5. Support employment opportunities by encouraging and training Tribes and allotment owners to conduct hazard fuel reduction projects.
6. Limit pile burning and prescribed fire to when winds are favorable and minimize the negative impacts of smoke emissions on air quality.

V. FOREST MANAGEMENT PRACTICES

A. Identification of Commercially Viable Timber Stands

Although the historic demand for forest products in the region has been relatively low, recent socioeconomic factors driven by the cost of home heating oil has seen an increased use of firewood for primary or secondary sources of residential heating, and for biomass boilers or hydronic boiler systems, particularly around Dillingham. It is expected that timber volumes on many of these allotments may provide for fuel use opportunities. These allotments may also prove as suitable candidates for forest development activities such as pre-commercial thinning. The Nushagak Bay Sub-Region (Dillingham Subunit) comprises the majority of these allotments with forestlands totaling 2.3 cubic feet of sawtimber and 2.8 million cubic feet of poletimber. The Iliamna Sub-Region (Kokhanok Subunit) comprises a lesser number of allotments with forestlands totaling less than 0.58 million cubic feet of sawtimber and 0.97 million cubic feet of poletimber. The Nushagak Sub-Region (Nushagak subunit) is comprised of 0.18 million cubic feet in sawtimber and 0.96 million cubic feet as poletimber. Detailed tables are found in Appendix A with a summary table of acreages and timber volumes presented as Table 2 as both board feet and as cubic feet.

Table 2. Land Cover Type Acreages and Volumes for Three Forested Subregions of Bristol Bay

			Board			Cubic Feet		
Land Cover Type	**Acres**	**%**	**Per Acre**	**Total**	**%**	**Per Acre**	**Total**	**%**
Forest								
Sawtimber								
White spruce	1,247	4.8%	1,557	1,941,695	12.6%	597	744,324	9.6%
Hardwood	66	0.3%	408	26,745	0.2%	411	26,942	0.3%
Cottonwood	15	0.1%	408	6,205	0.0%	411	6,250	0.1%
White spruce - Hardwood	3,543	13.8%	1,246	4,414,815	28.6%	632	2,239,609	28.9%
White spruce - Cottonwood	9	0.0%	1,605	13,904	0.1%	697	6,038	0.1%
Sawtimber Totals:	4,880	18.9%	1,312	6,403,365	41.5%	620	3,023,163	39.1%
Poletimber								
White spruce	3,666	14.2%	1,290	4,729,991	30.6%	543	1,991,271	25.7%
Hardwood	877	3.4%	408	357,910	2.3%	411	360,542	4.7%
Cottonwood	27	0.1%	408	10,924	0.1%	411	11,005	0.1%
White spruce - Hardwood	3,153	12.2%	1,249	3,938,614	25.5%	746	2,350,809	30.4%
Poletimber Totals:	7,723	30.0%	1,170	9,037,439	58.5%	610	4,713,626	60.9%
Dwarf/Repro								
White spruce	281	1.1%	0	0	0.0%	0	0	0.0%
Dwarf/Repro Totals:	281	1.1%	0	0	0.0%	0	0	0.0%
Forest Totals:	12,884	50.0%	1,198	15,440,804	100.0	601	7,736,790	100.0
Shrubland								
Shrubland Totals:	6,656	25.8%	0	0	0.0%	0	0	0.0%
Wetland								
Wetland Totals:	3,476	13.5%	0	0	0.0%	0	0	0.0%
Rivers and Lakes								
Rivers and Lakes Totals:	681	2.6%	0	0	0.0%	0	0	0.0%
Barren and Cultural								
Barren and Cultural Totals:	1,062	4.1%	0	0	0.0%	0	0	0.0%
Unknown								
Unknown Totals:	1,007	3.9%	0	0	0.0%	0	0	0.0%
Total:	**25,765**	**100.0%**	**599**	**15,440,804**	**100.0**	**300**	**7,736,790**	**100.0**

Figure 17. Native Allotments in the Dillingham Subunit

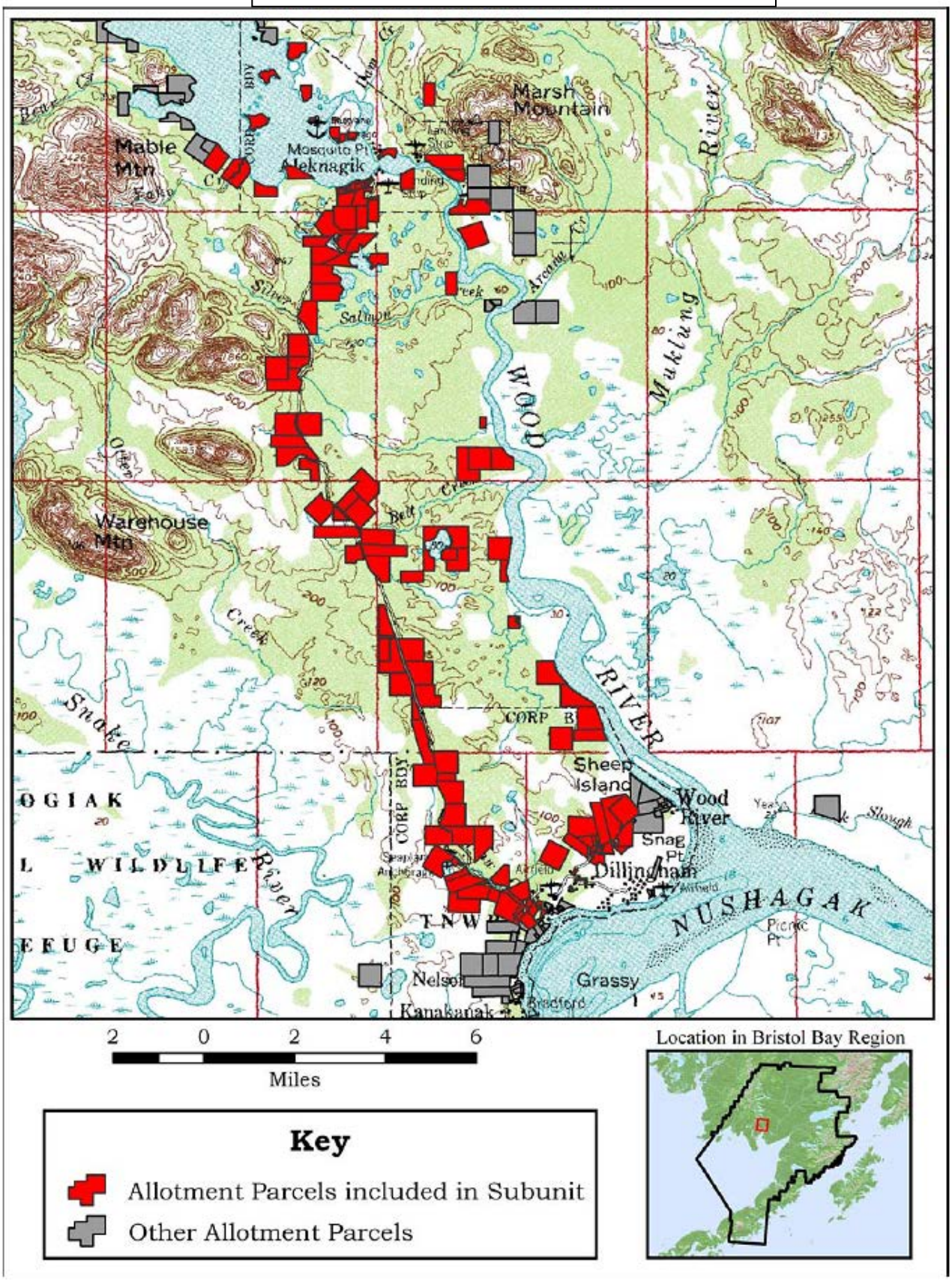

Table 3. Net Cubic Foot Timber Volume by Allotment, Nushagak Bay Sub-region, Dillingham Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 047964A	0	AKA 056278	76,653	AKAA 007643	138,654
AKA 047964B	10,040	AKA 056303A	0	AKAA 007644	1,621
AKA 053203	7,504	AKA 056318	0	AKAA 007645	143,356
AKA 053204A	6,375	AKA 056716	0	AKAA 007647	93,907
AKA 053246	1,988	AKA 058084A	33,692	AKAA 007649	87,505
AKA 053908A	20,963	AKA 058084B	0	AKAA 007650	92,678
AKA 053920	5,494	AKA 058203B	65,312	AKAA 007652	87,894
AKA 053983	0	AKA 062357	168	AKAA 007653	79,551
AKA 053991	6,650	AKA 056498B	18,245	AKAA 007654	115,056
AKA 054113	0	AKAA 000876	80,624	AKAA 007656A	43,018
AKA 054430B	66,667	AKAA 002918B	16,484	AKAA 007657A	55,396
AKA 054430C	0	AKAA 002958	73,598	AKAA 007657B	47,530
AKA 054433	0	AKAA 005793A	0	AKAA 007658A	37,981
AKA 054434	0	AKAA 005794	53,751	AKAA 007668A	48,024
AKA 054435	0	AKAA 005875A	1,821	AKAA 007671	21,493
AKA 054436A	0	AKAA 005930	78,663	AKAA 007672A	43,047
AKA 054436C	0	AKAA 005944B	23,548	AKAA 007673	20,953
AKA 054437A	2,828	AKAA 006079	2,246	AKAA 007676	109,639
AKA 054437B	0	AKAA 006093B	59,041	AKAA 007677	51,344
AKA 054442	0	AKAA 006093C	0	AKAA 007679A	57,227
AKA 054445	168	AKAA 006094	0	AKAA 007681	105,825
AKA 054446	45,456	AKAA 006125A	32,853	AKAA 007699A	700
AKA 054448	0	AKAA 006251	0	AKAA 007699B	568
AKA 054453A	3,352	AKAA 006334	29,242	AKAA 007700	45,551
AKA 054460B	5,386	AKAA 006431C	45,103	AKAA 007701	78,137
AKA 054462	21,954	AKAA 006626	4,152	AKAA 007706	90,159
AKA 054464A	43,649	AKAA 006997	48,213	AKAA 007707	36,937
AKA 054465	25,115	AKAA 007109	67,081	AKAA 007709A	83,340
AKA 054467	38,364	AKAA 007270B	4,554	AKAA 007756	76,543
AKA 054471	38,392	AKAA 007273	90,383	AKAA 007759C	47,449
AKA 054481	999	AKAA 007276A	19,741	AKAA 007760B	33,775
AKA 054482	68,269	AKAA 007276B	29,835	AKAA 007762	32,187
AKA 054484	35,494	AKAA 007277B	42,979	AKAA 007763	73,541
AKA 054487A	0	AKAA 007279B	43,313	AKAA 007795	48,218
AKA 054488	27,676	AKAA 007280A	30,540	AKAA 007797	4,600
AKA 054491	5,473	AKAA 007281B	11,673	AKAA 007904	81,733
AKA 054492A	2,246	AKAA 007281C	21,042	AKAA 007905	91,128
AKA 054493A	1,145	AKAA 007281D	0	AKAA 007908	57,051
AKA 054494A	0	AKAA 007282	22,508	AKAA 008051	17,730
AKA 054527A	0	AKAA 007288C	12,167	AKAA 008106	109,927
AKA 054529A	2,733	AKAA 007289A	878	AKAA 008107	148,392
AKA 054530	42,696	AKAA 007289B	28,074	AKAA 008113A	65,613
AKA 054832	0	AKAA 007294A	14,454	AKAA 008136	0
AKA 054833	0	AKAA 007307A	46,698	AKAA 008260	22,169
AKA 055534	40,404	AKAA 007594B	20,593	AKAA 008279	5,380
AKA 055904A	0	AKAA 007614	82,320	AKAA 008784	13,367
AKA 055924	5,126	AKAA 007638	41,416	AKAA 051012	83,149
AKA 055996A	0	AKAA 007640	69,448	AKAA 055918	5,789
AKA 056124	74,979	AKAA 007642A	4,903		
AKA 056177A	1,635	AKAA 007642B	92,035		

Figure 18. Native Allotments in the Kokhanok Subunit

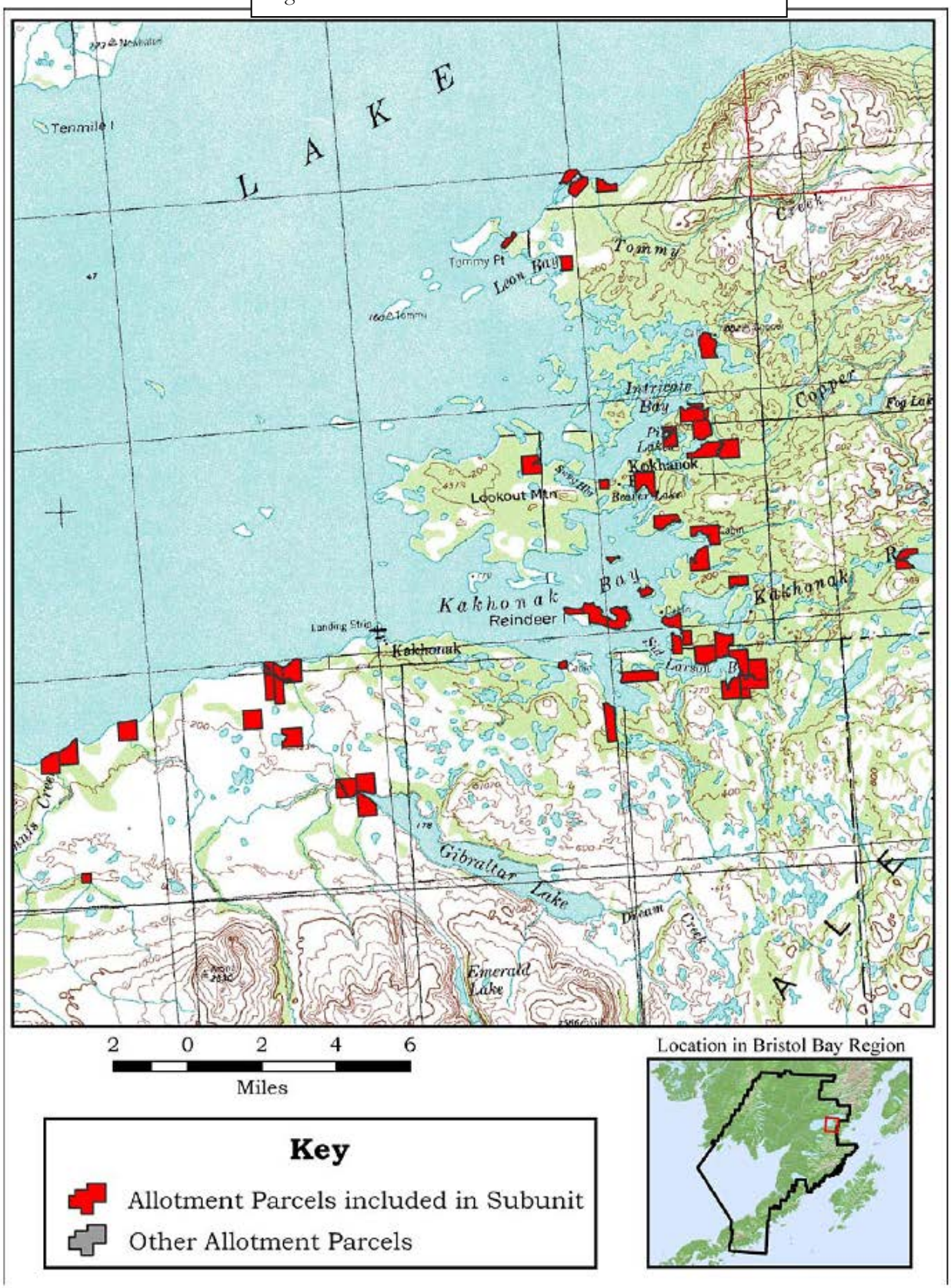

Table 4. Net Cubic Foot Timber Volume by Allotment, Iliamna Sub-region, Kokhanok Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 052503	3,182	AKAA 006263	0
AKA 052505	0	AKAA 006264	585
AKA 052510	94,686	AKAA 006265	33,832
AKA 052690B	81,698	AKAA 006266	9,888
AKA 059683	11,656	AKAA 006267	1,556
AKA 061756	20,113	AKAA 006268	0
AKA 063274B	24,445	AKAA 006507A	0
AKA 063810	48,989	AKAA 006507B	22,966
AKAA 002714	105,549	AKAA 007058	58,874
AKAA 006123	74,507	AKAA 007344	43,708
AKAA 006205	1,116	AKAA 007345	74,170
AKAA 006210	0	AKAA 007527A	6,250
AKAA 006211B	25,678	AKAA 007527B	0
AKAA 006211D	0	AKAA 007544	16,729
AKAA 006213A	37,478	AKAA 007546	74,259
AKAA 006213B	6,305	AKAA 007555A	68,195
AKAA 006216	0	AKAA 007555B	2,569
AKAA 006219	45,350	AKAA 007898	52,483
AKAA 006222	32,697	AKAA 007899	50,263
AKAA 006232	78,583	AKAA 008063	81,688
AKAA 006259	15,440	AKAA 008065A	23,451
AKAA 006260	110,270	AKAA 008065B	11,229
AKAA 006261	2,006	AKAA 008065D	16,207
AKAA 006262	0	AKAA 008252	85,790

Figure 19. Native Allotments in the Nushagak Subunit

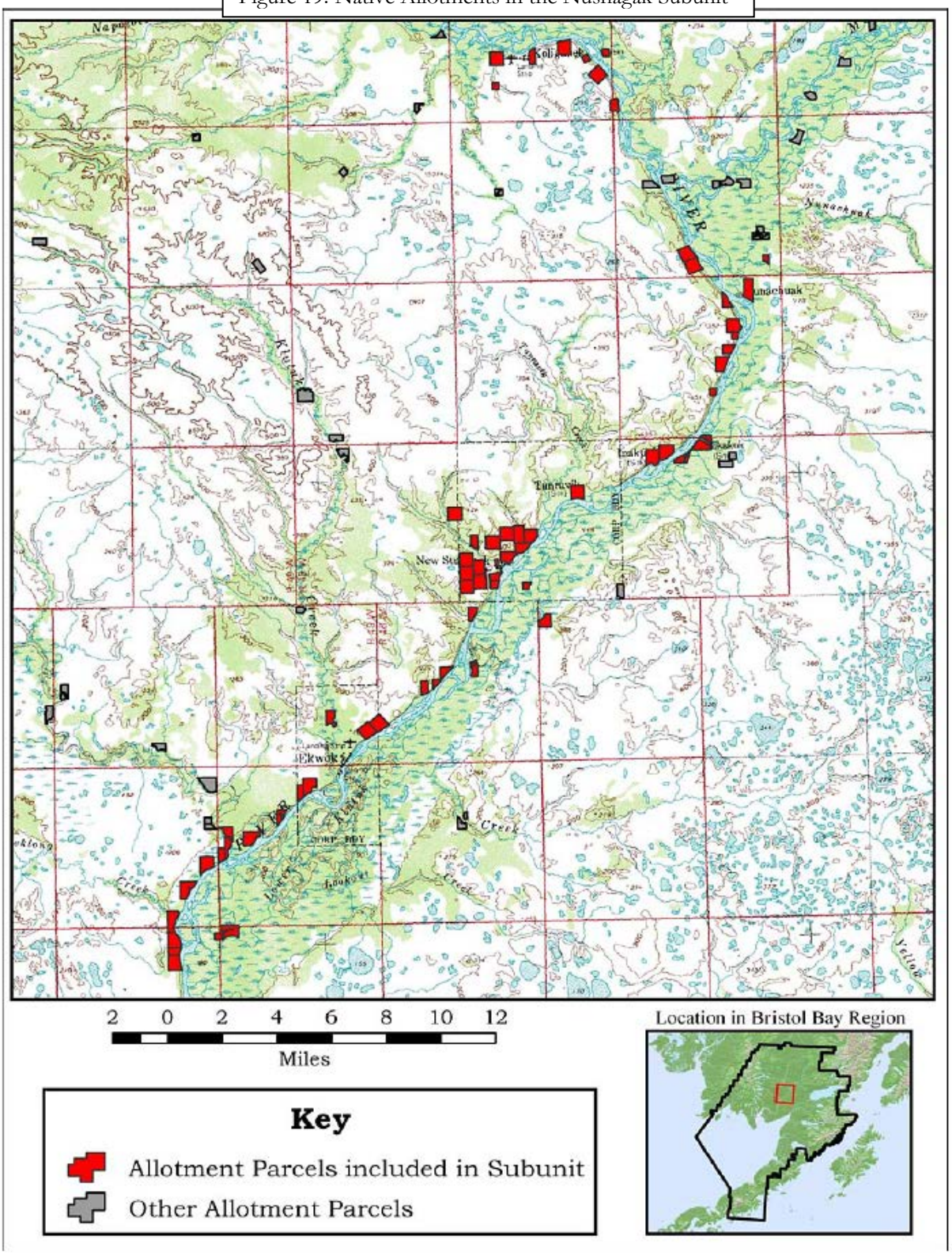

Table 5. Net Cubic Foot Timber Volume by Allotment Parcel, Nushagak River Sub-region, Nushagak Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 054026A	10,217	AKAA 007665	6,439
AKA 054026B	13,549	AKAA 007678	45,249
AKA 054026C	6,109	AKAA 007683	4,785
AKA 054027	5,017	AKAA 007684	47,910
AKA 054029	4,213	AKAA 007687A	11,684
AKA 054031A	17,366	AKAA 007687B	6,329
AKA 054031B	18,164	AKAA 007688	23,233
AKA 054033A	3,118	AKAA 007690B	24,278
AKA 054033B	9,593	AKAA 007691A	12,759
AKA 054034A	31,559	AKAA 007691B	19,652
AKA 054035	31,400	AKAA 007692	18,729
AKA 054036A	35,547	AKAA 007694B	21,944
AKA 054037	43,668	AKAA 007714B	8,271
AKA 054817	14,247	AKAA 007715	3,582
AKAA 006317	50,763	AKAA 007716	79,626
AKAA 006375B	13,415	AKAA 007764B	14,103
AKAA 006376	8,818	AKAA 007766B	12,179
AKAA 006379	47,943	AKAA 007768	50,089
AKAA 006380B	22,940	AKAA 007771	31,238
AKAA 006385	29,159	AKAA 007774	7,088
AKAA 006392A	1,077	AKAA 007775B	8,257
AKAA 006398	10,833	AKAA 007784B	2,845
AKAA 006400	10,603	AKAA 007810A	0
AKAA 006406	3,423	AKAA 007812A	5,584
AKAA 006410	0	AKAA 007837A	14,616
AKAA 006413	23,295	AKAA 007838A	6,165
AKAA 006420	41,770	AKAA 007850C	0
AKAA 006422	31,142	AKAA 007852B	13,768
AKAA 006721	11,976	AKAA 008115C	11,888
AKAA 007662	33,985	AKAA 008292	13,342
AKAA 007663	918	AKAA 057642	13,541
AKAA 007664	14,043	AKAA 081231B	9,211

Mature High Risk Stands: Mature high risk timber stands are those stands that are deemed valuable and that are particularly susceptible to loss due to animals, insects, disease, fire, flooding, stream bank erosion or property development. Many of these stands are situated on the potential commercially viable allotments. During the field inventory performed by Tanana Chiefs Conference forestry staff in July of 2006, individual white spruce trees within stands located in the Kokhanok subunit where found to have evidence of tree bore holes with most of the beetle-killed spruce (63 percent) with the Dillingham Subunit the secondary site of beetle-kill (34 percent).

Based on the 2010 Forest Health Conditions in Alaska (USFS 2011), spruce bark beetles have been active for several years in the Bristol Bay region. The areas of Katmai National Park, Lake Clark National Park, and the Lake Iliamna area accounted for 75 percent of the total statewide spruce beetle-caused mortality in 2010. In the Lake Iliamna region, spruce beetle activity declined sharply from more than 55000 acres in 2009 to 8,400 acres in 2010. Activity persists in the Kokhanok Bay area on the southeast shores of Lake Iliamna, and mortality of susceptible trees in stands on the north side of the lake is nearly 80-90 percent. The Lake Clark area infestation has declined as well, owing to the high

percentage of susceptible host trees killed in the past several years. There remain, however, vast stands of susceptible, uninfested timber throughout much of the Lake Clark area.

Conditions Conducive to Spruce Bark Beetle Infestations

- Warm, dry summers puts stress on spruce trees and makes them more susceptible to attack from spruce bark beetles. Drought conditions may invite beetle infestations. Colder wet springs and summers will actually slow bark beetle progression. Trees are generally healthier with more moisture and, therefore, more resistant to attack.
- Spruce bark beetles generally attack mature, older, injured or fallen spruce trees. These trees produce significantly less resin than healthy trees which are able to repel many of the initial beetles trying to enter and establish galleries. Green, older trees that have recently fallen are the most susceptible to attack.
- Old dead trees are not attacked by beetles.

Signs of Beetle Infestation

- Signs of spruce bark beetles include small holes or mounds of saw dust on the tree and tree base. A small section of bark from an area near the bore holes can be pulled off to expose the inner layer of the bark. Tunneling pathways in this layer is evidence of infestation.
- Reddening of the spruce needles is evidence that the tree is being killed by something. Examining the tree as detailed above can help determine the cause.

Methods to Avoid Infestations

- Spruce bark beetles generally don't feed on young trees. To improve the overall condition of stands, thinning can be performed to increase residual tree vigor and remove some of the older, large diameter spruce trees that are most susceptible to attack.
- Adult spruce bark beetles over-winter under the bark at the tree base. This area is generally in the root flare of the tree below ground level. When cutting down infested trees, cut as low as possible to the ground to remove potential breeding sites.
- Spruce bark beetles can feed on downed spruce trees for 2 years before the moisture content becomes too low. Infested material should be cut into 4 foot lengths or less, split and cross stacked in the sun to dry. Partially de-barking the larger pieces will hasten drying.
- Spruce bark beetles cannot feed on dried spruce trees. Removing the bark or drying the wood will destroy the eggs laid underneath.

B. Silvicultural Systems

Silviculture is defined as the art and science of tending a forest by controlling forest establishment, composition and growth. Returns from silviculture are generally thought of in terms of timber production. With increased emphasis on integrated resource management, it is not uncommon for the owner to have goals other than timber production such as wildlife habitat enhancement, watershed restoration or hazard fuel reduction. The essential requirement therefore, is to define objectives with targeted outcomes and then design treatments shaped to their attainment (Smith 1962). Silviculture treatments should apply to the total cycle of forest development -at least one rotation. When deciding

on a particular system, the forest biology of the tree species being managed needs to be considered as well as the economics of the various treatments in question. White spruce and hardwood species usually develop following fire or flooding and tend to be even aged. Even aged silvicultural systems are considered better suited to boreal forest tree species because they tend to more closely resemble a fire dependent ecosystem. When fire produces clearings in the forest, soil warming occurs, which in turn increases vegetative growth. Fire also reduces the thickness of the organic mat, which increases the amount of mineral soil seedbed present and the relative amount of precipitation infiltrating mineral soil. The same general site characteristics which promote successful natural regeneration of white spruce also promote successful regeneration for the associated hardwoods. Clearcutting is one method of even aged management, but in no means the only method. Partial removal variations such as clearcutting with reserve trees, seed tree with reserve trees, and shelterwood with reserve trees, are all even aged methods of stand management.

Balsam poplar and birch are short lived pioneer species which seed and sprout profusely. Natural uneven aged stands of hardwoods are rare because the species are intolerant of shade. Under favorable conditions, stocking of young stands is dense and early growth is comparatively rapid. Tree crowns close in at an early age and mortality due to shade intolerance is high. The species are susceptible to pathogens and stands only reach ages of 90 to 100 years before they begin to disintegrate. At ages greater than 70 years however, decay can seriously degrade wood quality.

White spruce, a slower growing yet longer lived species than the hardwoods, may seed in concurrently or after the hardwoods, but then eventually overtops and replaces them over time. Since white spruce is a moderately shade tolerant species, it can exist in the understory and then respond with increased growth rates when overstory competition is reduced. White spruce generally develops as even aged stands; however, multiple age stands of white spruce can occur on floodplains and uplands when undisturbed by flooding and fire for more than 100 years.

C. Forest Development

Forest development includes activities performed in the forest to meet various silvicultural objectives. Thus forest development may include thinning, reforestation, wildlife habitat enhancement and access development. All of these activities require funding to implement. Table 6 gives a range of costs estimates for various treatments and items of forestry infrastructure.

Reforestation: Adequate reforestation of white spruce can be a difficult silvicultural treatment in the boreal forest region of southwestern Alaska. The species only produces viable seed every five to seven years with exceptional seed years every 12 years. Bare mineral soil is often required for optimal seed germination. Natural regeneration has one primary advantage over artificial regeneration and that is lower cost. This is especially important where low value and remote timber stands have been harvested. If healthy, vigorous seed trees are left after harvest and scarification (removal of moss layer patches) is performed, natural regeneration may be accomplished.

Table 6. Estimated Costs of Forest Development Practices and Infrastructure

Silviculture Costs/Acre	
Prescribed burning	$100.00+
Scarification	$100-$150
Direct seeding	$50-$75
Tree planting	$300-350
Tree thinning	$400-425
Access Costs/Mile	
Winter road construction	$3,000-$7,500
Winter road maintenance	$240-$500
Secondary road construction	$7,500-$10,000
Secondary road maintenance	$360-$750
Other Infrastructure Costs/Item	
Ice bridge construction	$2,500+
Steel bridge construction <40ft	<$50,000
Steel bridge construction >40ft	>$50,000+
Bridge maintenance	$500+
Mobilization	$300+
Culverts	$500-$750/each

Scarification should only be performed where risk of erosion is low and can be performed by blade (dozer or skidder) or by pulling a disk trencher. Maximum distance from the seed source for the spread of adequate quantities of seed is about 150-300 feet (Zasada 1971). Where prompt regeneration is desired, artificial regeneration by way of planting of one year old containerized white spruce seedlings may offer a solution. The biggest production facilities for these seedling types are located in Canada for reforestation of timber harvest operations in British Columbia and Alberta. Seed, however, needs to be collected locally and shipped to the nursery of choice. After cones are collected, they can be dried and the seed shaken out. Final seed cleaning and de-winging can be performed at the nursery. A bushel of cones can produce over 50,000 viable seeds able to be frozen for many years.

Pre-Commercial and Commercial Thinning: A program of thinning has advantages of increasing productivity of the forest, generating shareholder employment opportunities, reducing hazardous fuels, and increasing forest products marketing capabilities. Selective commercial and pre-commercial thinning of reproduction and poletimber white spruce stands can be done to increase growth per unit, increase vigor, and increase resistance to disease and insects. In thinning trials performed in the Bonanza Creek experimental forest (Van Cleve and Zasada 1976) a doubling of diameter increment was observed over a five year period. The stands were thinned to a 61% level of the initial stocking. To achieve these levels in operational practice however, care must be taken not to damage residual trees. Precommercial thinning of dense white spruce seedling/sapling stands will also increase growth. Stands such as these may occur on terraces surrounding mature spruce stands
within river floodplains

Wildlife Habitat Enhancement: Silvicultural treatments designed to replicate the random patchwork created by wildland fire on the landscape can be done to improve wildlife habitat. Treatments can be used that favor early successional habitat or late successional habitat. Spatial distribution of these two broad habitat types can influence bird and mammal populations across the landscape. Scarification as discussed above for white spruce establishment can also be performed to help with regeneration of most other woody species from natural seedfall. Maintaining deciduous trees and shrubs on specific sites also serves to reduce the risk of uncontrollable wildland fire.

Specific techniques for early successional habitat are:

- Crushing old willows with machinery to stimulate sprouting. The best results are during cold temperatures which allow brittle stems to break off while minimizing uprooting of shrubs.
- Broadcast burning over a logged site the first summer after winter harvest can stimulate willows on wet areas if the roots are not burnt. On drier areas the duff can be consumed exposing mineral soil during peak seed dispersal of most willows in early summer.
- Creating stump sprouting of paper birch and cottonwood by cutting the trees during the dormant season. Sprouting is greatest from trees that are healthy, not too old, and located on warm open sites. Stumps should be left at least 6 inches above the ground surface to avoid damaging growth buds located near the root collar.

Late successional habitat is a mixture of live trees, snags and woody debris that provide vertical structure, denning sites and cover for wildlife. Older stands in the boreal forest are believed to contain substantial species diversity or high biomass of non-vascular plants (mosses) and invertebrates, which in turn provide forage for vertebrates such as songbirds. Specific techniques for late successional habitat are:

- Retaining cavity trees wherever possible. Trees with broken tops often develop heart rot while still alive and become hollow. These trees may not have evidence of cavity openings on the trunk. Larger cavity trees are relatively more valuable to wildlife.
- Leaving in place woody debris. Woody debris should be left in place unless it hinders regeneration of desired species or presents hazard fuel or insect problems.
- Retaining advanced regeneration within a harvest unit. Patch retention within harvest units functions to protect animal dens, seed trees and future tree crops.

VI. FIRE AND FUELS MANAGEMENT PRACTICES

A. Introduction

Acknowledgement: Much of the elements of this section are significantly based on the excellent fire management plans produced by Tanana Chiefs Conference's Forestry Program. To ensure a quality fire management section for the Bristol Bay region, their work has been incorporated in large part into this plan.

An important element of the trust responsibility held by the United States Government and BBNA is the protection of the land and resources from damaging wildland fires. In the past, both the public and resource managers focused exclusively on fire's immediate, often damaging, effects. In recent years, the emphasis has begun to move toward the other end of the spectrum, with fire touted as a vital process for healthy functioning ecosystems. Managed fires (prescribed burning or strategies to use wildland fire) can often be used as a surrogate for natural fires to restore ecological balance while consuming unnatural accumulations of fuels. In some places, however, the fuels accumulations or species conversions are so significant that even the most carefully managed fires are neither safe nor effective. In addition, the presence of other highly valued resources, such as those found within the wildland urban interface, or important cultural and subsistence resources, often makes fire an unacceptably risky or politically unpalatable management tool. In such cases, other fuels treatment options such as mechanical treatments are a better choice.

Resource managers now acknowledge that the most effective programs use active management of wildland fires, prescribed burning and other fuels treatment options to balance the short-term fire protection needs with longer-term ecological and human needs. The shift in management emphasis is tied to some essential observations:

- Fire cannot be excluded from the landscape indefinitely. Attempting to do so only prolongs the inevitable while increasing the severity of both the pre-fire and post-fire ecological consequences.
- Fire suppression is often done under the worst circumstances. Examples are hot, dry, windy burning conditions, heavy competition for fire-fighting resources and critical decisions made without sufficient data or time. Such circumstances jeopardize firefighter and public safety, require more risk-taking with diminishing probabilities for success, favor negative fire effects, and incur greater costs.
- In contrast, prescribed fire and other fuel treatment options are carefully planned and implemented when conditions favor maximum benefits with the least risk. Costs for such projects are significantly less, especially when offset against the diverse resources benefits resulting from these projects.

The revised Federal fire policy now allows funding and resources formerly intended primarily for fire suppression to also be used for projects to reduce hazardous fuels accumulations, lessen the likelihood of catastrophic fire damages and return fire (or a surrogate disturbance) to its role in the ecosystem. The

use of funds for project work requires a detailed planning process to better ensure success. This Forest and Fire Management Plan meets the requirements of having a programmatic plan conforming to the National Environmental Policy Act (NEPA).Operational plans or burn plans are also required for implementation of individual projects.

The advantages of implementing pro-active management of the fire environment rather than mere fire control are numerous. Prescribed burning and mechanical fuels treatments have demonstrated value for land managers and landowners alike. However, such operations have potential for public controversy, requiring careful planning to identify goals and objectives, secure consent, and evaluate results. Moving beyond simply protecting trust resources, BBNA., tribes, and landowners now have opportunities to use fire and other fuels treatments as a tool for decreasing the risk of catastrophic fire damages while enhancing existing resources. Addressing the following questions will improve the policy orientation for the preservation, protection and enhancement of natural resources and cultural practices on the Native allotments within the Bering Straits region.

- What are the roles and responsibilities of the various affected parties or stakeholders allottees, tribes, BIA Alaska Regional Office, ANCSA Corporations and interagency cooperators?
- What is the role of BBNA's fire management program with respect to allotments?
- What are the standard procedures BBNA will undertake for planning and executing these program activities?

Cooperators: Effective fire management on Native allotments requires the participation and cooperation of a number of entities, including the following:

Native Allottees (Landowners): The allottee has a role in the management of fire effects on their parcel. BBNA acts as the liaison to facilitate this role and implements the items listed below. Allottees are encouraged to:

- Provide input to the designated suppression agency during a wildland fire event where the parcel is threatened.
- Provide input, when requested by the designated suppression agency, for a revision in the fire management option.
- Provide input for a prescribed fire project that is proposed by adjacent landowners.

BBNA will assume that the first item is of an emergency nature and will attempt in every instance to contact the allottee during a wildland fire event threatening their allotment.

BIA Alaska Regional Office: The BIA Regional Fire Management Officer shall be available for consultation during the active portion of the Alaska fire season. This individual shall provide technical assistance to landowners, tribes, tribal organizations, as well as contract/compact tribes in developing and implementing safe and effective fuels management strategies. The regional office shall facilitate negotiations between BBNA and the designated suppression agencies for projects initiated by tribes that are proposed for village corporation lands and are of benefit to the tribes, and allottees.

Bureau of Land Management (BLM)/Alaska Fire Service (AFS): BLM/AFS's predominate role is for providing fire suppression activities on allotments within their protection zone. The fire resource staff shall provide technical assistance to landowners, tribes, tribal organizations, as well as contract/compact tribes in developing and implementing safe and effective fuels management strategies. Based on availability of resources, BLM/AFS may provide assistance on prescribed fires in the form of equipment, training and qualified crewmembers, however, crews will be attempted at the village level. Review of mechanical treatment or prescribed burn plans may also be provided for projects within their protection zone.

Through regulations established in ANCSA, BLM/AFS is the designated suppression agency on village and regional corporation lands, as well as the allotments themselves. Allottees are affected in this dual suppression role because of the large number of parcels that are inholdings within these village and regional lands. Another important role of BLM/AFS however, is to fund requests for hazard fuel reduction projects on village and regional corporation lands. BBNA may assist the tribes in developing proposals to submit to BLM/AFS. It is important for the BIA Alaska Regional Office and BLM/AFS to establish methodology to facilitate projects on ANCSA lands that are of benefit to the tribes, allottees and village firefighting crews. BLM/AFS also may be requested to provide emergency fire-fighting (EFF) training and explore the possibilities of creating new village EFF crews within the Bristol Bay region.

State of Alaska Department of Fish and Game: The predominate role of ADF&G is for providing input on fish and wildlife habitat concerns in prescribed burn plans that are proposed for Native allotments or village corporation lands. Prescribed burns that are planned and funded by ADF&G on State or Federal lands will also incorporate allottee input from parcel owners within the proposed prescribed burn area.

B. Fire Management Planning

The management direction for planning fire management activities on any particular allotment is defined at three levels – strategic, operational, and project planning as described below.

- Strategic Plan – This BBNA Forest and Fire Management Plan serves as the strategic level planning document for any fuels management projects on Native allotments in the Bristol Bay region. It sets forth the authorities and procedures for prescribed burning and mechanical treatments on the allotments. NEPA compliance for strategic plans is required by the Federal fire policy.
- Operational Plans – Operational procedures to implement the strategic plan listed above are described in existing applicable State or Federal zone mobilization plans, prevention plans, preparedness plans or fuels management plans. Preparedness plans, mobilization plans, and prevention plans are not considered to be resource management plans, and as a result do not require documentation for NEPA compliance.
- Project Plans – Include detailed information describing the implementation process of specific projects such as mechanical fuels treatment project plans, prescribed burn plans and emergency

rehabilitation plans. Project plans will be developed using established standard procedures as outlined in appropriate handbooks or other guidance documents such as the Prescribed Fire Plan Guide and Burned Area Rehabilitation Handbook. Emergency rehabilitation plans, as an example of an emergency operation, are exempt from NEPA compliance.

C. Emergency Operations for Wildland Fire Management

Through interagency agreements between the Bureau of Land Management's Alaska Fire Service (BLM/AFS) and the BIA, and pursuant to the Alaska Native Claims Settlement Act (ANCSA) of 1971 and the Alaska National Interest Lands Act of 1980, the Alaska Fire Service (AFS) has been designated the fire suppression agency for the Bristol Bay region and provides for crews and equipment necessary to protect Native allotments. Guidance for fire management decisions are outlined in the Alaska Interagency Wildland Fire Management Plan (AIWFMP) and describe suppression activities within the context of four fire management options. These fire management options are Critical, Full, Limited, and Modified and are described as follows:

- **Critical:** The Critical management option is created to prioritize suppression action on wild land fires that threaten human life and health, inhabited property, and designated physical developments. Critical areas receive priority over all other wild land fires.
- **Full:** Areas assigned this designation will receive aggressive initial attack and continued suppression efforts on all fire starts until the fires are contained or controlled. This option is designed for high-value areas that do not involve the protection of human life, human health and inhabited property.
- **Limited:** This category applies to areas where the cost of suppression may exceed the value of the resources to be protected. Suppression actions are initiated only to extent necessary to keep a fire within the Limited zone or to protect identified higher value areas. Generally this designation receives the lowest priority for initial attack resources, although surveillance may be a high priority.
- **Modified***:* The intent of the Modified management option is to provide a relatively high level of protection during seasonal periods when fires usually burn with greater frequency, intensity and duration, and a lower level of protection when burning conditions are less severe. Unlike Full management areas, the intent is not to minimize burned acres, but to balance suppression costs with acres burned and to accomplish other resource objectives. After a conversion date which is established as a date when fire conditions become less severe, Modified management option becomes the same as the Limited management option.

Wildland fire suppression is a fundamental trust responsibility for the BIA Alaska Regional Office's fire management program. Accordingly, formal preparedness planning and arrangements are made at the regional level to ensure a prudent level of fire protection (suppression) for all allotments. In fulfilling this commitment, the Alaska Regional Fire Management Officer represents the interests of Native landowners in securing a formal cooperative agreement with protection agencies. The Bristol Bay region is under the Interagency Fire Protection Agreement between BLM/AFS and BIA for initial attack on allotments. This agreement is negotiated every 5 years or sooner upon agreement of the parties. The Alaska Wildland Fire Coordinating Group (AWFCG) maintains formal cooperation and coordination

for all wildland fire activities in Alaska. The BIA is a member of the AWFCG and shares in the cost of jointly funded projects or activities as appropriate.

The AIWFMP provides all land owners/managers throughout Alaska with one document that describes the wildland fire management options, responsibilities, and operation of wildland fire management in Alaska. The BIA prior to the AIWFMP had a specific policy regarding Native allotments and directed BLM/AFS to provide wildland fire management options of Critical or Full protection for these lands without regard to cost.

Now with more reliable information becoming available on allotment location, natural and cultural resources, as well as better dialog with the landowners themselves, a more objective assessment of protection levels can be made. In this regard, the Department of Interior Departmental Manual 620 chapter 1.4 also supports more objectivity in defining protection levels and states that wildland fire losses will be held to a minimum consistent with values at risk. Given this interpretation, fire management options of Modified or Limited protection can now be applied to Native allotments. **Fire management options of Critical or Full still apply to Native allotments in the Bristol Bay region unless the allottees themselves have authorized a change**. If the allottees authorize a change in the fire management option, the change will be submitted to the appropriate agency through the BBNA land management program. It is anticipated that in most instances, however, a determination during a particular wildland fire event will be made as to whether a fire will be allowed to burn a particular parcel. The fire suppression agencies may request permission to allow fire to spread onto an allotment even if it is within a Full Management Option. Generally these requests are made for three reasons: (1) the allotment is very remote and the resource value is low; (2) the fire is quite active, difficult to contain, and firefighter safety may be at stake if suppression actions are undertaken to protect the allotment; and (3) statewide fire resources are stretched thin due to exceptionally high fire activity. In the former case, if BBNA determines that the resource value is indeed low, the allottee is contacted to determine their willingness to let their parcel burn. The allottee and all heirs must agree to allow the parcel to burn. If some individuals cannot be contacted or 100% agreement is unable to be obtained, then the parcel remains in full protection status concurrent with fire fighter safety issues.

Strategies for Use of Wildland Fire to Achieve Resource Benefits

The revised Federal fire policy now allows the use of naturally ignited wildland fire as a management tool to achieve resource benefits. Benefits include the reduction of hazardous fuel accumulations and/or the reestablishment of fire's natural role in the ecosystem. Prior to any use of wildland fires for resource benefits, BBNA will provide appropriate revised fire management options to BLM/AFS. Changes that will establish fire management options other than the "critical" or "full" management options will be done only after an analysis of allotment resource values and consent from the individual allottee to allow the burning of an allotment. In some instances, even if the allottee allows burning, the parcel may have to remain in full protection to adequately protect trust resources. Guidance for these options is detailed in the AIWFMP. Changes in fire management options will be submitted to the office responsible for providing fire suppression services between September 30 and March 1. The March 1 cut-off date allows suppression agencies time to update map atlases with current information prior to the onset of

the fire season. In special cases it may be possible to request changes outside these dates. A request for fire management option change includes 1) a written description of the area, 2) a map showing the change and 3) a brief explanation of the reason for the change. The BBNA land management officer signs the request. Suppression agencies will provide proposed fire management option changes to all adjacent and affected land manager/owners to verify operational feasibility. The goal is a consensus among all affected land manager/owners to optimize management of ecosystems and resources irrespective of administrative boundaries. BLM/AFS has established a central filing system for documentation of fire management option changes. These files are available as reference material for future managers.

D. Standards for Hazardous Fuels Reduction

A number of methods are available for conducting hazard fuel reduction projects. Within the context of hazardous fuels reduction projects, there are three acceptable treatment categories that can be conducted with BIA funding on Native allotments.

1. Mechanical and Chemical Treatments

Mechanical methods of fuel treatment physically alter the fuel bed using hand tools, power tools, or heavy equipment. Practices that may be utilized include mowing, disking, plowing, or blading a fire break in grassy fuels, using chainsaws or rotary brush cutting saws to fell or prune trees and brush, using heavy equipment to uproot trees and brush, or using equipment to chip or roller chop woody debris. Shear blading, where a dozer is outfitted with a sharpened blade has been shown to be a cost effective means of felling small trees. Its effectiveness is best during cold temperatures where the trees shear easier. Chemical treatments involve the application of foliar or soil-based herbicides to kill undesirable vegetation, usually tree and shrub species.

Hazardous fuels reduction projects require that the fuels actually be reduced in quantity, not merely rearranged. While plowing, chipping, and roller chopping accelerate natural decomposition, the most effective treatments actually remove the debris from the site. When tree species are treated, some fuel is often removed as fuel wood or posts. Otherwise, the debris is often consumed with follow-up applications such as burning of slash piles or prescribed fire. Unlike prescribed burning, which is limited to seasonal windows when the prescriptive criteria are within predefined parameters, many mechanical fuels treatments offer an advantage in that they can be conducted at any time of the year. Mechanical treatments applied during the dormant period often favor the re-growth of deciduous trees and shrubs over conifers, which reduce flammability for several years and favors many wildlife species. However, it should be noted that many herbicide applications are most effective when timed to coincide with a particular stage of vegetation growth. A Mechanical Fuels Treatment Plan is required for mechanical hazardous fuels reduction projects.

2. Prescribed Fire

Prescribed fire treatments for hazardous fuels reduction include broadcast and understory burning to consume unwanted vegetation and downed woody debris. While fuels accumulations

of surface ground cover species in tundra ecosystems can occasionally accumulate to hazardous levels requiring treatment with prescribed fire, most burning is directed at reducing flammable conifer tree species concentrations while favoring sprouting and reproduction of less flammable deciduous tree species and shrubs. To be effective and minimize damage to the residual vegetation, most burns are constrained to periods when the vegetation is in a particular stage of development and other prescriptive criteria such as wind, temperature, humidity, fuel moisture, and wildlife needs are within established parameters. A Prescribed Burn Plan is required for prescribed burn projects.

3. Combination Treatments

Many hazardous fuels reduction projects require a combination of mechanical and prescribed fire treatments. These treatments provide the advantage of consuming fuels by burning, so they are truly hazardous fuels reduction projects. The most common application involves the burning of piles and windrows resulting from thinning or clear cutting stands of flammable tree and shrub species. Thinning and pruning stands, removal of brush and burning slash, create what is referred to as shaded fuel breaks. Because they involve burning, combination treatments are subject to the same restrictions presented in the preceding section. Elements from both the Mechanical Fuels Treatment Plan and the Prescribed Burn Plan formats may be included in the project plan.

Scale of Hazard Fuel Projects

The management emphasis for hazardous fuels reduction occurs at two project levels. At the lowest level, small projects around individual homes can produce desired results of lowered fire risk. Such small "fireproofing" projects that occur within the wildland urban interface (WUI) are beneficial and formal planning documents are not required. BIA funding, however, is also not provided. There may also be projects that originate from management emphasis on a larger sale, and may utilize BIA funding. These larger projects may also be conducted within the WUI. Several locations within the Bristol Bay region may be candidates for BIA funded hazard fuel reduction projects. Fire risk to allotment structures may be reduced by thinning adjacent flammable spruce forests. Other areas containing WUI problems may include allotments that are located within close proximity to the villages. In these areas WUI problems may be associated with allotments and village corporation owned lands. BBNA will work with the suppression agencies in determining communities at risk from wildland fire. If a WUI area is threatened by hazardous fuels accumulations on several adjacent allotments and/or adjoining landowners such as Native Corporation, State or Federal lands, consolidation of fuels treatment projects into a single, larger scale prescribed burn or mechanical treatment may be appropriate. Similarly, it may be more efficient to construct a fuel break across multiple allotments to minimize the threat of fire spreading to their homes and structures.

Prescribed fire for ecosystem maintenance, fuel reduction or resource management needs that are conducted on State of Alaska or BLM lands may also result in hazard fuel reduction projects being proposed on Native allotments. These burns typically are focused on lands that have been excluded

from fire for a long period of time and generally compose a relatively large area. Allotments are included as inholdings within these areas.

Small Scale "Fireproofing": Hazard fuel reduction activities intended to lessen the risk of damages from wildland fires occurring in or spreading to the WUI include treatments in areas defined by the presence of houses or other structures at risk of damage by wildland fires. In many cases scattered allotment parcels with home sites amid larger tracts of wildland fuels create WUI problems. Long response times associated with the rural setting also influence suppression effectiveness. Given this, fireproofing and other fuels management strategies are promoted in the interest of both the landowners and the resource managers entrusted to protect their property. These projects have a dual role – to prevent fires and to create defensible space to maximize the effectiveness of the suppression forces. Many of these projects are small in scale and may be implemented by the resident landowners or their tenants. These efforts typically focus on prevention, access, readiness, landscape planning, etc. Small-scale fuels management projects, such as localized debris burning and weed and brush control efforts, are also considered the resident landowners' responsibility and are not subject to Federal planning and safety requirements. In these cases, BBNA may function in a service role, providing informal technical consultations and references to the many publications and on-line documents such as the "Firewise" program that address fireproofing tactics.

Coordination with other firefighting agencies' fire prevention programs also can be done to promote technical assistance. Two important aspects of small scale "fireproofing" include minimizing exposure of the structure and creating defensible space around home sites by isolating structures with fuel breaks:

- **Minimizing Exposure of the Structure -** The homeowner is responsible for minimizing the exposure of the structure to damage from an approaching wildland fire. This includes the use of fire resistant building materials on the exterior of the structure and eliminating potential heat sources on or immediately adjacent to the structure including, but not limited to piles of wood, fuel containers, and natural fuel accumulations of leaves and spruce needles. Recent research has determined that this alone may be the most important action in reducing the risk of structural damage from a wildland fire.

- **Creating Defensible Space -** In most cases, creating defensible space around home sites is the homeowner's responsibility. Creating defensible space produces a firebreak between the home and the wildland fire. It is typically 30 feet or more in width in which combustible material has been removed or modified. Standards should follow the guidelines presented in the above acceptable treatments section, and be based on the fuel group that surrounds the structures.

Larger Scale Hazardous Fuels Treatment Projects

- **Fuel Breaks** - Fuel breaks are a strategically located, linear constructed barrier, such as a dozer line to mineral soil, to provide a control line from which firefighting personnel can work. These areas break up the continuity of hazardous fuel. The primary objective of fuel breaks is to provide a safer, more defensible space for firefighting personnel to build and hold a control line.

The construction of a fuel break of sufficient width to stop a running fire without support action is not an objective of these fuel treatments. As a general rule, these treatments should be no wider than three times the height of the vegetation at maturity given that slope and other factors may require some modification to meet the objective. They are usually constructed in conjunction with some other hazardous fuels reduction project such as a prescribed burn or a mechanical fuels treatment. Fuel breaks cannot be funded from the BIA's hazardous fuels reduction program when they are stand-alone projects but instead are funded out of the BIA's preparedness account.

• **Hazardous Fuels Reduction** - Like the situation faced on wildlands throughout much of the nation, fire prevention and suppression efforts have allowed the vegetation on many Native allotments to age and become more fire-prone. Significant changes in forest fuel loads and composition have resulted where suppression efforts have reduced or eliminated the periodic fires that used to naturally occur across the landscape. Without the recurrence of fire, forest stands gradually become more spruce-dominated and fire-prone as the shorter-lived, less shade tolerant, and less flammable shrubs and hardwood trees are out-competed.
Likewise, on the landscape-scale, spruce-dominated stands become more extensive as younger-aged stands, predominately comprised of shrubs or hardwood trees, mature and forest diversity or "patchiness" is often lost. The resulting fuel continuity increases resistance to fire control and makes protection of allotments more difficult. A fire burning under these conditions is also more likely to produce severe and, perhaps, less desirable ecological effects than it would under a more natural burn regime. While debris burning and fire proofing efforts in the WUI might technically reduce hazardous fuels, they are generally small in scale. In contrast, hazardous fuels reduction projects by either mechanical means or through prescribed fire, generally are large enough in scale to require formal planning.

• **Natural Role of Fire** - Fire is a vital component in many ecosystems and maintaining a natural range of forest types and stand ages. Fire also cycles nutrients, opens growing space to regenerate forests, maintains species diversity, and provides enhanced wildlife habitat. When the duff burns the resulting ash makes the soil less acidic. This combined with increased warming from the blackened soil helps new plants sprout. The intensity of the fire's heat determines how vegetation will recover.
Active fire suppression over the past 50 years has decreased the natural disturbance level in many areas. The high level of human disturbance during the gold rush of the early 1900s and fire suppression since the 1950s has resulted in a distribution of forest age classes that are predominantly in the 60 and older category with fewer younger stands. These old stands become less diverse and may be subject to severe wildland fire, insects or disease damage.
They may also provide inferior wildlife habitat for many game species that are important subsistence resources.

BBNA could emphasize prescribed burning for ecosystem maintenance by incorporating several allotment parcels into a single project. However, in all likelihood, burning done for ecosystem

maintenance will consolidate projects of adjacent landowners. In places where the fuels have been significantly modified, it may be necessary to implement hazardous fuels reduction treatments as a prerequisite to the effort to return fire to its role in the ecosystem. Burning done for ecosystem maintenance requires a prescribed burn plan. General goals for prescribed fire on plant communities are presented below:

− Meadows and Tundra: burn with low severity to remove dead thatch and leave most of the root system intact.

− Shrublands: burn with low to moderate severity to remove dead downed fuels and litter and promote regeneration of shrub species from existing root stocks.

− Broadleaf and Mixed Forest: burn with low to moderate severity to consume dead downed fuels and litter and top-kill deciduous species that will regenerate from root stocks to enhance habitat preferred by many wildlife species that are of interest to subsistence users.

Project Implementation Standards: The policies and procedures that follow apply to hazard fuel reduction projects that utilize BIA funding. BBNA will comply with the standards prior to implementation of projects.

1. **Project Permit:** Any required permits will be acquired prior to project implementation. Permits shall be noted in the checklists in the standard project plan formats, and the implementation of the project shall be contingent upon obtaining these required permissions.
2. **Project Plan:** BBNA will produce and submit to the BIA Alaska Regional Office a Prescribed Burn Plan or Mechanical Fuels Treatment Plan for all fuels management projects that occur on Native allotments that apply to the following situations:
   • Projects that use Federal funding (notably, the emergency fire suppression account or the hazardous fuels reduction account).
   • Projects that require significant involvement of Federal employees in project planning, implementation, or monitoring.
3. **Notification Procedures:** Each project plan completed by BBNA will specify the appropriate notification procedures for fuels treatment projects. State or Federal agencies conducting projects on their own lands that contain allotment inholdings shall also adhere to the notification procedures. At a minimum, notification generally will require the party implementing the project to notify the BIA, protection agency (BLM/AFS, DOF), tribe or tribal compact, local law enforcement, and adjacent landowners one week in advance and on the day of the project. The notification process shall be stated on the project plan checklist.
4. **Personnel Qualifications:** Formal training, experience, and fitness certifications are vital for safe and effective prescribed fire and mechanical treatment operations. Recent changes in the Federal fire policy through the National Wildfire Coordinating Group (NWCG) impose planning and safety requirements on fire and fuels management activities funded by the hazardous fuel reduction operations account. Personnel qualifications are indicated below for prescribed burns and mechanical fuels treatment projects:

• **Prescribed Burns** - On prescribed fires, workers are held to the same standards of physical fitness, training and use of personal protective equipment as suppression forces. Personnel qualifications are presented in the Wildland and Prescribed Fire Qualifications System Guide (PMS 310-1). Employees assigned to projects that utilize Federal funding shall comply with the PMS 310-1 standards. For burns evaluated to have low complexity, BBNA and its local cooperators will jointly agree on qualifications required. Low complexity burns generally will require a minimum qualification of the Firefighter II level. For burns that are of moderate complexity or higher and on which resources of more than one agency are utilized, the minimum qualifications established in the guide will be followed.

• **Mechanical Fuel Treatment Projects** - BBNA will adhere to federal U.S. Department of Labor Occupational Safety and Health Administration (OSHA) logging regulations for mechanical fuels treatment projects. Personnel requirements will be same as required for pre-commercial thinning projects that are performed on Native allotments through forest development funding sources. Standards include:

− Ability to thin trees on Native allotments using chainsaws and brush cutters in accordance to contract specifications of each particular project.
− Stack brush. Dig fire lines. Maintain equipment.
− Perform other job-related duties as assigned.
− High school diploma or GED equivalent.
− Ability to follow verbal and written instructions.
− Ability to work as part of a crew as well as alone and unsupervised.
− Ability to work in a safe, productive manner, adhere to safe felling and bucking practices, and maintain all work equipment including personal protective equipment.
− CPR and Advanced First Aid Training per OSHA requirements.
− Use of safety gear including: hard hat, chaps, chainsaw resistant boots, protective eye and ear wear.

• **Combination Treatments -** Mechanical fuel treatment projects that include burning of slash piles will utilize employees that meet the minimum qualifications as stated above for each phase of the treatments.

• **Personal Protective Equipment** - Personal Protective Equipment (PPE) shall be utilized for all hazardous fuel reduction projects.

Air Quality (Smoke Management): The Alaska Department of Environmental Conservation (ADEC) is the regulatory agency responsible for air quality on both State and Federal lands within Alaska. Prescribed burns require written approval from the department. ADEC is also responsible for declaring air episodes and issuing air quality advisories during inadequate dispersion conditions. The Alaska Interagency Coordination Center is notified of any advisories. ADEC is represented on the Alaska Wildland Fire Coordinating Group. BBNA will give careful consideration to the anticipated smoke impacts produced under the various burn scenarios. Knowledge of local factors such as: prevailing

winds; topographic depressions prone to smoke accumulation; location and volume of air and vehicular traffic; and residents who are especially sensitive to smoke, is important to consider when addressing smoke and air quality impacts.

Funding: The BLM/AFS is responsible for all wildland fire suppression operational costs in the Bristol Bay region for both Native allotments and Native corporation lands. BLM/AFS and BIA are responsible for hazardous fuel reduction costs on Native corporation lands. The BIA is responsible for costs associated with hazardous fuel reduction operations on Native allotments. BBNA will track the costs of local treatment methods and use them to develop a standardized cost reference sheet, which could then be made available to allottees and tribes to facilitate development of their own project proposals. The Native allottee will normally initiate hazard fuel reduction projects on Native allotments. A tribal organization or Federal or State land manager, however, may initiate the project when allotments are inholdings within agency's land area that is to be treated. Upon consultation with the allottee, BBNA will submit a project proposal to the Alaska Regional Office to request funding. The approved BBNA Forest and Fire Management Plan will be the primary source of guidance concerning general policy, procedures and NEPA compliance.

The hazardous fuel reduction program is only authorized for the treatment of natural fuels. Treatment of fuels generated from commodity production activities is excluded. Monitoring is required for all hazardous fuel reduction projects and will be in accordance with methods and procedures identified in the BIA Prescribed Fire System Handbook. Prescribed fire monitoring includes both fire effects and smoke monitoring. The primary purpose of monitoring mechanical fuel treatments is to determine if the treatment met the objective.

Examples of costs authorized by the BIA to be funded under the hazardous fuel reduction program: Salaries, benefits, and support costs for permanent, career seasonal, and temporary personnel who are hired specifically for the hazardous fuels program, inside or outside the defined fire season. At least 80% of their time must be associated with the hazardous fuels program.

- All programmatic planning and oversight.
- All federally approved indirect costs.
- Permanent non-fire personnel dedicated for pay periods of time to development of hazardous fuels project work and permanent non-fire personnel actual time on project implementation/execution.
- Project site preparation, air quality monitoring, initial fire effects monitoring plot establishment and first year post fire monitoring on these plots.
- Includes replacement or repair of capitalized equipment damaged or destroyed on hazardous fuels reduction projects, and purchase of expendable supplies.
- Aircraft flight time costs associated with hazardous fuels reduction project.
- All training that is specifically related to fuels management and/or fire use. All training necessary to fully carry out the duties of the position for personnel hired specifically for the hazardous fuels program.

The hazardous fuel reduction program excludes the following costs:

• Treatment of fuels resulting from commodity production activities, such as slash generated from forest development and timber sale projects (activity fuels).

• Regular planned salaries (base 8) for all fire management personnel, and for those temporary, career seasonal, and seasonal personnel who are hired to meet preparedness requirements.

• Purchase of new capitalized equipment.

Fire Program Elements and Concerns: The following planning elements describe the management of wildland and prescribed fire on Native allotments within the Bristol Bay region. Generally they are consistent with the BIA Alaska Regional Office plan guidelines. All existing planning documents that cover particular elements are referenced.

a. Land Management Goals and Objectives

Fire and fuels management treatments will be implemented to achieve specific allottee goals and objectives. This planning document attempts to identify the general goals and objectives assumed to be representative of most allottees. This however is not a complete list given the large number of landowners. Individual goals and objectives will be presented in the project level plans (e.g. prescribed burn plan or mechanical fuels treatment plan). Overall, BBNA will initiate fire and fuels management treatments for reduction of hazardous fuels and maintenance of fire dependent ecosystems only with the consent of the allotment owner. A higher priority will be placed on treatments that reduce hazardous fuels where wildland fires, when ignited, threaten public safety, structures and facilities, cultural resources, natural resources or could permit the spread of wildland fires to management option areas requiring a greater suppression response. General goals and objectives that are assumed to be representative of the allottees include:

• Ensure that firefighter and public safety is the first priority in every fire management activity.

• Ensure that all fire management personnel strictly adhere to national standards for qualifications, physical fitness and personal protective equipment.

• Minimize damage to resources from unwanted wildland fires, commensurate with the values at risk.

• Use prescribed fire and/or mechanical treatment to reduce the danger of accumulated fuels, achieve multiple resource management objectives and provide for a natural role of fire in the ecosystem.

• Minimize danger to people and damage to structures in the wildland urban interface.

• Support Native self-determination by allowing and encouraging tribes and/or allottees to conduct projects through personal services contracts, assistance agreements, etc.

• Provide career, seasonal employment and training opportunities for tribal members in support of local and national fire management operations including prescribed fire.

• Foster cooperation and respect from suppression agencies through planning and sharing of resources.

• Manage smoke emissions from unwanted wildland fires and prescribed fires to minimize the impact on air quality.

b. Values At Risk

On Native allotments, safety of fire suppression personnel and life and property of the general public are the primary values to be protected. Archeological and commercial timber resources are considered secondary. Other resource values will be prioritized as the Native allottee directs and as reported in individual project planning documents.

c. Preparedness Strategy

The BIA Alaska Regional Office's Fire Management Preparedness Analysis describes the statewide BIA fire program's responsibilities, personnel and organization, and relative costs for Native allotments in Alaska. The BIA does not provide suppression services in Alaska. The preparedness strategies concerning initial attack personnel and equipment, facilities, shared resources, non-fire support overhead, and training and qualifications are described in BLM/AFS management and planning documents. Through the self-governance compact, preparedness activities on Native allotments within the Bristol Bay region are now the responsibility of BBNA. BBNA functions as the liaison between the suppression organizations and the allottees. It may also provide technical assistance to tribes and village corporations concerning fire management activities.

The role of the BBNA fire and fuels management program is to act on the allottees' management direction with respect to their land while protecting the trust resource for future generations. BBNA cannot simply select a set of areas to treat either through prescribed burning or mechanical treatment because only the individual allotment owners can make decisions of this nature. The scattered allotment ownership pattern may also dictate that treatment projects be combined with adjacent landowners' projects. Funding for fire management projects will be authorized through BIA upon approval of the Forest and Fire Management Plan for Native Allotments in the Bristol Bay Region. This funding will allow BBNA to provide new benefits to allotment owners, while assisting the tribes, BLM/AFS, Alaska Department of Fish and Game (ADF&G) and village corporations achieve their land and resource management goals.

BBNA's main responsibilities to the BLM/AFS are to (1) maintain on-call availability of a resource advisor during the fire season (2) provide accurate allotment location information (3) provide allottee contact information (4) provide resource advice and (5) provide appropriate management response levels. The program's main responsibilities to the allottees are to keep them informed as to fire events on or near their allotments and if possible to solicit their input to guide suppression activities. BBNA may serve as a liaison between tribal and village corporation entities and public landowners. Activities include facilitating village input that addresses the appropriate management response levels on areas of concern and the implementation of Critical, Full, Modified, or Limited Management Options by fire suppression agencies.

d. Mobilization Strategy

BLM/AFS's Operational Procedures, Policies, and Guidelines Manual describes the mobilization of initial attack, extended attack, and non-local assignment of resources and the Wildland Fire Situation Analysis (WFSA) for assessment of escaped fires. BBNA will provide, if requested, a resource advisor to

an incident involving Native allotment lands. Besides providing resource advice, this person will act as the liaison between the suppression agencies and the allottee. The resource advisor will assist the designated suppression agency in the review of the WFSA document and development of an Emergency Wildland Fire Rehabilitation and Restoration document, if required, on an allotment fire. Final signatory authority of these documents will be by the BIA Alaska Regional Director. If the scope and complexity of the project warrants, a Burned Area Emergency Response Team may be ordered from the National Interagency Fire Center through the Alaska Interagency Coordination Center. Fire suppression activity rehabilitation actions are planned and performed prior to demobilization by the suppression incident organization. The BBNA fire program will attempt to utilize local village labor on any other projects that require labor after initial incident demobilization. Emergency stabilization, rehabilitation or restoration projects may include regeneration of forest stands, hazard tree assessment and felling, protection to historical or cultural resources, soil stabilization activities and invasive species identification and mitigation.

e. Prevention Strategy

Prevention strategies include public information/education, fire burn permit systems, closure restrictions, trespass/arson investigation, and enforcement of regulations. The BBNA fire program representative will assist in the coordination of these activities with the interagency fire community in Alaska through the AWFCG, protection agencies, and tribal organizations. In dealing with trespass and arson investigations, the designated suppression agencies will make the preliminary investigation of suspected human caused fires on Native allotments. BBNA will assume further investigation responsibilities at this point and pursue appropriate legal ramifications.

VII. SUMMARY OF ALTERNATIVES

Forest and fire management action alternatives are driven by a number of potentially conflicting considerations. What follows here is a guideline for a decision-making process to aid a manager in creating reasonable alternatives and selecting a preferred alternative to implement a proposed management action. The range of possible alternatives for a given proposed action is defined by the nature of the site and resource conditions of an allotment parcel or parcels involved in the action. The detail and number of possible alternatives that would exist across the region on all forested allotments is beyond the scope of this plan, which is why this plan is focused on defining a process rather than defining a series of all possible management alternatives.

Implementation of this plan will result in conducting this decision-making process for future proposed management actions. The nature of an individual action and its potential impacts will result in the process itself falling into one of several categories. Given that the categories are largely defined by the level of potential impacts associated with a proposed action, each category is associated with, and defined by, the nature of the NEPA process and documentation required for a process that falls within it. These process categories constitute sub-alternatives under the overall alternative of implementing the plan. The alternatives and sub-alternatives are defined as follows:

1. Alternative 1 - Plan Not Implemented (No-action alternative)

The No-Action alternative in this case means that a Forest and Fire Management Plan is not implemented. Any management activities would be evaluated on their own merit with regards to potential impacts, NEPA compliance, and compliance with other statutes and regulations, or are not evaluated at all. Any past activities, having been executed in the absence of a plan, would fall into this category.

Consequences of Alternative 1: This alternative would result in noncompliance with BIA requirements for implementation of Forest and Fire Management Plans on restricted Trust lands, and there would be no benefit to be gained by tiering from a programmatic plan.

2. Alternative 2 – Proposed Actions With Plan Implementation

Implementation of this plan results in proposed actions on Native allotments being subjected to an analysis, resulting in the proposed action falling under one of several possible sub-alternatives:

i. Alternative 2a - Proposed Actions with No Significant Impact

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and are permitted to occur if they are deemed to pose no significant impact on the affected natural or human environment. The proposed activity is evaluated in terms of environmental and human impacts, including cumulative effects, after which it may be determined that the action qualifies for a categorical exclusion under NEPA guidelines implemented by the BIA. If so, required NEPA documentation would be limited to the paperwork documenting the categorical exclusion qualification. Otherwise, an Environmental Assessment (EA) would be required, accompanied by a Finding of No Significant Impact (FONSI) if it is still determined that no significant

impacts result from the proposed activity. Much of the discussion and analysis required in the EA could be tiered from this plan.

Consequences of Alternative 2a: A decision to approve the proposed action would be made. The NEPA documentation generated by this process would take the form of a Categorical Exclusion if the action qualifies as such after evaluation, or the generation of an Environmental Assessment (EA) and attached Finding of No Significant Impact (FONSI) if such a finding can be made. Reference to this plan through tiering could constitute much of the EA documentation.

ii. Alternative 2b - Proposed Actions with Mitigated Impacts

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and potentially significant impacts are mitigated through modification of the activities or appropriate application of best management practices as discussed in this plan.

Consequences of Alternative 2b: A decision to approve the proposed action with an Environmental Assessment (EA) and attached Finding of No Significant Impact (FONSI). Reference to this plan through tiering could constitute much of the EA documentation.

iii. Alternative 2c - Proposed Actions Resulting in Significant Impacts

Proposed forest and fire management activities on Native allotments are evaluated using the specifications and criteria outlined in this plan, and potentially significant impacts are determined to be possible even with the inclusion of mitigation strategies in the application of the actions.

Consequences of Alternative 2c: A decision to approve the proposed activity would be a result of the analysis weighing the negative and positive impacts of the action. Costs, as represented by negative impacts, would be weighed against the benefits, as represented by the positive impacts. If the benefits obviously and significantly outweigh the costs associated with the proposed action, an EA is prepared and the proposed action may be approved. If the benefits do not obviously outweigh the costs, or the proposed action involves some level of controversy, the process may be driven to require an Environmental Impact Statement (EIS) with a final Record of Decision (ROD). With either an EA or an EIS, as with the preparation of an EA in the previous alternatives, much of the required discussion and analysis could be tiered from this plan.

VIII. PLAN IMPLEMENTATION: PROCESS GUIDELINES

Compliance with this plan will involve all proposed forest and fire management actions to be considered in a process in which the proposed action is evaluated and a course of action is determined based on the evaluation. This process mirrors a NEPA process conducted for a proposed action, but the required NEPA documentation is not fully described here; for a fuller description of required NEPA processes, please refer to the BIA Alaska Regional Office NEPA Handbook.

Following is a step-by-step description of the process that a manager would engage in during the planning phases of a proposed action on Native allotments that would conform to this plan:

1. Define the proposed action

Possible proposed forest and fire management actions include those discussed and listed in previous sections of this document. A proposed management action can originate from a variety of sources, but ultimately needs to specifically address an allottee goal and be endorsed by the allotment owners. A proposed action may be directly requested by the owners, it may be an action specified in a stewardship plan or other document in place for an allotment parcel, or it may be solicited from the owners by a manager (BBNA) in response to funding availability, market opportunities, or other management opportunities.

To ensure that a proposed action reflects the goals of the allotment owners, the owners themselves need to be determined and consulted. Groups of owners may be directly involved if there are multiple owners for an affected parcel, or if there are potentially multiple parcels involved in a proposed activity. For a proposed activity to be considered on a parcel, owners representing 50% or more interest in the parcel need to approve of the activity. Define the proposed activity as clearly and concisely as possible, with enough detail to enable proper evaluation of the action. Specific location, size, intensity, timing, and duration are factors to include in the action description.

2. Determine and notify adjacent landowners

Proposed actions directed to a specific allottee goal may have impacts on other lands not directly involved in the management of a particular parcel. Most often, these will be those land parcels immediately adjacent to the allotment parcel directly involved in the proposed action, and may include other allotment parcels, private lands, corporation lands, and agency lands. Research land status for the area immediately adjacent to the allotment parcels involved in a proposed action.

Notify the adjacent land owners of the nature of the proposed activity. If significant impacts are anticipated, extend the notification to any potentially affected landowners, adjacent or not. To help gauge cumulative impacts, the adjacent owners can be queried for the presence of past or future similar activities in the area of the proposed action.

3. Consult for and to evaluate potential effects on cultural resources

Evaluating for potential effects on cultural resources relies primarily on consultation with professional archaeologists and literature research of available information. There is a variety of legislation requiring the identification and proper handling of cultural resources, including the National Historic Preservation Act (NHPA), the American Indian Religious Freedom Act (AIRFA) and Executive Order 13007, the Native American Graves Protection and Repatriation Act (NAGPRA), and the Archaeological Resources Protection Act (ARPA). Key among these is Section 106 of the NHPA, which requires the BIA Branch of Natural Resources to evaluate the impacts of Native allotment actions on historic properties are on or may be eligible for the National Register of Historic Places. This is generally referred to as the "Section 106 review process", and is initiated early in the planning phase of a proposed action by consulting with the Regional Archaeologist. The review process itself is conducted by the BIA or sometimes other professionals such as tribal cultural resource managers through self-governance agreements with the BIA. In any case, the final responsibility and authority for conducting the review resides with the BIA Branch of Natural Resources. The geographic area within which the proposed action may cause changes, or "adverse effects", to historic properties is defined as the "area of potential effects", and is determined prior to conducting a field survey, or inventory, in that area. If cultural resources are identified during the archaeological inventory, the BIA Archaeologist will make every attempt to avoid these resources through the recommended establishment of buffer zones or other mitigation measures, as appropriate.

Other parties are identified and consulted in this process, including the State Historic Preservation Officer (SHPO), tribes, land owners, and other interested parties. The initial phase of a Section 106 review begins with background literature research using a variety of resources:

- Alaska Heritage Resources Survey (AHRS) maintained by the Alaska Office of History and Archaeology.
- BIA Regional Archaeology's Native allotment field inventories.
- BIA ANCSA's 14(h)(1) historic and cemetery site reports.
- Archaeological publications
- Local historians, anthropologists, and elders
- USGS maps that may show a "cabin" or "ruins" or "winter trail"

Section 304 of the NHPA requires that information about the location, character, or ownership of a historic property be withheld from public disclosure if it is determined that disclosure may cause a significant invasion of privacy, risk harm to historic property, or impede the use of a traditional religious site by practitioners. Part of the recommendations coming back to a manager as a result of the Section 106 review should refer to the appropriate level of confidentiality and disclosure related to potentially affect historic properties and archaeological sites.

4. Evaluate proposed action with regards to natural resources and impacts on the human environment

Conceptually, the "human environment" can be considered to include the various natural resources to which human values can be attached; fish and wildlife resources are important because of their value to

human communities for subsistence and other uses, soil resources are important because of their effects on productivity of human commodities and their effect on the overall environment, air quality is important because of potential impacts on human health, and so forth. A proposed management activity needs to be evaluated for its potential impacts, positive and negative, on the various natural resources that collectively affect the human environment. Previous sections of this document are designed to help guide that process.

- For forest management actions involving timber cutting, clearing, road-building, and related activities, the requirements and regulations of the State of Alaska Forest Resources and Practices Act (FRPA) for Region II should be adopted to help mitigate potential negative impacts on soil, water, and fishery resources and address sustained yield management goals. A summary of the pertinent standards relating to water quality and fish habitat is given in the list of objectives in Section VII.F.
- For forest management actions involving timber cutting, clearing, road-building, and related activities, the Best Management Practices (BMPs) developed in conjunction with the FRPA should be adapted to help mitigate potential negative impacts to other resources. For reference, Appendix B has an extracted list of appropriate BMPs, organized by affected resource.
- Within the management constraints imposed by the proposed action itself, silvicultural actions involving timber cutting or clearing should be modified to promote enhancement of wildlife habitat.
- Timing and duration of prescribed burning activities should be managed to minimize negative air quality effects.
- State of Alaska Department of Environmental Conservation should be notified and approval should be sought for any prescribed burning activity.
- NEPA documentation requires that the presence of Threatened and Endangered (T&E) species be considered; consultation with the U.S. Fish and Wildlife Service regarding Threatened & Endangered (T&E) species in the region needs to occur to confirm that though there are two T&E species occurring within Bristol Bay, i.e. Steller's and spectacled eiders, they are not found in forested regions. This needs to be confirmed to still be the case at the time and place of a proposed management action.
- For actions requiring road construction, focus on the possibility of winter access to allow building of temporary winter roads with minimized adverse impacts to soil, vegetation, and water resources.

5. Evaluate cumulative impacts and landscape-level management implications

Up to this point, a proposed forest or fire management action is primarily evaluated on its own merits. The action also needs to be evaluated in terms of its contribution to cumulative impacts resulting from the effects of this action and other activities that have occurred or may occur in the same relative time and space. Similarly, the proposed action needs to be evaluated for how well it conforms to landscape- or regional-level goals that may have been established by BBNA or other managers.

Cumulative effects include direct and indirect effects, the significance of which can be difficult to objectively determine. The sensitivity of the affected resources and the timing and spatial distribution of multiple actions needs to be considered. Situations that produce what could be determined to be significant cumulative impacts in one place may not be considered significant somewhere else, and vice versa. The relative lack of substantial human activity in the vicinity of Native allotments in much of the Bristol Bay region tends to downplay the importance of cumulative impacts, and the current situation indicates that cumulative impacts often may not be significant. However, each situation needs to be researched and other activities that have the potential to affect the same resources in the same area and time need to be identified and documented, and potential cumulative effects need to be objectively evaluated.

There are a few situations that appear to be particularly sensitive to the consideration of cumulative adverse impacts:

- The widespread and environmentally sensitive nature of fish resources and the waters they are found in dictates that cumulative impacts to fish habitat and water quality could be considered significant with relatively few adverse impacts over relatively large geographic areas such as entire watersheds.
- The cultural importance of fish and wildlife stocks to communities in the Bristol Bay region and the migratory nature of those stocks make it critical to consider cumulative adverse impacts of management activities over large geographic areas such as watersheds or larger landscapes.
- Prescribed burning would tend to contribute to significant cumulative impacts if concentrated too much in the same time frame as other burning activity. In addition to considering cumulative impacts, the proposed action should also be evaluated in terms of its relationship to overall specific landscape goals established by BBNA or other land managers.

6. Determine if proposed activity qualifies for a Categorical Exclusion under NEPA.

After conducting the review steps listed above, the proposed action may qualify for a Categorical Exclusion, minimizing the required NEPA documentation. Using the BIA NEPA Handbook, check to see if the proposed action qualifies as a Categorical Exclusion. This involves checking the list of qualifying actions to see if the proposed action qualifies as a possible categorical exclusion, and running through an exception checklist presented in Appendix 7 of the BIA NEPA Manual. The checklist involves a number of determinations involved in previous process steps (adverse effects on cultural resources, adverse effects on threatened and endangered species, adverse cumulative effects, etc.) If the use of a categorical exclusion is upheld, the proposed action can approved, accompanied by documentation required for the Categorical Exclusion itself (See BIA NEPA Handbook).

Some fire management planning actions, including preparedness plans, mobilization plans, and prevention plans, are not considered to be resource management planning, and as such do not require NEPA documentation and compliance. In addition, fire management activities that are considered to be emergency operations, including emergency rehabilitation plans, also do not require NEPA compliance.

Following is a list of forest management activities extracted from 516 DM 10.5 that qualify for Categorical Exclusions. Several of these only qualify if they are in compliance with a current management plan addressed in an earlier NEPA analysis (this document):

- Free-use cutting to allotment owners for personal use not exceeding 2,500 board feet.
- Cutting permits for forest products not exceeding $25,000 in value.
- Annual logging plans.
- Fire Management Plan Analysis detailing emergency fire suppression.
- Emergency forest and range rehabilitation plans limited to environmental stabilization on less than 10,000 acres.
- Forest stand improvement projects less than 2000 acres.
- Timber management access skid trail and logging road constructions.
- Prescribed burning plans less than 2000 acres.
- Forestation projects with native species and associated protection and site preparation activities.

If the proposed forest or fire management action qualifies as a Categorical Exclusion, all that remains for approval is to complete the exception checklist in Appendix 7 of the BIA NEPA Manual. Most of the items on the checklist should have already been considered in the previous steps. If all items on the checklist are answered with "No", then the checklist itself is complete, signed, dated and attached as pertinent NEPA documentation. In this case, the process completes with a selection of Alternative 2, "Proposed action with no significant impact". Otherwise, proceed to the next step.

7. Prepare an Environmental Assessment, and determine if there are significant impacts.

Using the information collected and evaluated in the previous steps, prepare an Environmental Assessment (EA) using the BIA NEPA Handbook as a guide in structuring the document. The EA will include a list of alternatives and the selection of a preferred alternative for the implementation of the proposed activity. If implementation of the preferred alternative is deemed to not produce significant impacts on the human environment, a Finding of No Significant Impact (FONSI) may be prepared to accompany the EA, completing the NEPA process. If the action as initially proposed is still essentially what is proposed in the preferred alternative, this result in this process completing with Alternative 2, "Proposed action with no significant impact". If the evaluation of the proposed action resulted in substantial measures being recommended to mitigate adverse effects of the proposed action, but still results in a FONSI, then the result of this process is Alternative 3, "Proposed Action with Mitigated Impacts"

If there are deemed to be significant impacts, then the positive impacts are weighed against the negative impacts and evaluated. It can be difficult to conduct this analysis objectively since some of the impacts will be difficult to measure and compare, but this can be thought of as a cost/benefit analysis where the negative impacts can be thought of as costs of implementing the proposed action and positive impacts can be thought of as benefits. Obvious dominance of the positive impacts over the negative impacts would result in the selection of the preferred alternative and approval of the EA, although a FONSI will not apply. Negative impacts greater than the positive impacts or an unclear result would result in

requiring the preparation of an Environmental Impact Statement (EIS) for the proposed action. Both of these processes result in this process concluding with Alternative 4, "Proposed Action with Significant Impacts".

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APPENDIX A:
BRISTOL BAY NATIVE ASSOCIATION FOREST INVENTORY

Bristol Bay Region Native Allotment Forest Inventory

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April 16, 2007

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Introduction

During the years 2004 and 2005, Tanana Chiefs Conference Forestry Program staff was contacted by Bristol Bay Native Association's Lands and Resources Department about conducting a forest inventory on Native allotments within the Bristol Bay region of southwestern Alaska. TCC agreed to conduct the inventory, and work was initiated in late 2005. Field work was conducted in July and September of 2006, and the project was completed in April, 2007. This report summarizes the project and the results of the forest inventory.

Both Bristol Bay Native Association (BBNA) and Tanana Chiefs Conference (TCC) are non-profit regional Native corporations that, among many other responsibilities, have assumed land management trust functions on Native allotments within their respective regions. These land management responsibilities include overseeing forestry and realty activities, which require information on the forest resources present on the allotments. Collecting and managing forest resource information has been problematic in the remote rural settings in which many of these allotments exist; the parcels are remote and can be difficult to efficiently access, aerial photography may be outdated, remote sensing data may be expensive and difficult to reference to a coordinate system, and basic timber data such as stand tables and volume equations may be sketchy or nonexistent for a particular area. Even the most basic required information, such as where the parcels are located on the landscape, may be difficult to determine. In this environment of uncertainty, the TCC Forestry Program has been able to successfully complete forest inventories on Native allotments in the TCC region of interior Alaska, and has been able to provide valuable information on allotment resources to aid trust management functions at TCC. Because of TCC Forestry's experience in completing forest inventories of this nature, staff at BBNA contracted with TCC Forestry staff to conduct a forest inventory on Native allotments within the Bristol Bay region.

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The Region

The Bristol Bay region, as defined by the Alaska Native Claims Settlement Act, comprises over 40,000 square miles in southwestern Alaska (Figure 1). The Bristol Bay region includes the ocean waters of Bristol Bay to the west, the Wood River Mountains to the north and northwest, Illiamna Lake and Katmai National Park to the east and the beginning stretch of the Alaska Penninsula to the south. The largest community, and the location of the main offices of Bristol Bay Native Association, is Dillingham (Figure 2).

According to a spatial dataset of Native allotments developed and maintained by the Bureau of Land Management, there are 1,629 Native allotment parcels in the Bristol Bay region. Two hundred and sixty one (261) of these allotment parcels were selected for the forest inventory project based on the coverage of recently acquired aerial photography. The selected allotments were separated into the following 3 subunits: (1) *Dillingham*, (2) *Kokhanok* and (3) *Nushagak* (Figures 3, 4 and 5 respectively).

Figure 1. The Bristol Bay Region in Alaska

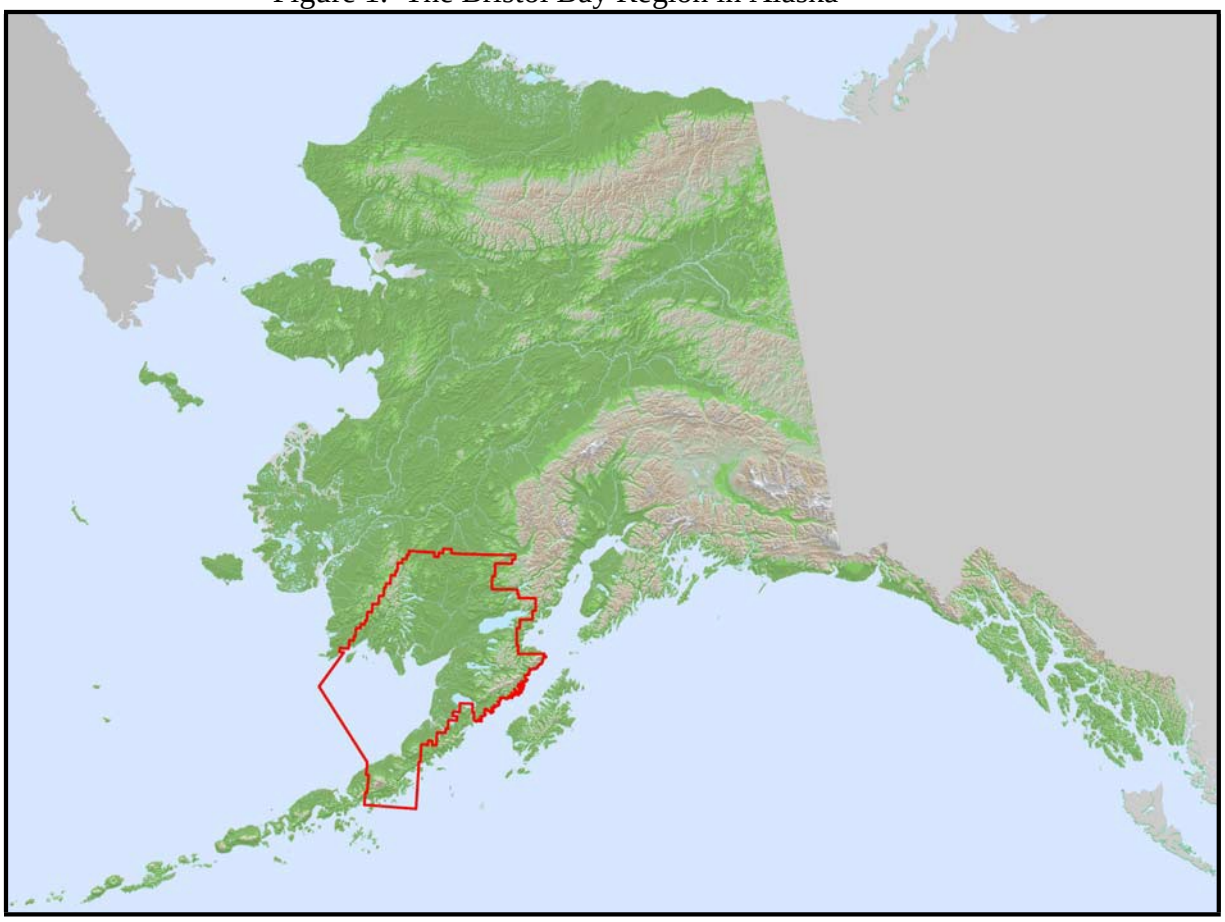


Figure 2. Communities in the Bristol Bay Region

Figure 3. The Dillingham Subunit

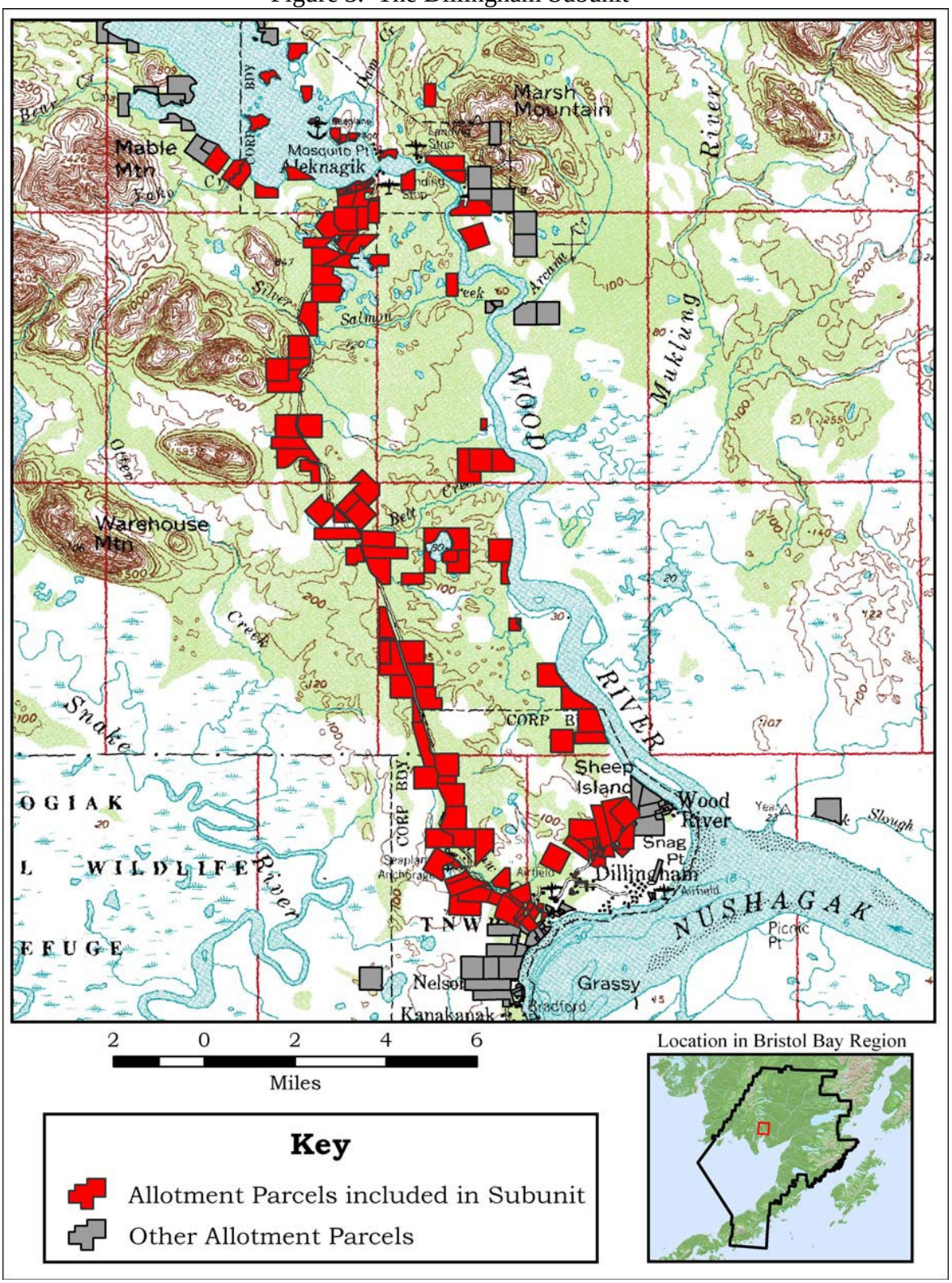


Figure 4. The Kokhanok Subunit.

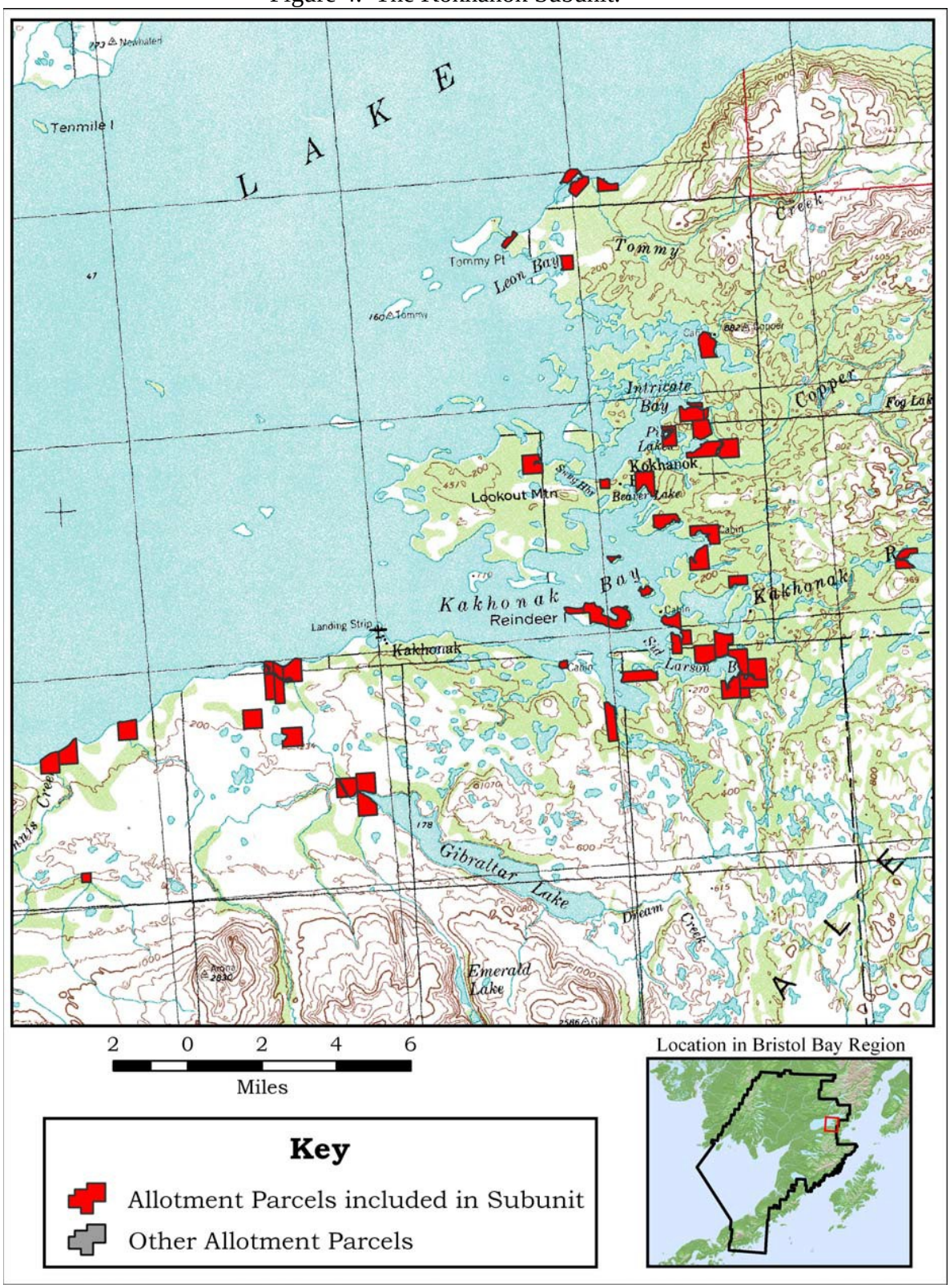
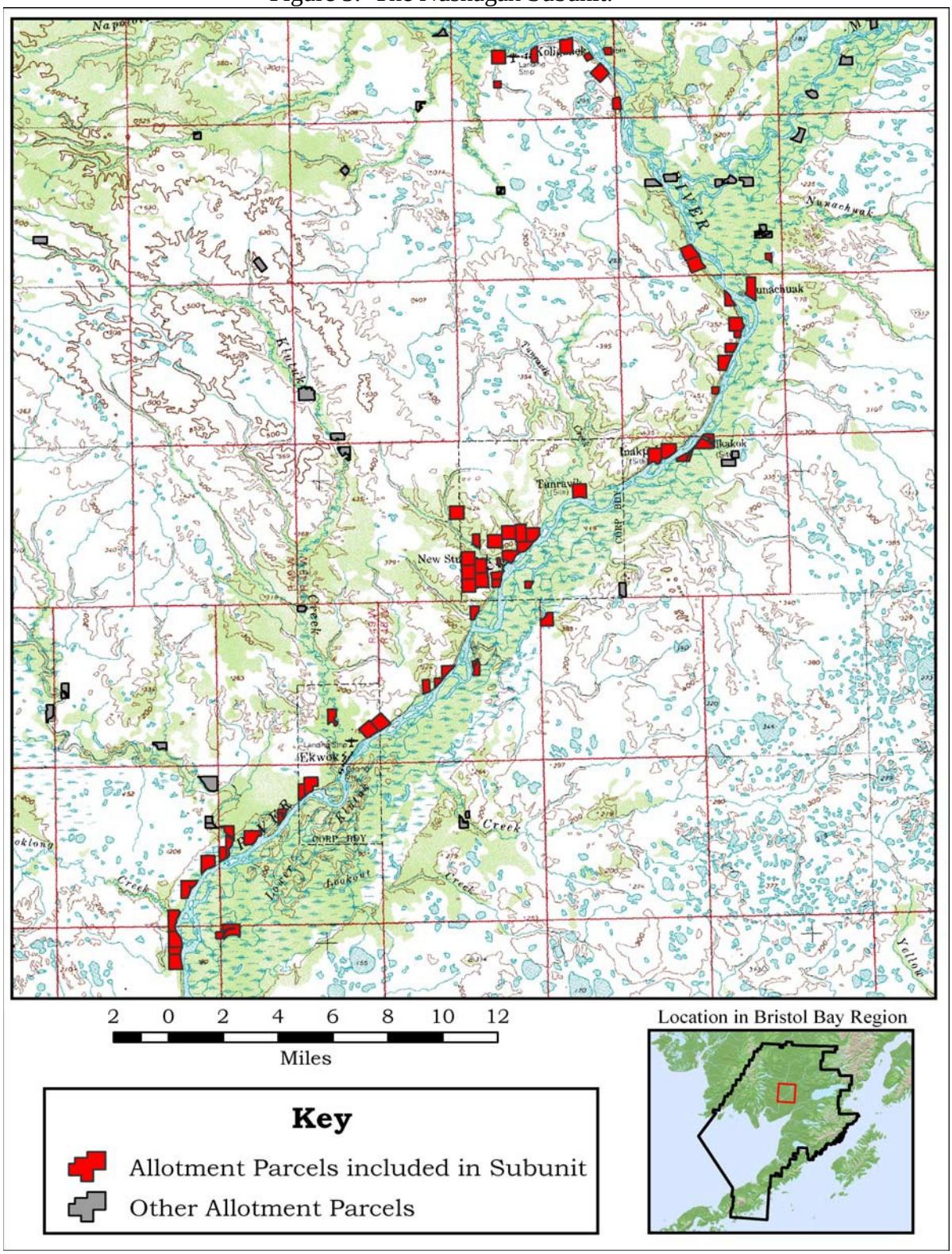


Figure 5. The Nushagak Subunit.



Methods

Terms and Definitions

In the following discussion, the following terms may have special meaning:

- A "GIS" is a geographic information system, a general term referring in this case to a computerized system where spatial data may be collected, organized, analyzed, and displayed. The system consists of computer hardware, software, and data integrated together.
- A "spatial dataset" is a collection of digital data that contains information about features on a landscape. A spatial dataset can take many forms, including "vector", or x,y point-based datasets such as ArcInfo coverages, ArcGIS shapefiles, or geodatabase feature classes, and raster or image datasets such as digital aerial photography or satellite images..
- A spatial dataset is "georeferenced" when the features in the dataset are referenced to the proper geographic location using a standard coordinate system.
- A "polygon" refers to a feature in a spatial dataset that represents an area on the landscape.
- An "attribute" is a particular kind of information about features in a spatial dataset. An "attribute table" is a database table containing information about spatial features, where each record or row in the table is unique to an individual feature, and each column, or item, in the table is an attribute, or kind of information, stored for each feature.
- A "land cover type", or "cover type" is a class or category of vegetation or other land cover describing an area with relatively homogenous cover, and is an attribute of cover type polygons in a GIS.
- A "timber type" is a forested cover type.
- A "stand" is a timber type polygon.
- "DBH" is "Diameter Breast Height", or the diameter of the bole of a tree at a height of 4.5 feet.

Process Summary

The forest inventory process consisted of a number of phases:

- Available information was compiled and integrated into a GIS.
- Land cover types were interpreted from aerial photographs and digitized into the GIS.
- A subset of timbered areas, or stands, was identified for field sampling.
- The selected sample stands were visited in the field and data were collected with tree measurements and other sampled information.
- The field sample data were entered into a computer program for processing.
- The resulting timber volume data were organized and processed in a relational database. Using information from the GIS, volumes were calculated and output as reports.

- The timber volume data in the relational database were integrated into the GIS, and an application was constructed to facilitate dynamic querying and calculation of timber volumes from within the GIS.

Data acquisition and integration

Locations of Native allotments were determined by acquiring Native allotment boundary digital spatial data from the Bureau of Land Management (BLM). The Bristol Bay region was described in a spatial dataset of ANCSA regions downloaded from the State of Alaska DNR (http://www.asgdc.state.ak.us/homehtml/pubaccess.html). The polygon describing the Bristol Bay region was used to extract those Native allotment parcels within the Bristol Bay region from the BLM allotment data, resulting in a spatial dataset containing the location of 1,629 allotment parcel polygons. The allotment parcel data were incorporated into a geodatabase being constructed at the same time as part of an overall effort by TCC to assist the BIA in building tools to help manage allotment forest inventory data. This geodatabase also included feature classes for allotment cover types and other layers pertinent to allotment forest inventory data management. The geodatabase was a personal geodatabase managed with ArcGIS software by ESRI, Inc.

The forest inventory results are driven by the determination of relatively homogenous cover type areas stored in a cover type feature class in the geodatabase. For this project, these cover types were determined by interpreting aerial photographs that were provided by Bristol Bay Native Association. The aerial photographs came from a variety of sources, but generally took the form of natural-color photographs flown at a scale of 1:18,000 and acquired in the summer of 2003. Many of the photos appear to have been acquired as part of efforts to develop community profile datasets at Aleknagik, Koliganek, New Stuyahok, and Ekwok. Photos in the vicinity of the village of Kokhanok were flown by AeroMap (now called Aero-Metric, Inc.), also in 2003. Photos were not provided for all allotment parcels in the region, but were provided for those areas where relatively recent digital aerial photography was available. The extent of the subunits defined and considered in the project, and the parcels included in each subunit, were defined by the extent of the available photo coverage. The aerial photos were provided by BBNA in both their hard-copy contact print form and as digital imagery. The digital images provided were georeferenced and were able to be used in the GIS without further processing.

The available aerial photography was clustered in 3 general areas, which formed the basis of conducting the forest inventory in 3 subunits. The Dillingham Subunit was comprised of the area accessed by the road system and the Wood River between the communities of Dillingham and Aleknagik, and included 148 allotment parcels. The Nushagak Subunit was comprised of the area along the Nushagak River between the villages of Koliganek and Ekwok, and included 49 parcels. The Kokhanok Subunit

was comprised of an area in the vicinity of the village of Kokhanok on the southern shores of Lake Illiamna, and included 64 parcels.

Land cover typing

The process of creating the land cover type data involved the following steps:

- A stereoscope was set up next to a computer workstation.
- The GIS was displayed on the workstation. ArcGIS 9.1 was the software used to display the spatial data and facilitate editing of the land cover polygon data. The operator zoomed into the GIS to a particular native allotment parcel or group of parcels.
- A stereo pair of aerial photographs was mounted under the stereoscope such that the area covered by the parcels in the GIS was displayed in stereo in the stereoscope.
- The operator manually interpreted the land cover on the native allotment parcels while viewing in the stereoscope. The operator determined the location of the boundaries of the cover type polygons, and entered them into the GIS using a "heads-up" digitizing technique – that is, the operator clicked in the location of new feature directly on the computer screen while viewing allotment boundaries and an image of the aerial photograph on the computer. As a general rule, areas less than 2 acres in size were not typed out. As part of TCC's effort to assist the BIA in forest inventory data management, a custom application in ArcGIS was constructed to automate and streamline the data entry and editing process.
- After the new cover type polygons were created or edited, the operator coded the attribute table for the new features for the cover type codes, as interpreted by viewing through the stereoscope. A description of the land cover type codes is in Appendix A. As the polygons were created, they were also automatically coded for allotment serial number, stand number, and acreage using features in the custom application.

Identifying Stands for Field Sampling

Only stands interpreted with timber type calls were selected for field sampling. The total number of stands to be visited was based on the amount of time available during a scheduled field trip and an estimate of how many stands could be accessed in a typical work day. The field work was attempted in one continuous trip by 4 TCC staff. The foresters worked in 2 crews of 2 foresters each. Based on an estimate of 4 full days spent at each subunit with travel days between the subunits, it was assumed that the 2 crews could visit 32 stands in each subunit. For each subunit, the number of stands visited in the field for each timber type were proportionally allocated among the timber type calls based on the total acreage of each timber type. For example, there were 7,031 acres of timber types in the Dillingham Subunit, of which 1,915 acres, or 27%, is typed as high density white spruce poletimber mixed with birch

poletimber (WSP/BIP3). 27% of the 32 stands to be visited at Dillingham means that 9 stands (8.7 rounded up) in that cover type were selected for field sampling in that subunit.

To determine which stands within a timber type were to be selected for sampling, all stands were assigned a random number between 0 and 1. Those stands within a timber type with the highest random number were selected for sampling. After looking at a map, if any of the selected stands were deemed to be impractical to access, they were dropped and the next highest available stand was selected. The stands that were ultimately selected were coded as selected in the attribute table for the cover type features in the GIS. In addition, within each timber type to be visited, 2 alternate stands were selected off the random number listing in case difficulties were encountered in the field trying to access selected stands within that type.

Field Sampling

For each stand selected, a transect crossing a representative cross-section of the stand was determined from aerial photographs. Along each transect, 10 plots were established. Using a variable-radius sampling system, trees were selected for measurement based on their DBH and proximity to the plot center. On at least 5 of the plots, tree measurements for DBH, height, and defect were taken on sample trees; on the remainder of the plots, sample trees were only counted for basal area estimates. A Basal Area Factor (BAF) of 20 was deemed to be appropriate everywhere that stands were sampled. On each measure plot, a white spruce tree was sampled, if present, for age and radial growth by increment coring; an attempt was made to select relatively well-growing trees whose growth was representative of site quality.

The field trip was scheduled from July 5 to July 20, 2006. July 6 through July 9 was spent visiting stands in the Dillingham Subunit. Access difficulties and difficulties acquiring access permissions from some allottees resulted in only 27 of the 32 selected stands being visited. The crew traveled by chartered aircraft from Dillingham to Koliganek on the Nushagak River on July 10, and spent July 11 to July 14 traveling and visiting stands along the Nushagak River by inflatable boat to the vicinity of the village of Ekwok. Similarly, access and logistical difficulties resulted in only 28 of the 32 stands selected for sampling in the Nushagak Subunit being sampled. The crew again traveled by chartered aircraft on July 15 from Ekwok to Kokhanok on Lake Illiamna. The crew attempted to travel on Lake Illiamna in rented boats, but windy weather prohibited safe travel, and no work was accomplished. The crew left Kokhanok on July 18 and returned to Dillingham, and eventually to Fairbanks. Two foresters returned to Kokhanok from September 18 to September 23, 2006, and despite additional weather problems, were able to visit 9 of the selected stands in the Kokhanok Subunit.

Data Processing

Upon returning to the office, the field data were entered on a computer into a forest inventory data processing system. At the time, the system was under development by Dave Wilson of the Branch of Forest Resources and Planning, BIA. TCC staff worked closely with Mr. Wilson for the duration of the project and succeeded in using the system to enter, store, analyze, and report forest inventory data for this project. The system is comprised of a Microsoft Access database and a forest inventory application written in Visual Basic used to facilitate data entry and processing of the collected field data, and creation of timber volume summary tables and statistics.

Individual stands and the data collected in them were treated as separate timber cruises, with timber volume per acre data calculated for each cruise. After reviewing the data, similar timber types were lumped into strata, and the data were processed by strata to produce timber volume summaries. Each polygon from the GIS with a timber type was associated with a timber stratum in the database. Like the individual cruise data, the strata were associated with stand/stock tables and statistics produced by the inventory application. Reports were defined within a MS Access application to summarize the timber volumes using the defined relationships between cover type polygons and the calculated strata timber volume data.

Results

Forest Volume Definitions

Estimates of timber volume on forested lands have been calculated with two different measurements; cubic foot volume and board foot volume. The cubic foot measurement is most useful for estimating total volume available and is easily converted into cords of wood. Roughly 100 cubic feet (1 CCF) of solid wood is equivalent to a cord. The seedling/sapling component of the forest includes all trees greater than 1 inch and less than 4.5 inches DBH, the poletimber component includes trees 4.5 inches to 8.9 inches DBH, and the sawtimber component includes trees equal to or greater than 9.0 inches DBH. The cubic foot measurement, in this report, includes all timber greater than 4.5 inches DBH and is divided among poletimber, sawtimber and recently dead components of the forest. Volume for recently dead trees includes all size classes.

A board foot is a slab of wood equivalent in volume to a board one inch thick, twelve inches wide, and twelve inches long. The board foot measurement is commonly used to determine the amount of boards that can be sawn from a log. Because the board foot measure is based on actual boards that can be sawn from a log, it disregards all material wasted in the process such as slabs and sawdust. The board foot measurement, in this report, only includes timber equal to or greater than 9.0 inches DBH.

Volume calculations for both cubic and board foot measurements are based on volume equations produced for Interior Alaska; U.S. Forest Service research notes NOR-5, NOR-6 and PNW-59. Board foot volume was determined using the Scribner Decimal C scale and is based on 16 foot log segments (short log scale). For spruce it is reported to a 6 inch top (PNW-59) and for hardwoods to an 8 inch top (NOR-5). Cubic volume is reported in Smalian's rule and for spruce and hardwoods includes volume to a 4 inch top (NOR-6). Timber volume calculations for both board feet and cubic feet are based on a net figure for all size classes, where the net volume equals gross volume minus the observed defect. Defect renders portions of individual trees unusable or of very limited use as forest products due to insect damage, rot and physical damage such as broken stems, sweep and crook. The net timber volumes shown however do not take into account all defect because hidden defect (usually internal rot) has not been estimated.

Timber volume estimates for the entire inventory are 15,427,263 board feet and 7,731,036 cubic feet. 65% of the estimated cubic foot volume is in the Dillingham Subunit, 20% is in the Kokhanok Subunit, and 15% is in the Nushagak Subunit. Net timber volumes are reported by species and size class for each stratum in Appendix B. Summaries for each subunit and for the inventory as a whole are contained in tables in Appendix C. Tables C-1, C-2, and C-3 show net forest volume by timber type by grouping strata into broad timber type classes and reporting timber volumes and acreages by subunit; Table C-4 shows the same thing for all subunits combined. Board foot volumes reported include the volume of all species in the sawtimber size

classes found in the timber type class reported. Cubic foot volumes include all species in the sawtimber and poletimber size classes found in the timber type class reported. Tables C-5, C-6, and C-7 show net forest volume by size class/species without regard to timber type by combining the volume of each size class by species for each subunit; Table C-8 is the same thing for all subunits combined.

Estimated Sampling Error

Sampling errors were calculated for the net cubic foot estimates for the Bristol Bay forest inventory and are reported by strata, by subunit, and overall (Table 1.). Sampling error is a measure of the precision of an estimate (in this case, cubic foot volume), and is calculated from the standard deviation of the sample. It is the standard error of the mean expressed as a percentage of the mean.

Sampling errors were calculated for each stratum by the software routines in the inventory application and stored in the strata records in the inventory database. An overall sampling error was calculated for each subunit by combining the sampling errors from the strata for the subunit with the following formula:

$$SE = \sqrt{\frac{\sum\left[(Ns^2)*(S\bar{x}^2)\right]}{\sum(Ns^2)}}$$

where

SE = overall standard error of mean in cubic feet for a subunit

N_s = number of plots in a stratum

$S\bar{x}$ = standard error of the mean of a stratum

Overall mean for a subunit was calculated from the strata means weighted by the number of plots in each stratum:

$$X = \sum[(\downarrow X_s)*(PS)]$$

where:

$\bar{X}$ = weighted mean cubic feet/acre

X_s = mean cubic feet/acre (CF/Acre) in a stratum or size class

PS = percent sample based on number of plots for a stratum

Sampling error percent is calculated as the standard error expressed as a percentage of the mean multiplied by the number of standard deviations required for the desired precision:

$$E\% = \frac{t*(SE)*(100)}{\downarrow X}$$

where:

t = number of standard deviations (used 1)

$E\%$ = sampling error in percent

Similarly, a sample error was calculated for the entire project by combining strata from all subunits together. These statistics are summarized in Table 1.

Table 1. Bristol Bay Inventory Statistics

Dillingham Subunit

Strata	# of plots	CF/Acre	CF Std. Err.
WSP/BIP3	90	897	13.6
WSP1	20	538	46.4
WSP2	20	832	57
WSS/BIP3	140	621	6.9
Total Plots:	270		

Mean Cubic Feet/Acre (weighted by plots): 722
Standard Error of the Mean: 12.7
Sampling Error %: 1.8%

Kokhanok Subunit

Strata	# of plots	CF/Acre	CF Std. Err.
WSP2	50	757	21.3
WSS/BIP3	10	698	95.0
WSS2	30	742	36.6
Total Plots:	90		

Mean Cubic Feet/Acre (weighted by plots): 745
Standard Error of the Mean: 30.5
Sampling Error %: 4.1%

Nushagak Subunit

Strata	# of plots	CF/Acre	CF Std. Err.
BIP/WSP3	40	338	12.7
BIP2	40	412	12.6
WSP1	60	132	2.9
WSP2	104	355	4.8
WSS/BIP3	20	572	42.6
Total Plots:	264		

Mean Cubic Feet/Acre (weighted by plots): 327
Standard Error of the Mean: 9.2
Sampling Error %: 2.8%

All Subunits:

Total Plots: 624
Mean Cubic Feet/Acre: 558
Standard Error of the Mean: 13.7
Sampling Error %: 2.45%

When determining a sampling error at one standard deviation, there is a 66% chance (one standard deviation) that the actual volume is within plus or minus the sampling error percentage of the inventory mean. For example, the following statistics show a sampling error of 2.45% for the cubic foot volume for the entire inventory. This means that for a total volume of 7,731,036 cubic feet there is a 66% chance that the volume is within 189,410 cubic feet (2.45%) of the total volume estimate, based on the variation observed in the sample stands.

Land Cover Typing Accuracy Assessment

Land cover type accuracy was assessed by comparing the land cover type as determined by interpreting the aerial photographs to the land cover type as determined on the ground in those timber stands where the field sampling occurred. Table 2 compares the ground calls to land cover type calls made on the aerial photographs. Levels of accuracy depicted for the land cover type calls are independent of timber volume accuracy shown elsewhere in this report. However, they do provide the user with an idea as the variability of land cover classification and error that may have occurred from misclassification. Since only timbered stands were sampled, only timber types are included in this accuracy assessment.

The contingency table shown in Table 2 shows how many stands within each timber type sampled actually were found to be that timber type. Producer's accuracy is the probability that a type on the ground will be adequately represented by the types as interpreted on the photos, and is calculated by dividing the number of stands where the ground call was the same as the photo call for a timber type by the total number of sampled stands for that ground call. User's accuracy or photo accuracy is the probability that a timber type shown on the photo actually represents that timber type on the ground, and is calculated by dividing the number of stands where the ground call was the same as the photo call by the total number of sampled stands with that photo call. The overall photo accuracy is the average of the user's accuracies for the timber types weighted by the acreages for each timber type, and is calculated to be 36.4%.

One consideration when analyzing timber type accuracy is that a timber type call is composed of several elements; species, size class and density, and in the case of mixed type calls, 2 species each with an associated size class. Additional contingency tables were prepared to examine the individual components separately; Table 3 for the species component, Table 4 for the size class component, and Table 5 for the density component. Calculated overall user accuracies for the individual components reveal accuracies of 70% for species, 46% for size class, and 85% for crown density. The accuracy for any individual component is a function of the number of possible classes for the component and the ability to determine the component with photo interpretation; the relatively lower accuracies for size class is a result of more possible classes or combinations of classes and the difficulty in estimating tree bole diameters from aerial photography. Tree species and densities

are more directly viewable on the photography, and have higher accuracies as a result. Species, size class, and density combined together produce a relatively more difficult attribute to accurately interpret, hence the lower overall combined accuracy. In particular, mixed-species stands are particularly difficult to interpret accurately with regard to all the components of the type calls, and 58% of the timbered acreage was interpreted as mixed-species stands.

Table 2. Contingency table comparing cover type calls to ground observations.

Ground Calls / **Photo Calls**	BIP/WSP2	BIP/WSP3	BIP/WSS3	BIP2	BIP3	BIS/WSP3	WSP/BIP1	WSP/BIP2	WSP/BIP3	WSP1	WSP1/TS	WSP1/TU	WSP2	WSP2/TS	WSS/BIP2	WSS/BIP3	WSS/BIS3	WSS2	WSS3	Other	**Total**	**User Accuracies**	**Acreage**
BIP/WSP2																				1	1	0.%	173
BIP/WSP3		**2**													1						3	67%	474
BIP/WSS3			**1**						1												2	50%	195
BIP2	1			**1**																	2	50%	241
BIP3			1		**2**																3	67%	377
BIS/WSP3																1					1	0%	125
WSP/BIP1																				1	1	0%	133
WSP/BIP2								**1**													1	100%	93
WSP/BIP3								1	**3**							2				2	8	38%	2013
WSP1										**2**										1	3	67%	587
WSP1/TS	1						1													1	3	0%	334
WSP1/TU							1														1	0%	138
WSP2								2		2			**2**		2	1		1	1	2	13	15%	1984
WSP2/TS															1					3	4	25%	429
WSS/BIP2								3								1					4	0%	1046
WSS/BIP3									2							**4**					6	67%	1855
WSS/BIS3									1							1					2	0%	431
WSS2																		**4**		1	5	80%	564
WSS3																		1			1	0%	162
Total	2	2	2	1	2	0	2	7	7	4	0	0	2	0	4	10	0	6	1	12	64	**36%**	
Producer's Accuracies	0%	100%	50%	100%	100%		0%	14%	43%	50%			100%		0%	40%		67%	0%	0%			

Table 3. Contingency table comparing species component of cover type calls to ground observations.

	Ground Calls							
Aerial Photo Calls	BI	WS	BI/WS	WS/BI	WS/AS	**Total**	**User's Accuracies**	**Acreage**
BI	**3**		2			5	60%	618
WS		**14**	2	12	2	30	47%	4199
BI/WS			**4**	**3**		7	57%	967
WS/BI		2		**20**		22	91%	5572
Total	3	16	8	35	2	64	**70%**	
Producer's Accuracies	100%	88%	50%	57%				

Table 4. Contingency table comparing size class component of cover type calls to ground observations.

	Ground Calls									
Aerial Photo Calls	P	S	P/P	P/S	S/P	S/S	P/D	**Total**	**User's Accuracies**	**Acreage**
P	**10**	2	7	1	5		4	29	34%	4091
S		**5**				1		6	83%	726
P/P	2		**7**	1	3		1	14	50%	2887
P/S			1	**1**				2	50%	195
S/P			5		**6**			11	55%	3026
S/S			1		1			2	0%	431
Total	12	7	21	3	15	1	5	64	**46%**	
Producer's Accuracies	83%	71%	33%	33%	40%	0%	20%			

Table 5. Contingency table comparing crown density component of cover type calls to ground observations.

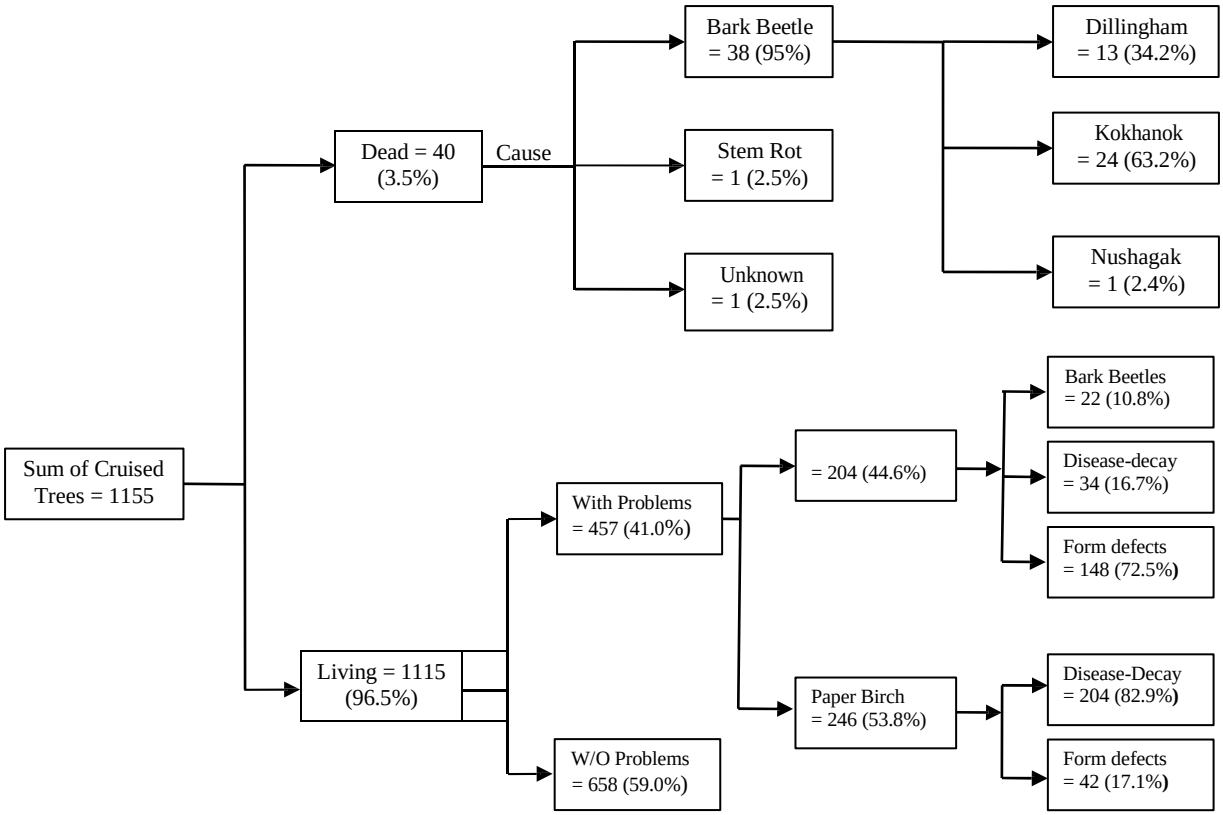
	Ground Calls					
Aerial Photo Calls	1	2	3	**Total**	**User's Accuracies**	**Acreage**
1	**7**	1		8	88%	1192
2	2	**24**	4	30	80%	4532
3		3	**23**	26	88%	5632
Total	9	28	27	64	**85%**	
Producer's Accuracies	78%	86%	85%			

Damages and Problems

Damages and problems, such as insect attacks, stem rots, and form defects were observed and coded for individual trees, plots and stands. The results for damages and problems found in individual trees encountered in the sample are summarized in Figure 6. These data were collected only for those trees sampled on measure plots in the sample stand.

Only 3.4% of the sampled trees were found to be recently dead, and of those, 95% were white spruce trees killed by bark beetles. Most of beetle-killed spruce (63%) were in the Kokhanok Subunit, with nearly all of the remainder (34%) found to be in the Dillingham
Subunit. 10% of sampled live white spruce showed some signs of bark beetle activity. Stem rot and decay was the most prevalent problem in birch, with 48.7% of the live sampled birch coded for some sort of stem rot or decay.

Figure 6. Tree Damage and Problem Summary.


Sum of Cruised Trees = 1155
Dead = 40 (3.5%)
Cause
Bark Beetle = 38 (95%)
Stem Rot = 1 (2.5%)
Unknown = 1 (2.5%)
Dillingham = 13 (34.2%)
Kokhanok = 24 (63.2%)
Nushagak = 1 (2.4%)
Living = 1115 (96.5%)
With Problems = 457 (41.0%)
W/O Problems = 658 (59.0%)
= 204 (44.6%)
Paper Birch = 246 (53.8%)
Bark Beetles = 22 (10.8%)
Disease-decay = 34 (16.7%)
Form defects = 148 (72.5%)
Disease-Decay = 204 (82.9%)
Form defects = 42 (17.1%)

GIS and Database Products

In addition to the summary tables and other information contained in this report, a GIS application and a relational database were also provided to accompany this report and to provide additional information as required.

Forest Inventory Database and Application

Plot and tree data collected in the field, strata definitions and processed timber stocking data is stored in a MS Access database. Accompanying this database is a forest inventory application produced by Dave Wilson, BOFRP, BIA that enables field data entry and data processing, including compiling of the field data into stocking tables used for timber volume summary reports. In addition, there are forms and reports created as an Access application with the database that perform some of the functions of entering and maintaining the data and outputting reports.

GIS Application

The GIS application is in the form of an ArcGIS ArcMap document that allows display, editing, and querying of spatial data associated with this project. The application was developed using ArcGIS 9.1 software from ESRI, Inc., and requires the installation of this software to operate properly. Use of the application requires the software to locate a geodatabase containing the allotment spatial data and a MS Access database containing the forest inventory field data and processed timber volume data; if the databases are not located when the application is started, the user is prompted for their location. There is a compiled HTML Help file accompanying the ArcMap document and stored in the same location that can be accessed from within the application for detailed information on the use of the GIS application.

Appendix A: Land Cover Types and Strata by Subunit

Land Cover Typing Codes

Forestland

WS	White spruce
BS	Black spruce
CW	Cottonwood (balsam poplar)
BI	Paper birch
AS	Aspen

Shrubland

TS	Tall shrub (alder,willow)
DS	Dwarf shrub (bog birch, other)
Tu	Tundra (herb, sedge, grass)

Wetlands

W	Lakes, ponds
B	Bog, herbaceous species
TSw	Tall shrub wet
WM	Wet meadow
DSw	Dwarf shrub wet
R	River

Special Cover Types

Ba	Bare ground, gravel bar
Cu(95)	Cultural/village
Cu(97)	Cultutal/mines, gravel pits, quarries
Cu(98)	Cultural/roads, airstrips

Forestland calls are further described with size and density codes:
Forest size codes:

D	Dwarf forest/scrub forest	< 25 feet tall, any DBH
R	Reproduction	< 4.5” DBH
P	Poletimber	4.5” to 8.9” DBH
S	Sawtimber	≥ 9.0” DBH

Forest stand density codes:
Low density, 10-24% crown closure
Medium density, 25-59% crown closure
High density, 60-100% crown closure

Mixtures of species/size class combinations may be coded, with one density code for the overall type. In such a case, the predominant species is given first, and the secondary species must comprise at least 30% of the stand. Example: WSP/BIP3; a mix of white spruce poletimber and birch poletimber with the white spruce being predominant, and the overall stand density being 60-100% crown closure.

Table A-1. Cover types and strata, Dillingham Subunit.

Cover Class	Stratum	Cover Type	Polygons	Acres	Sampled Stands
Forest	BIP2 (Bristol Bay-Nushagak)				
		BIP1/DS	1	1	0
		BIP1/TS	7	22	0
		BIP2	3	16	0
		BIP2/TS	11	79	0
		BIP3	8	46	0
		BIP3/TS	2	23	0
		BIS1/DS	1	8	0
		BIS2/TS	1	1	0
		BIS3	1	1	0
	WSP/BIP3				
		BIP/WSP3	7	121	0
		BIS/WSP3	9	125	1
		WSP/BIP3	45	1,965	8
		WSP/BIS3	2	36	0
		WSP3	6	108	0
	WSP1				
		WSP1	16	173	1
		WSP1/DS	2	35	0
		WSP1/TS	7	144	1
		WSS1	9	29	0
		WSS1/DS	1	3	0
		WSS1/TS	17	70	0
	WSP2				
		BIP/WSP2	2	102	0
		WSP/BIP2	5	37	0
		WSP2	22	238	1
		WSP2/TS	9	136	1
		WSS/BIP1	2	10	0
	WSS/BIP3				
		BIP/WSS2	3	24	0
		BIP/WSS3	9	125	1
		BIS/WSS2	3	26	0
		BIS/WSS3	5	50	0
		WSS/BIP2	45	1,011	4
		WSS/BIP3	62	1,579	5
		WSS/BIS3	10	431	2
		WSS2	14	109	1
		WSS2/TS	12	121	1
		WSS3	2	24	0
	Strata not assigned				
		WSD	6	16	0

Table A-1 (continued)

Cover Class	Stratum	Cover Type	Polygons	Acres	Sampled Stands
Shrubland		DS	25	83	
		DS/TS	1	1	
		TS	72	470	
		TU	30	244	
Wetland		B	204	2,431	
		TS/R	2	30	
		TSw	4	19	
Rivers and Lakes		R	39	238	
		W	60	156	
Barren and Cultural		BA	18	27	
		CU(98)	94	220	
		CU(VI)	172	673	
Unknown		No Photo	20	907	
		Totals:	1,108	12,548	27

.

Table A-2. Cover types and strata, Kokhanok Subunit

Cover Class	Stratum	Cover Type	Polygons	Acres	Sampled Stands
Forest	BIP2 (Bristol Bay-Nushagak)				
		BIS3	1	13	0
		CWP2	1	24	0
		CWP3	1	3	0
		CWS3	2	15	0
	WSP2				
		WSP/BIP1	1	2	0
		WSP/BIP2	1	5	0
		WSP1	16	223	0
		WSP2	36	1,027	5
		WSP3	2	27	0
	WSS/BIP3				
		WSS/BIP2	2	35	0
		WSS/BIP3	9	116	1
		WSS/CWS2	1	9	0
	WSS2				
		WSS1	4	46	0
		WSS2	12	438	2
		WSS3	4	131	1
	Strata not assigned				
		WSR	9	187	0
Shrubland		DS	63	1,259	
		TS	60	1,094	
		TU	36	768	
Wetland		B	8	47	
		DSw	13	195	
		WM	5	69	
Rivers and Lakes		R	5	23	
		W	28	121	
Barren and Cultural		BA	5	17	
		CU(98)	1	10	
		CU(VI)	16	34	
		Totals:	342	5,937	9

Table A-3. Cover types and strata, Nushagak Subunit.

Cover Class	Stratum	Cover Type	Polygons	Acres	Sampled Stands
Forest	BIP/WSP3				
		BIP/WSP2	6	71	1
		BIP/WSP3	13	353	3
		WSP/BIP3	2	48	0
	BIP2				
		BIP/WSP1	1	10	0
		BIP1	5	13	0
		BIP1/TS	3	37	0
		BIP1/WSD	2	3	0
		BIP2	21	225	2
		BIP2/TS	3	69	0
		BIP3	12	331	3
		BIP3/TS	1	13	0
		BIS2/TS	3	11	0
		BIS3/TS	2	32	0
	WSP1				
		WSP/BIP1	5	131	1
		WSP1	25	191	2
		WSP1/DS	1	10	0
		WSP1/TS	17	190	2
		WSP1/TU	4	138	1
		WSS1	4	69	0
		WSS1/TS	4	37	0
	WSP2				
		WSP/BIP2	4	51	1
		WSP2	20	719	6
		WSP2/TS	10	294	3
		WSP3	1	13	0
		WSS2	2	17	0
		WSS2/B	1	7	0
		WSS2/TS	3	138	1
	WSS/BIP3				
		BIP/WSP2	6	71	1
		BIP/WSP3	13	353	3
		BIP/WSS3	1	70	1
		WSS/BIP3	4	160	0
		WSS3	1	7	0
	Strata not assigned				
		WSD	9	75	0
		WSD/DS	1	2	0
Shrubland		DS	43	1,125	
		TS	58	651	
		TS/DS	2	4	
		TSwill	8	126	
		TU	57	831	
Wetland		B	44	561	
		DSw	9	93	
		TSw	4	30	
Rivers and Lakes		R	30	98	
		W	13	44	

Table A-3. (continued)

Cover Class	Stratum	Cover Type	Polygons	Acres	Sampled Stands
Barren and Cultural		BA	3	15	
		CU(98)	8	24	
		CU(VI)	10	41	
Unknown		No Photo	5	100	
		Totals:	485	7,280	27

Appendix B: Net Timber Volume by Strata Summaries

Table B-1. Net Timber Volume by Species and Size Class for Dillingham Subunit, WSP1 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,220	82.0%	276	51.3%	554,123	125,359
Paper Birch	268	18.0%	65	12.1%	121,725	29,523
Subtotal:	**1,488**	**100.0%**	**341**	**63.4%**	**675,849**	**154,882**
Poletimber						
White Spruce			130	24.2%		59,046
Paper Birch			67	12.5%		30,431
Subtotal:			**197**	**36.6%**		**89,477**
TOTAL:	**1,488**	**100.0%**	**538**	**100.0%**	**675,849**	**244,359**

Stratum Acreage in this Subunit: 454

* Board feet calculated for trees 9" d.b.h. and greater

Table B-2. Net Timber Volume by Species and Size Class for Dillingham Subunit, WSP2 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,743	87.4%	442	53.1%	901,167	228,523
Paper Birch	252	12.6%	99	11.9%	130,289	51,185
Subtotal:	**1,995**	**100.0%**	**541**	**64.9%**	**1,031,456**	**279,708**
Poletimber						
White Spruce			161	19.3%		83,240
Paper Birch			131	15.7%		67,730
Subtotal:			**292**	**35.1%**		**150,970**
TOTAL:	**1,995**	**100.0%**	**833**	**100.0%**	**1,031,456**	**430,678**

Stratum Acreage in this Subunit: 517

* Board feet calculated for trees 9" d.b.h. and greater

Table B-3. Net Timber Volume by Species and Size Class for Dillingham Subunit, WSP/BIP3 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,207	90.8%	385	43.2%	2,841,891	906,486
Paper Birch	45	3.4%	36	4.0%	105,953	84,762
Subtotal:	**1,252**	**94.2%**	**421**	**47.3%**	**2,947,844**	**991,248**
Poletimber						
White Spruce			352	39.5%		828,787
Paper Birch			77	8.6%		181,297
Subtotal:			**429**	**48.1%**		**1,010,084**
Dead						
White Spruce			41	4.6%		96,535
Subtotal:			**41**	**4.6%**		**96,535**
TOTAL:	**1,329**	**100.0%**	**891**	**100.0%**	**3,129,141**	**2,097,867**

Stratum Acreage in this Subunit: 2,355

* Board feet calculated for trees 9" d.b.h. and greater

Table B-4. Net Timber Volume by Species and Size Class for Dillingham Subunit, WSS/BIP3 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,061	84.9%	311	50.1%	3,714,925	1,088,918
Paper Birch	189	15.1%	46	7.4%	661,754	161,062
Subtotal:	**1,250**	**100.0%**	**357**	**57.5%**	**4,376,679**	**1,249,980**
Poletimber						
White Spruce			202	32.5%		707,271
Paper Birch			62	10.0%		217,083
Subtotal:			**264**	**42.5%**		**924,355**
TOTAL:	**1,250**	**100.0%**	**621**	**100.0%**	**4,376,679**	**2,174,334**

Stratum Acreage in this Subunit: 3,501

* Board feet calculated for trees 9" d.b.h. and greater

Table B-5. Net Timber Volume by Species and Size Class for Kokhanok Subunit, WSP2 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,951	97.7%	551	73.3%	2,504,243	707,246
Paper Birch	0	0.0%	5	0.7%	0	6,418
Subtotal:	**1,951**	**97.7%**	**556**	**73.9%**	**2,504,243**	**713,664**
Poletimber						
White Spruce			158	21.0%		202,804
Paper Birch			14	1.9%		17,970
Subtotal:			**172**	**22.9%**		**220,774**
Dead						
White Spruce			24	3.2%		30,806
Subtotal:			**24**	**3.2%**		**30,806**
TOTAL:	**1,996**	**100.0%**	**752**	**100.0%**	**2,562,004**	**965,244**

Stratum Acreage in this Subunit: 1,284

* Board feet calculated for trees 9" d.b.h. and greater

Table B-6. Net Timber Volume by Species and Size Class for Kokhanok Subunit, WSS/BIP3 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,412	88.0%	453	65.0%	224,858	72,139
Paper Birch	127	7.9%	32	4.6%	20,224	5,096
Balsam Poplar	66	4.1%	36	5.2%	10,510	5,733
Subtotal:	**1,605**	**100.0%**	**521**	**74.7%**	**255,593**	**82,968**
Poletimber						
White Spruce			63	9.0%		10,033
Paper Birch			25	3.6%		3,981
Balsam Poplar			8	1.1%		1,274
Subtotal:			**96**	**13.8%**		**15,288**
Dead						
White Spruce			65	9.3%		10,351
Balsam Poplar			15	2.2%		2,389
Subtotal:			**80**	**11.5%**		**12,740**
TOTAL:	**1,605**	**100.0%**	**697**	**100.0%**	**255,593**	**110,996**

Stratum Acreage in this Subunit: 159

* Board feet calculated for trees 9" d.b.h. and greater

Table B-7. Net Timber Volume by Species and Size Class for Kokhanok Subunit, WSS2 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	2,107	96.6%	579	78.1%	1,295,390	355,971
Subtotal:	**2,107**	**96.6%**	**579**	**78.1%**	**1,295,390**	**355,971**
Poletimber						
White Spruce			134	18.1%		82,384
Subtotal:			**134**	**18.1%**		**82,384**
Dead						
White Spruce			28	3.8%		17,214
Subtotal:			**28**	**3.8%**		**17,214**
TOTAL:	**2,181**	**100.0%**	**741**	**100.0%**	**1,340,885**	**455,569**

Stratum Acreage in this Subunit: 615

* Board feet calculated for trees 9" d.b.h. and greater

Table B-8. Net Timber Volume by Species and Size Class for Nushagak Subunit, WSS/BIP3 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	674	93.6%	151	26.4%	179,964	40,318
Paper Birch	45	6.3%	66	11.6%	12,015	17,623
Subtotal:	**719**	**99.9%**	**217**	**38.0%**	**191,979**	**57,941**
Poletimber						
White Spruce			109	19.1%		29,104
Paper Birch			245	42.9%		65,417
Subtotal:			**354**	**62.0%**		**94,521**
White Spruce			0	0.0%		0
Subtotal:			**0**	**0.0%**		**0**
TOTAL:	**720**	**100.0%**	**571**	**100.0%**	**192,246**	**152,462**

Stratum Acreage in this Subunit: 267

* Board feet calculated for trees 9" d.b.h. and greater

Table B-9. Net Timber Volume by Species and Size Class for Nushagak Subunit, BIP2 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	273	66.9%	93	22.6%	202,779	69,079
Paper Birch	135	33.1%	82	20.0%	100,275	60,908
Subtotal:	**408**	**100.0%**	**175**	**42.6%**	**303,055**	**129,987**
Poletimber						
White Spruce			27	6.6%		20,055
Paper Birch			209	50.9%		155,241
Subtotal:			**236**	**57.4%**		**175,296**
TOTAL:	**408**	**100.0%**	**411**	**100.0%**	**303,055**	**305,283**

Stratum Acreage in this Subunit: 743

* Board feet calculated for trees 9" d.b.h. and greater

Table B-10. Net Timber Volume by Species and Size Class for Nushagak Subunit, WSP2 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	626	94.8%	186	52.4%	776,176	230,621
Paper Birch	34	5.2%	21	5.9%	42,157	26,038
Subtotal:	**660**	**100.0%**	**207**	**58.3%**	**818,333**	**256,659**
Poletimber						
White Spruce			116	32.7%		143,828
Paper Birch			26	7.3%		32,237
Quaking Aspen			6	1.7%		7,439
Subtotal:			**148**	**41.7%**		**183,505**
TOTAL:	**660**	**100.0%**	**355**	**100.0%**	**818,333**	**440,164**

Stratum Acreage in this Subunit: 1,240

* Board feet calculated for trees 9" d.b.h. and greater

Table B-11. Net Timber Volume by Species and Size Class for Nushagak Subunit, WSP1 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	167	97.1%	67	50.8%	128,038	51,369
Paper Birch	5	2.9%	1	0.8%	3,833	767
Subtotal:	**172**	**100.0%**	**68**	**51.5%**	**131,872**	**52,135**
Poletimber						
White Spruce			32	24.2%		24,534
Paper Birch			32	24.2%		24,534
Subtotal:			**64**	**48.5%**		**49,069**
TOTAL:	**172**	**100.0%**	**132**	**100.0%**	**131,872**	**101,204**

Stratum Acreage in this Subunit: 767

* Board feet calculated for trees 9" d.b.h. and greater

Table B-12. Net Timber Volume by Species and Size Class for Nushagak Subunit, BIP/WSP3 Stratum.

	Net Volume Per Acre				Total Net Volume	
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**Board Feet***	**Cubic Feet**
Sawtimber						
White Spruce	1,073	93.6%	245	72.7%	474,867	108,427
Paper Birch	73	6.4%	18	5.3%	32,307	7,966
Subtotal:	**1,146**	**100.0%**	**263**	**78.0%**	**507,174**	**116,393**
Poletimber						
White Spruce			37	11.0%		16,375
Paper Birch			28	8.3%		12,392
Quaking Aspen			3	0.9%		1,328
Cottonwood			6	1.8%		2,655
Subtotal:			**74**	**22.0%**		**32,749**
TOTAL:	**1,146**	**100.0%**	**337**	**100.0%**	**507,174**	**149,143**

Stratum Acreage in this Subunit: 443

* Board feet calculated for trees 9" d.b.h. and greater

Appendix C: Timber Volume Summaries

Table C-1. Net Forest Volume by Timber Type, Dillingham Subunit.

			Board Feet			Cubic Feet		
Land Cover Type	**Acres**	**%**	**Per Acre**	**Total**	**%**	**Per Acre**	**Total**	**%**
Forest								
Sawtimber								
White spruce	357	2.8%	1,318	470,392	5.1%	597	213,140	4.2%
Hardwood	10	0.1%	408	3,896	0.0%	411	3,924	0.1%
White spruce - Hardwood	3,233	25.8%	1,255	4,057,716	43.6%	632	2,043,124	40.6%
Sawtimber Totals:	3,599	28.7%	1,259	4,532,004	48.7%	628	2,260,189	44.9%
Poletimber								
White spruce	834	6.6%	1,695	1,413,202	15.2%	716	596,930	11.9%
Hardwood	188	1.5%	408	76,616	0.8%	411	77,180	1.5%
White spruce - Hardwood	2,411	19.2%	1,363	3,285,356	35.3%	871	2,099,798	41.7%
Poletimber Totals:	3,433	27.4%	1,391	4,775,175	51.3%	808	2,773,908	55.1%
Dwarf/Repro								
White spruce	16	0.1%	0	0	0.0%	0	0	0.0%
Dwarf/Repro Totals:	16	0.1%	0	0	0.0%	0	0	0.0%
Forest Totals:	7,048	56.2%	1,321	9,307,178	100.0	714	5,034,097	100.0
Shrubland								
Shrubland Totals:	798	6.4%	0	0	0.0%	0	0	0.0%
Wetland								
Wetland Totals:	2,480	19.8%	0	0	0.0%	0	0	0.0%
Rivers and Lakes								
Rivers and Lakes Totals:	394	3.1%	0	0	0.0%	0	0	0.0%
Barren and Cultural								
Barren and Cultural Totals:	921	7.3%	0	0	0.0%	0	0	0.0%
Unknown								
Unknown Totals:	907	7.2%	0	0	0.0%	0	0	0.0%
Total:	**12,548**	**100.0%**	**742**	**9,307,178**	**100.0**	**401**	**5,034,097**	**100.0**

Table C-2. Net Forest Volume by Timber Type, Kokhanok Subunit.

			Board Feet			Cubic Feet		
Land Cover Type	**Acres**	**%**	**Per Acre**	**Total**	**%**	**Per Acre**	**Total**	**%**
Forest								
Sawtimber								
White spruce	615	10.4%	2,181	1,340,885	32.1%	741	455,569	29.3%
Hardwood	13	0.2%	408	5,335	0.1%	411	5,374	0.3%
Cottonwood	15	0.3%	408	6,205	0.1%	411	6,250	0.4%
White spruce - Hardwood	151	2.5%	1,605	241,688	5.8%	697	104,958	6.8%
White spruce - Cottonwood	9	0.1%	1,605	13,904	0.3%	697	6,038	0.4%
Sawtimber Totals:	802	13.5%	2,004	1,608,018	38.5%	721	578,190	37.2%
Poletimber								
White spruce	1,277	21.5%	1,996	2,548,369	61.0%	752	960,107	61.8%
Cottonwood	27	0.5%	408	10,924	0.3%	411	11,005	0.7%
White spruce - Hardwood	7	0.1%	1,996	13,635	0.3%	752	5,137	0.3%
Poletimber Totals:	1,310	22.1%	1,964	2,572,928	61.5%	745	976,249	62.8%
Dwarf/Repro								
White spruce	187	3.2%	0	0	0.0%	0	0	0.0%
Dwarf/Repro Totals:	187	3.2%	0	0	0.0%	0	0	0.0%
Forest Totals:	2,300	38.7%	1,818	4,180,946	100.0	676	1,554,438	100.0
Shrubland								
Shrubland Totals:	3,121	52.6%	0	0	0.0%	0	0	0.0%
Wetland								
Wetland Totals:	311	5.2%	0	0	0.0%	0	0	0.0%
Rivers and Lakes								
Rivers and Lakes Totals:	144	2.4%	0	0	0.0%	0	0	0.0%
Barren and Cultural								
Barren and Cultural Totals:	61	1.0%	0	0	0.0%	0	0	0.0%
Total:	**5,937**	**100.0%**	**704**	**4,180,946**	**100.0**	**262**	**1,554,438**	**100.0**

Table C-3. Net Forest Volume by Timber Type, Nushagak Subunit.

Land Cover Type	Acres	%	Per Acre	Total	%	Per Acre	Total	%
Forest								
Sawtimber								
White spruce	275	3.8%	474	130,418	6.7%	275	75,615	6.6%
Hardwood	43	0.6%	408	17,515	0.9%	411	17,643	1.5%
White spruce - Hardwood	160	2.2%	720	115,411	5.9%	571	91,527	8.0%
Sawtimber Totals:	478	6.6%	550	263,343	13.5%	386	184,785	16.1%
Poletimber								
White spruce	1,556	21.4%	494	768,420	39.4%	279	434,234	37.8%
Hardwood	689	9.5%	408	281,294	14.4%	411	283,362	24.7%
White spruce - Hardwood	735	10.1%	870	639,622	32.8%	334	245,874	21.4%
Poletimber Totals:	2,980	40.9%	567	1,689,336	86.5%	323	963,470	83.9%
Dwarf/Repro								
White spruce	77	1.1%	0	0	0.0%	0	0	0.0%
Dwarf/Repro Totals:	77	1.1%	0	0	0.0%	0	0	0.0%
Forest Totals:	3,536	48.6%	552	1,952,679	100.0	325	1,148,255	100.0
Shrubland								
Shrubland Totals:	2,737	37.6%	0	0	0.0%	0	0	0.0%
Wetland								
Wetland Totals:	684	9.4%	0	0	0.0%	0	0	0.0%
Rivers and Lakes								
Rivers and Lakes Totals:	142	2.0%	0	0	0.0%	0	0	0.0%
Barren and Cultural								
Barren and Cultural Totals:	80	1.1%	0	0	0.0%	0	0	0.0%
Unknown								
Unknown Totals:	100	1.4%	0	0	0.0%	0	0	0.0%
Total:	**7,280**	**100.0%**	**268**	**1,952,679**	**100.0**	**158**	**1,148,255**	**100.0**

Table C-4. Net Forest Volume by Timber Type, All Subunits.

			Board			Cubic Feet		
Land Cover Type	**Acres**	**%**	**Per Acre**	**Total**	**%**	**Per Acre**	**Total**	**%**
Forest								
Sawtimber								
White spruce	1,247	4.8%	1,557	1,941,695	12.6%	597	744,324	9.6%
Hardwood	66	0.3%	408	26,745	0.2%	411	26,942	0.3%
Cottonwood	15	0.1%	408	6,205	0.0%	411	6,250	0.1%
White spruce - Hardwood	3,543	13.8%	1,246	4,414,815	28.6%	632	2,239,609	28.9%
White spruce - Cottonwood	9	0.0%	1,605	13,904	0.1%	697	6,038	0.1%
Sawtimber Totals:	4,880	18.9%	1,312	6,403,365	41.5%	620	3,023,163	39.1%
Poletimber								
White spruce	3,666	14.2%	1,290	4,729,991	30.6%	543	1,991,271	25.7%
Hardwood	877	3.4%	408	357,910	2.3%	411	360,542	4.7%
Cottonwood	27	0.1%	408	10,924	0.1%	411	11,005	0.1%
White spruce - Hardwood	3,153	12.2%	1,249	3,938,614	25.5%	746	2,350,809	30.4%
Poletimber Totals:	7,723	30.0%	1,170	9,037,439	58.5%	610	4,713,626	60.9%
Dwarf/Repro								
White spruce	281	1.1%	0	0	0.0%	0	0	0.0%
Dwarf/Repro Totals:	281	1.1%	0	0	0.0%	0	0	0.0%
Forest Totals:	12,884	50.0%	1,198	15,440,804	100.0	601	7,736,790	100.0
Shrubland								
Shrubland Totals:	6,656	25.8%	0	0	0.0%	0	0	0.0%
Wetland								
Wetland Totals:	3,476	13.5%	0	0	0.0%	0	0	0.0%
Rivers and Lakes								
Rivers and Lakes Totals:	681	2.6%	0	0	0.0%	0	0	0.0%
Barren and Cultural								
Barren and Cultural Totals:	1,062	4.1%	0	0	0.0%	0	0	0.0%
Unknown								
Unknown Totals:	1,007	3.9%	0	0	0.0%	0	0	0.0%
Total:	**25,765**	**100.0%**	**599**	**15,440,804**	**100.0**	**300**	**7,736,790**	**100.0**

Table C-5. Net Forest Volume by Size Class/Species Without Regard to Timber Type, Dillingham Subunit.

	Total Net Volume				
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**% Defect**
Sawtimber					
White Spruce	8,077,778	86.8%	2,370,672	47.1%	5.4%
Paper Birch	1,048,103	11.3%	343,369	6.8%	46.4%
Sawtimber Totals:	9,125,881	98.1%	2,714,041	53.9%	13.8%
Poletimber					
White Spruce	0	0.0%	1,684,868	33.5%	0.1%
Paper Birch	0	0.0%	538,653	10.7%	3.1%
Poletimber Totals:	0	0.0%	2,223,520	44.2%	0.9%
Dead					
White Spruce	181,297	1.9%	96,535	1.9%	38.3%
Dead Totals:	181,297	1.9%	96,535	1.9%	38.3%
Total:	9,307,178	100.0%	5,034,097	100.0%	9.3%

* Board feet calculated for trees 9" d.b.h. and greater

Table C-6. Net Forest Volume by Size Class/Species Without Regard to Timber Type, Kokhanok Subunit.

	Total Net Volume				
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**% Defect**
Sawtimber					
White Spruce	4,039,522	96.6%	1,140,477	73.4%	13.2%
Paper Birch	27,658	0.7%	16,029	1.0%	40.5%
Balsam Poplar	10,510	0.3%	5,733	0.4%	23.4%
Sawtimber Totals:	4,077,690	97.5%	1,162,239	74.8%	13.8%
Poletimber					
White Spruce	0	0.0%	296,707	19.1%	5.3%
Paper Birch	0	0.0%	33,459	2.2%	0.0%
Balsam Poplar	0	0.0%	1,274	0.1%	0.0%
Poletimber Totals:	0	0.0%	331,439	21.3%	4.7%
Dead					
White Spruce	103,256	2.5%	58,371	3.8%	76.6%
Balsam Poplar	0	0.0%	2,389	0.2%	0.0%
Dead Totals:	103,256	2.5%	60,760	3.9%	75.8%
Total:	4,180,946	100.0%	1,554,438	100.0%	20.2%

* Board feet calculated for trees 9" d.b.h. and greater

Table C-7. Net Forest Volume by Size Class/Species Without Regard to Timber Type, Nushagak Subunit.

	Total Net Volume				
Size/Species Class	**Board Feet***	**%**	**Cubic Feet**	**%**	**% Defect**
Sawtimber					
White Spruce	1,761,825	90.2%	499,814	43.5%	7.7%
Paper Birch	190,588	9.8%	113,301	9.9%	27.2%
Sawtimber Totals:	1,952,412	100.0%	613,115	53.4%	12.0%
Poletimber					
White Spruce	0	0.0%	233,896	20.4%	0.0%
Paper Birch	0	0.0%	289,822	25.2%	0.0%
Quaking Aspen	0	0.0%	8,767	0.8%	0.0%
Cottonwood	0	0.0%	2,655	0.2%	0.0%
Poletimber Totals:	0	0.0%	535,140	46.6%	0.0%
Dead					
White Spruce	267	0.0%	0	0.0%	100.0%
Dead Totals:	267	0.0%	0	0.0%	100.0%
Total:	1,952,679	100.0%	1,148,255	100.0%	7.3%

* Board feet calculated for trees 9" d.b.h. and greater

Table C-8. Net Forest Volume by Size Class/Species Without Regard to Timber Type, All Subunits.

Size/Species Class	Total Net Volume Board Feet*	%	Cubic Feet	%	% Defect
Sawtimber					
White Spruce	13,879,125	89.9%	4,010,963	51.8%	8.1%
Paper Birch	1,266,348	8.2%	472,699	6.1%	42.6%
Balsam Poplar	10,510	0.1%	5,733	0.1%	23.4%
Sawtimber Totals:	15,155,984	98.2%	4,489,395	58.0%	13.6%
Poletimber					
White Spruce	0	0.0%	2,215,471	28.6%	0.8%
Paper Birch	0	0.0%	861,933	11.1%	2.0%
Quaking Aspen	0	0.0%	8,767	0.1%	0.0%
Balsam Poplar	0	0.0%	1,274	0.0%	0.0%
Cottonwood	0	0.0%	2,655	0.0%	0.0%
Poletimber Totals:	0	0.0%	3,090,100	39.9%	1.2%
Dead					
White Spruce	284,820	1.8%	154,906	2.0%	62.4%
Balsam Poplar	0	0.0%	2,389	0.0%	0.0%
Dead Totals:	284,820	1.8%	157,295	2.0%	62.1%
Total:	15,440,804	100.0%	7,736,790	100.0%	11.4%

* Board feet calculated for trees 9" d.b.h. and greater

Appendix D: Timber Volumes by Allotment Parcel

Table D-1. Net Cubic Foot Timber Volume by Allotment Parcel, Dillingham Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 047964A	0	AKA 056278	76,653	AKAA 007643	138,654
AKA 047964B	10,040	AKA 056303A	0	AKAA 007644	1,621
AKA 053203	7,504	AKA 056318	0	AKAA 007645	143,356
AKA 053204A	6,375	AKA 056716	0	AKAA 007647	93,907
AKA 053246	1,988	AKA 058084A	33,692	AKAA 007649	87,505
AKA 053908A	20,963	AKA 058084B	0	AKAA 007650	92,678
AKA 053920	5,494	AKA 058203B	65,312	AKAA 007652	87,894
AKA 053983	0	AKA 062357	168	AKAA 007653	79,551
AKA 053991	6,650	AKA 056498B	18,245	AKAA 007654	115,056
AKA 054113	0	AKAA 000876	80,624	AKAA 007656A	43,018
AKA 054430B	66,667	AKAA 002918B	16,484	AKAA 007657A	55,396
AKA 054430C	0	AKAA 002958	73,598	AKAA 007657B	47,530
AKA 054433	0	AKAA 005793A	0	AKAA 007658A	37,981
AKA 054434	0	AKAA 005794	53,751	AKAA 007668A	48,024
AKA 054435	0	AKAA 005875A	1,821	AKAA 007671	21,493
AKA 054436A	0	AKAA 005930	78,663	AKAA 007672A	43,047
AKA 054436C	0	AKAA 005944B	23,548	AKAA 007673	20,953
AKA 054437A	2,828	AKAA 006079	2,246	AKAA 007676	109,639
AKA 054437B	0	AKAA 006093B	59,041	AKAA 007677	51,344
AKA 054442	0	AKAA 006093C	0	AKAA 007679A	57,227
AKA 054445	168	AKAA 006094	0	AKAA 007681	105,825
AKA 054446	45,456	AKAA 006125A	32,853	AKAA 007699A	700
AKA 054448	0	AKAA 006251	0	AKAA 007699B	568
AKA 054453A	3,352	AKAA 006334	29,242	AKAA 007700	45,551
AKA 054460B	5,386	AKAA 006431C	45,103	AKAA 007701	78,137
AKA 054462	21,954	AKAA 006626	4,152	AKAA 007706	90,159
AKA 054464A	43,649	AKAA 006997	48,213	AKAA 007707	36,937
AKA 054465	25,115	AKAA 007109	67,081	AKAA 007709A	83,340
AKA 054467	38,364	AKAA 007270B	4,554	AKAA 007756	76,543
AKA 054471	38,392	AKAA 007273	90,383	AKAA 007759C	47,449
AKA 054481	999	AKAA 007276A	19,741	AKAA 007760B	33,775
AKA 054482	68,269	AKAA 007276B	29,835	AKAA 007762	32,187
AKA 054484	35,494	AKAA 007277B	42,979	AKAA 007763	73,541
AKA 054487A	0	AKAA 007279B	43,313	AKAA 007795	48,218
AKA 054488	27,676	AKAA 007280A	30,540	AKAA 007797	4,600
AKA 054491	5,473	AKAA 007281B	11,673	AKAA 007904	81,733
AKA 054492A	2,246	AKAA 007281C	21,042	AKAA 007905	91,128
AKA 054493A	1,145	AKAA 007281D	0	AKAA 007908	57,051
AKA 054494A	0	AKAA 007282	22,508	AKAA 008051	17,730
AKA 054527A	0	AKAA 007288C	12,167	AKAA 008106	109,927
AKA 054529A	2,733	AKAA 007289A	878	AKAA 008107	148,392
AKA 054530	42,696	AKAA 007289B	28,074	AKAA 008113A	65,613
AKA 054832	0	AKAA 007294A	14,454	AKAA 008136	0
AKA 054833	0	AKAA 007307A	46,698	AKAA 008260	22,169
AKA 055534	40,404	AKAA 007594B	20,593	AKAA 008279	5,380
AKA 055904A	0	AKAA 007614	82,320	AKAA 008784	13,367
AKA 055924	5,126	AKAA 007638	41,416	AKAA 051012	83,149
AKA 055996A	0	AKAA 007640	69,448	AKAA 055918	5,789
AKA 056124	74,979	AKAA 007642A	4,903		
AKA 056177A	1,635	AKAA 007642B	92,035		

Table D-2. Net Cubic Foot Timber Volume by Allotment Parcel, Kokhanok Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 052503	3,182	AKAA 006263	0
AKA 052505	0	AKAA 006264	585
AKA 052510	94,686	AKAA 006265	33,832
AKA 052690B	81,698	AKAA 006266	9,888
AKA 059683	11,656	AKAA 006267	1,556
AKA 061756	20,113	AKAA 006268	0
AKA 063274B	24,445	AKAA 006507A	0
AKA 063810	48,989	AKAA 006507B	22,966
AKAA 002714	105,549	AKAA 007058	58,874
AKAA 006123	74,507	AKAA 007344	43,708
AKAA 006205	1,116	AKAA 007345	74,170
AKAA 006210	0	AKAA 007527A	6,250
AKAA 006211B	25,678	AKAA 007527B	0
AKAA 006211D	0	AKAA 007544	16,729
AKAA 006213A	37,478	AKAA 007546	74,259
AKAA 006213B	6,305	AKAA 007555A	68,195
AKAA 006216	0	AKAA 007555B	2,569
AKAA 006219	45,350	AKAA 007898	52,483
AKAA 006222	32,697	AKAA 007899	50,263
AKAA 006232	78,583	AKAA 008063	81,688
AKAA 006259	15,440	AKAA 008065A	23,451
AKAA 006260	110,270	AKAA 008065B	11,229
AKAA 006261	2,006	AKAA 008065D	16,207
AKAA 006262	0	AKAA 008252	85,790

Table D-3. Net Cubic Foot Timber Volume by Allotment Parcel, Nushagak Subunit

Parcel	Net CF Vol.	Parcel	Net CF Vol.
AKA 054026A	10,217	AKAA 007665	6,439
AKA 054026B	13,549	AKAA 007678	45,249
AKA 054026C	6,109	AKAA 007683	4,785
AKA 054027	5,017	AKAA 007684	47,910
AKA 054029	4,213	AKAA 007687A	11,684
AKA 054031A	17,366	AKAA 007687B	6,329
AKA 054031B	18,164	AKAA 007688	23,233
AKA 054033A	3,118	AKAA 007690B	24,278
AKA 054033B	9,593	AKAA 007691A	12,759
AKA 054034A	31,559	AKAA 007691B	19,652
AKA 054035	31,400	AKAA 007692	18,729
AKA 054036A	35,547	AKAA 007694B	21,944
AKA 054037	43,668	AKAA 007714B	8,271
AKA 054817	14,247	AKAA 007715	3,582
AKAA 006317	50,763	AKAA 007716	79,626
AKAA 006375B	13,415	AKAA 007764B	14,103
AKAA 006376	8,818	AKAA 007766B	12,179
AKAA 006379	47,943	AKAA 007768	50,089
AKAA 006380B	22,940	AKAA 007771	31,238
AKAA 006385	29,159	AKAA 007774	7,088
AKAA 006392A	1,077	AKAA 007775B	8,257
AKAA 006398	10,833	AKAA 007784B	2,845
AKAA 006400	10,603	AKAA 007810A	0
AKAA 006406	3,423	AKAA 007812A	5,584
AKAA 006410	0	AKAA 007837A	14,616
AKAA 006413	23,295	AKAA 007838A	6,165
AKAA 006420	41,770	AKAA 007850C	0
AKAA 006422	31,142	AKAA 007852B	13,768
AKAA 006721	11,976	AKAA 008115C	11,888
AKAA 007662	33,985	AKAA 008292	13,342
AKAA 007663	918	AKAA 057642	13,541
AKAA 007664	14,043	AKAA 081231B	9,211

APPENDIX B:
Alaska Forest Resources Protection Act (AFRPA)
Best Management Practices

I. Forestry Best Management Practices: Disposal of Waste Materials

i. Prevent any petroleum-contaminated soils or materials from entering and polluting surface waters.
ii. Remove all petroleum products and their containers from the operating area.
iii. Remove all oil-contaminated filters, absorbent pads, or soils from the operating area.
iv. Dispose of all petroleum products or petroleum contaminated waste material in accordance with the requirements of DEC.
v. Prevent metal or leachates from oxidation of metal parts from entering and polluting surface waters.
vi. Remove all machine parts, wire rope, scrap culverts, and similar scrap metal from the operating area.
vii. Dispose of all scrap metal in accordance with the requirements of DEC.

II. Forestry Best Management Practices: Operating in Riparian Areas

i. Identify and correctly classify all surface waters so appropriate and applicable BMP's can be implemented on them.
ii. All surface waters found in the field with a perennial flow along a defined channel, or an intermittent flow along a defined channel significant for protection of downstream water quality should be identified on a map of harvest operations. Factors in determining whether the stream is significant for protection of downstream water quality are: frequency of flow; volume of flow the channel can hold; stability of banks and bed material; amount of debris in the channel; and volume of flow in the receiving water body.
iii. Prevent depositing any more erodible material than necessary near a surface water, to minimize scour, bank erosion, or debris jams and debris torrents.
iv. Protect the riparian area immediately adjacent to a stream so the vegetation can continue to function as a filter strip and remove sediment carried by runoff from the road.
v. Minimize the amount of sediment that enters a riparian area, to lessen the likelihood of overwhelming the capability of the filtering vegetation to remove sediment.
vi. Avoid side-casting excess overburden and excavated material into a riparian or other designated area to the maximum extent feasible.
vii. Avoid locating roads within a riparian area except to cross a waterbody, or if there is no other feasible location for the road. The road should be located outside the riparian area, unless locating the road outside the riparian area is likely to cause slope failures, excessive erosion, or sedimentation that would have a greater adverse impact on the stream.
viii. Minimize the amount of road construction and resulting disturbance within a riparian area. Eroded material close to the stream is more likely to cause sedimentation because of fewer opportunities to design sediment control features into the drainage system.
ix. Prevent unnecessary crossings, which can contribute sediment.
x. A road within a riparian area must be designed and located to minimize significant adverse effects on fish habitat and water quality.
xi. Locate the road away from or upstream of a meander bend or recently abandoned channel.
xii. Where feasible, cross stream channels at right angles.
xiii. Locate the road to fit the topography.
xiv. Avoid deep gullies with fine textured soils when constructing roads.
xv. Include drainage features that minimize or direct road runoff away from any adjacent stream, and effectively control sediment.

xvi. Prevent felled or bucked timber from entering streams.

xvii. Leave high stumps in the riparian area where they will not cause frequent hang-ups or other operational difficulties when yarding.

xviii. Avoid creating conditions conducive to erosion and stream sedimentation. Trees or logs rolling downhill can disrupt soils and damage the streambed or banks. A tree or log in a stream can change the flow pattern.

xix. Avoid changing sediment storage and the rate of sediment transport through a stream system. Damage to the streambed or banks can destabilize the stream channel causing additional scour of the streambed or erosion of the banks. Avoid creating conditions conducive to initiation of debris torrents. Debris carried into streams, or existing material and debris mobilized by activity in the stream channel may form unstable debris dams, especially in steep, incised channels. If these structures fail under the right conditions they can lead to debris torrents.

xx. Prevent felled or bucked timber from entering streams. In steep areas, leave high stumps in the riparian area where they will not cause frequent hang-ups or other operational difficulties when yarding the setting. Trees or logs rolling downhill can disrupt soils and damage the streambed or banks. A tree or log in a stream can change the flow pattern

xxi. Avoid changing sediment storage and the rate of sediment transport through a stream system. Damage to the streambed or banks can destabilize the stream channel causing additional scour of the streambed or erosion of the banks. Avoid creating conditions conducive to soil erosion adjacent to surface waters. Avoid disturbances to the bed and banks of a stream caused by removing logs that enter the stream channel during yarding operations

xxii. Avoid creating conditions conducive to initiation of debris torrents. Debris carried into streams, or existing material and debris mobilized by activity in the stream channel may form unstable debris dams, especially in steep, incised channels. If these structures fail under the right conditions they can lead to debris torrents.

xxiii. Prevent damage to trees designated for retention (buffers) in a riparian area. Prevent damage to soils or understory vegetation caused by equipment operating in a riparian area.

xxiv. Minimize operation of track or wheeled equipment operation in a riparian area, minimizing ground disturbance. Prevent damage to retained timber, understory vegetation, and soils. Unless one end of a log is suspended, skidding a turn of logs through a riparian area can cause extensive damage to soils and remaining trees. Maintain one-end suspension of logs. Minimize the number of skid routes through a riparian area.

xxv. Shovel yarding should rarely require a skid trail within the riparian area. An exception might be where a stream is crossed to shovel log a small patch of timber on the other side without having to construct a road. Where feasible, the operator should reach into the riparian area to remove a log after having positioned the shovel outside the riparian area. Trees within a riparian area should have been felled and bucked so any log segment is reachable from outside the riparian area. A large log might require walking a shovel in and out of the riparian area to enable it to lift the log and achieve the required one end suspension, or to reach logs resulting from an approved harvest variation. If so, the shortest possible route should be followed. Maneuvering around a rock outcrop may also be a reason for entering a riparian area.

III. Forestry Best Management Practices: Timber Harvesting and Water Resources

i. Locate landings where they, and the operations conducted from them, will have the least impact on surface waters. Landings are focal points for harvest operations, and many impacts associated with harvesting activities can be minimized by selecting appropriate landing locations.

ii. Prevent deposition of logs and debris in surface waters. The large amount of waste and debris generated at a landing can end up in adjacent surface water if the landing is located too close, or on a hillside immediately above the water body.

iii. Avoid creating conditions conducive to erosion, mass wasting and stream sedimentation. Landings can disturb a lot of ground, drainage from haul and yarding roads lead towards them, and they can intercept ephemeral drainages. Landings are generally level and at least partially built on fill. Constant equipment operation and standing water can cause excessive deformation of the surface material and generate sediment. Poor drainage combined with the weight of fill material on steep side hills can lead to fill failures and mass wasting.

iv. Locating landings on ridges or benches along the hillside can greatly reduce the amount of excavation and fill required to construct them. They should not be built larger than needed to accommodate setting up the yarder or processor, and for safely landing and loading logs. If the landing is located on steep or unstable slopes, it should be constructed to prevent soil erosion and mass wasting. The landing, as well as trails and roads leading to it, should be effectively drained.

v. Harvest operations should avoid creating conditions favorable to erosion and mass wasting by protecting residual trees and understory vegetation. Their undisturbed root systems retain and stabilize soils.

vi. Harvest operations should avoid disturbing large woody debris embedded in the streambed or banks of streams. Avoid creating conditions conducive to erosion and stream sedimentation. Removing large woody debris decreases stream roughness and can cause scour or erosion

vii. Avoid changing sediment storage and the rate of sediment transport through a stream system. Disturbance of large woody debris can release stored gravel, reduce the capacity of the stream to store gravel, and increase the gravel transport rate through the stream system. Avoid impacting habitat forming structures in the stream channel. Large woody debris can form pools and riffles important for fish, so disturbance should be minimized. Less disturbance minimizes chances of erosion, stream sedimentation, changes to sediment storage and transport patterns, and loss of fish habitat.

viii. Avoid falling trees into a stream and avoid creating conditions conducive to erosion and stream sedimentation. Falling trees into streams can damage the streambed or banks. Streams flowing around the tree, as well as tree removal, can cause further damage.

ix. Avoid changing sediment storage and the rate of sediment transport through a stream system. Avoid creating conditions conducive to debris torrents. As previously mentioned, new debris, or existing debris mobilized by activity in the stream channel, may form unstable debris dams, especially in steep, incised channels. If these structures fail they can cause debris torrents.

x. All trees felled into non-fish-bearing surface or standing waters and their debris should be removed at the earliest feasible time, to the extent necessary to avoid degradation of water quality. Any significant amount of debris that may cause degradation of water quality in the stream or in downstream segments of the stream must be removed.

Sometimes removing a tree or a log from a stream can cause more damage to the streambed or banks and riparian area than leaving it. As such, the Forester in Charge should evaluate each situation.

xi. For all track or wheeled skidding operations, avoid disturbance to the ground cover and the soil, to minimize erosion and stream sedimentation. Locate and design skid trails to minimize sedimentation by keeping them from leading toward surface waters, minimizing the width of skid trails, and ensuring good drainage. Use water bars or other appropriate techniques as necessary to prevent or minimize sedimentation. Outslope skid trails where feasible, unless an inslope is necessary to prevent logs from sliding or rolling downhill off the skid trail. Bumper logs and/or trees can be used to protect stream banks and frozen ground and a layer of snow can help reduce the impacts caused by cross-stream yarding.

xii. Use puncheon where significant ground disturbances may contribute to sedimentation of surface water. Puncheon helps to spread the weight of equipment over the ground, reducing the depth and amount of ground disturbance and protecting underlying vegetation. Again, frozen ground and a layer of snow can greatly reduce the impacts from skidding operations, especially on wet sites.

III. Forestry Best Management Practices: Road Construction and Water Resources

i. When it is necessary to cross wetlands or soils associated with permafrost in order to access forest resources, construct temporary winter roads instead of all season permanent roads. Frozen soils and snow help minimize compaction and disturbance to soil resources and associated vegetation. Stream and river crossings are generally easier as well, and impacts to stream banks and stream channels are minimized. Many of the allotments in the Bering Straits region can only be accessed by wheeled or tract vehicles during the winter.

ii. Prevent or minimize sedimentation. Avoid generating sediment that can enter streams. Prevent or minimize erosion of unstable soils. Treat unstable soils with effective and appropriate erosion control measures.

iii. Sedimentation is less likely the farther away the road is from the stream. Intervening vegetation or terrain features can filter and trap sediment. Low spots or intervening ridges can intercept runoff, allowing suspended sediment to filter or settle out before reaching surface waters. Unstable soils usually must be stabilized before any measures can be taken to prevent or minimize erosion and re-vegetate exposed soils.

iv. Avoid overloading unstable slopes with fill for road construction or side-casted material. Avoid mass wasting and remember that slope failures are most likely to occur when soils are saturated, can result in landslides or debris torrents. Avoid erosion of sidecasted material. Use end-hauling or full-bench construction techniques if mass wasting from overloading on an unstable slope or erosion of sidecast material is likely to occur and cause degradation of surface or standing water quality.

v. Fill for road construction or side-casting excavated material should not be placed on unstable slopes (can cause landslides or debris torrents). Fine-grained, erodible material should not be side-casted in the vicinity of surface waters, but rather taken to a disposal site where the terrain and vegetation allows suspended sediment to filter or settle out before runoff from the site can reach any surface waters. To determine whether the slope is unstable, look for evidence of past slope failures (overgrown slide paths, colluvial fans, slumps, or other depositional areas), slopes greater than 67%, or J-butted

trees. To determine whether soils are susceptible to mass wasting, look for poorly drained marine sediments, a strike of bedrock conducive to sliding, and ephemeral drainages.

vi. When felling trees for road construction, fall trees away from all fish bearing waters, standing waters, and other surface waters. Do not fall a tree into anadromous fish waters cataloged under AS 41.14.870 without prior written approval of the Office of Habitat Management and Permitting (OHMP). If introduced, remove limbs and other small debris from other fish-bearing waters within 48 hours, and remove the bole as soon as the necessary equipment is at the site. If introduced, remove debris from nonfish-bearing surface waters and standing waters at the earliest feasible time when necessary to avoid degradation of water quality.

vii. Dispose of waste material created during road construction where it will not enter surface waters, away from surface waters and/or with vegetation suitable for filtering or settling out suspended sediments. Deposit all material in a suitable upland site stabilized by effective and appropriate erosion control measures.

viii. Keep roads constructed on unstable soils well drained through the construction of drainage systems. Also when a road is confined by a hillside, runoff from the road and ephemeral drainages from the hillside must be collected. Short sections of road that cut through a ridge may not require a ditch if the road can be graded or banked so that runoff will drain off the road within a short distance. If a ditch is needed on the uphill side of a road, it should be constructed as an integral part of the road, collecting runoff from the hillside and road surface. It should be close enough to the road so a grader can pull and clean it. Straight sections of road should visually slope to the outside edge of the road. Winding sections should be distinctly banked to direct runoff towards the inside corner of the curve and off the road. Runoff should rapidly seek the outer edge of the road and should not flow for an extended distance down the road.

ix. Avoid exceeding the capacity of the ditch by allowing runoff flowing down the ditchline to be relieved before it can overwhelm the capacity of the ditch and flood the road. As flows increase, so does their capability to cause erosion, especially on steeper grades. Runoff collected by the road drainage system needs to be spread out across the hillside to avoid erosion that would be caused by a more concentrated flow, and allow vegetation to filter out suspended sediment. To the extent feasible, direct ditchline runoff away from unstable soils and surface waters, and onto vegetative areas. Discharges should also be directed away from stream channels and intermittent stream channels. A drainage structure should be provided as close as practical to the stream crossing to relieve the ditchline before flows reach the crossing site. Drainage relief should be provided where soil, or drainage should be directed through sufficient vegetation to remove suspended sediment before reaching surface waters.

x. Less frequent spacing of drainage structures is permissible if the parent material of roadbed is not erodible, such as rock or gravel, or the topography is not conducive to erosion. More frequent spacing is required where soil is unstable or where peak flows require more drainage structures to prevent degradation of surface water quality. Ditchline flows need to be reduced where the grade increases, and where soils are highly erodible. Wetter hillsides require more drainage structures to handle anticipated flows. If subsurface flow dominates on a well-drained hillside, roads will usually not intercept subsurface flows, requiring fewer drainage structures. Discharges near surface waters should be minimized, potentially requiring additional relief structures to reduce the drainage area. Fewer drainage structures may be needed where the terrain prevents

runoff from reaching surface waters. Sediment entering surface waters indicates a need for more drainage structures.

xi. Drainage structures must be capable of handling peak flows (estimated by width and depth of channel at high water mark).

xii. Streams with floodplains require addition drainage considerations when designing and constructing the approach road and crossing structure. Most floodplains have side or overflow channels that will be crossed by approach roads; sometimes they are hidden by brush or vegetation, and may be intermittent or limited to flood events. To determine the extent of the floodplain, examine vegetation, sediment deposits, or debris trapped by brush or other understory vegetation. A relief dip should be incorporated into the approach road to allow for passage of flood waters that exceed the drainage design for the road and it should be located where it will protect the bridge abutments from erosion but away from any side channels.

xiii. Any permanent log or wood bridge must be firmly anchored at one end as water under a wooden bridge can float it and carry it off its abutments. The bridge must be securely anchored to a physical structure that will not be disturbed by floodwaters, typically by: 1) drill steel driven through the sill logs into the ground, 2) sills tied back to large stumps along the approaches, or 3) to deadmen buried in the approach fills. The bridge superstructure must also be tied to the bridge sills. Anchors must be capable of withstanding high flows that overtop the stream banks. Stumps should be firmly fixed in the ground, and not be affected by floodwaters that overtop the stream banks in the vicinity of the crossing. Deadmen should be covered by large rock that will not be moved by floodwaters, and buried in sections of the road that are protected from erosion and have adequate overflow drainage structures installed. This BMP applies to bridge approaches constructed from readily erodible materials. Approaches constructed with rock should still have retaining walls or other structures adequate to keep fill material from entering surface waters. Erodible material must be protected from erosion by plantings, seeding, riprap or other ground cover. Retaining walls, bulkheads, or other means may also be employed. Sill logs or other abutments for the bridge should be installed back from the edge of the bank and above the line of ordinary high water to avoid encroaching on the stream. Bridge construction that involves activity within the channel of an anadromous stream requires a Title 16 permit.

IV. Forestry Best Management Practices: Culverts

i. For fish-bearing waters, the entrance (to the extent possible) and exit of a stream culvert must match the natural course of a stream channel, and a culvert may not be perched at its inlet or outlet. During low flows perched culverts may prevent fish passage, especially for small fry or smolt. Under ADF&G criteria a culvert perched more than four inches does not provide adequate fish passage. High flows through a perched culvert tend to erode the streambed below the culvert outlet, generating sediment and increasing the perch height. Also, stream flows redirected by a skewed culvert can erode the stream banks and change the course of the stream. Ideally culverts should be bedded to match the stream channel such that gravel can fill the bottom of the culvert. The deposition of gravel within the culverts increases roughness, helps to maintain the original stream gradient and reduces flows through the culvert that may inhibit fish passage. The inlet should be buried so that the culvert is as level as possible. Under ADF&G criteria a culvert with spiral corrugations, 48" and less, does not provided adequate fish passage if the gradient is greater than 1%. Burying the inlets also helps the culvert fill with gravel.

ii. Material at the outlet of the culvert must be adequate to resist or reduce the erosive force of the discharge. If material is not resistant, additional measures must be taken to minimize erosion, for example, the installation of a half round, flume, downfall culvert or similar structure. Outfall from that structure must be protected from erosion.

iii. For culverts installed on nonfish-bearing waters along a forest road, prevent mobile slash generated during harvest activities from being carried downstream and blocking a culvert inlet. This will ultimately prevent culverts from washing out. Clear the stream channel for 50 feet above the culvert inlet of mobile slash or debris that may be expected to plug a culvert. The larger the stream, the more likely high flows will mobilize slash left in the stream and carry it down to the culvert inlet. If only a small amount of slash, or small pieces, are left after cleaning the stream, the more likely it is the culvert will continue to function adequately. The few pieces of slash that don't pass through the structure can be cleaned out during routine road maintenance. If the slash or debris is imbedded, it is less likely to become mobile.

iv. To insure drainage enters and flows through a culvert, instead of bypassing the culvert and down the ditch or over the road and where the parent soil material allows, and interference with fish passage is avoided, install a catch basin to collect water and direct it into the inlet of a culvert. Catch basins are often needed to collect ditch water and divert it into a relief culvert. Side drainages that are not incised, or along roads with a slight bench cut, will often need catch basins to direct side drainages into a culvert and keep flows from diverting down the ditchline.

v. Culverts must be of sufficient length to prevent road overlay material from blocking the ends of the culvert. The ends of the culvert must extend beyond the fill far enough to keep material from sloughing into the entrances to the culvert. The greater the depth of fill over the culvert the longer it will have to be. Also allowance in the length of the culvert is needed to anticipate the widening of the road over time due to maintenance practices.

vi. Keep all culverts and ditches functional when maintaining active roads.
When maintaining active roads, keep the road surface crowned or outsloped during operations and keep the downhill side of the road free from berms, except those intentionally constructed for the protection of fill.

vii. For inactive roads, keep the road surface crowned, out-sloped, or water barred and left in a condition that is not conducive to erosion. (Johnson,B, 2005).

V. Forestry Best Management Practices: Soil Resources

i. Choose your land locations wisely. Landings are focal points for harvest operations, and many impacts associated with harvesting activities can be minimized by selecting appropriate landing locations. Avoid creating conditions conducive to erosion, mass wasting and stream sedimentation. Landings can disturb a lot of ground, drainage from haul and yarding roads lead towards them, and they can intercept ephemeral drainages. Locate landings where they, and the operations conducted from them, will have the least impact on surface waters. Landings are generally level and at least partially built on fill. Constant equipment operation and standing water can cause excessive deformation of the surface material and generate sediment. Poor drainage combined with the weight of fill material on steep side hills can lead to fill failures and mass wasting.

ii. Locating landings on ridges or benches along the hillside can greatly reduce the amount of excavation and fill required to construct them. They should not be built larger than needed to accommodate setting up the yarder or processor, and for safely landing and

loading logs. If the landing is located on steep or unstable slopes, it should be constructed to prevent soil erosion and mass wasting. The landing, as well as trails and roads leading to it, should be effectively drained.

iii. Harvest operations should avoid creating conditions favorable to erosion and mass wasting by protecting residual trees and understory vegetation. Their undisturbed root systems retain and stabilize soils.

iv. For all track or wheeled skidding operations, avoid disturbance to the ground cover and the soil, to minimize erosion and stream sedimentation. Locate and design skid trails to minimize sedimentation by keeping them from leading toward surface waters, minimizing the width of skid trails, and ensuring good drainage. Use water bars or other appropriate techniques as necessary to prevent or minimize sedimentation. Outslope skid trails where feasible, unless an inslope is necessary to prevent logs from sliding or rolling downhill off the skid trail. Bumper logs and/or trees can be used to protect stream banks and frozen ground and a layer of snow can help reduce the impacts caused by cross-stream yarding.

v. Use puncheon where significant ground disturbances may contribute to sedimentation of surface water. Puncheon helps to spread the weight of equipment over the ground, reducing the depth and amount of ground disturbance and protecting underlying vegetation. Again, frozen ground and a layer of snow can greatly reduce the impacts from skidding operations, especially on wet sites.

vi. When it is necessary to cross wetlands or soils associated with permafrost in order to access forest resources, construct temporary winter roads instead of all season permanent roads. Frozen soils and snow help minimize compaction and disturbance to soil resources and associated vegetation.

vii. Avoid overloading unstable slopes with fill for road construction or sidecasted material. Avoid mass wasting and remember that slope failures are most likely to occur when soils are saturated, can result in landslides or debris torrents. Avoid erosion of sidecasted material. Use end-hauling or full-bench construction techniques if mass wasting from overloading on an unstable slope or erosion of sidecast material is likely to occur and cause degradation of surface or standing water quality.

viii. Fill for road construction or sidecasting excavated material should not be placed on unstable slopes). Fine-grained, erodible material should not be sidecasted in the vicinity of surface waters, but rather taken to a disposal site where the terrain and vegetation allows suspended sediment to filter or settle out before runoff from the site can reach any surface waters. To determine whether the slope is unstable, look for evidence of past slope failures (overgrown slide paths, colluvial fans, slumps, or other depositional areas), slopes greater than 67%, or J-butted trees.

ix. Dispose of waste material created during road construction where it will not enter surface waters, away from surface waters and/or with vegetation suitable for filtering or settling out suspended sediments. Deposit all material in a suitable upland site stabilized by effective and appropriate erosion control measures.

x. Keep roads constructed on unstable soils well drained through the construction of drainage systems. Also when a road is confined by a hillside, runoff from the road and ephemeral drainages from the hillside must be collected. Short sections of road that cut through a ridge may not require a ditch if the road can be graded or banked so that runoff will drain off the road within a short distance. If a ditch is needed on the uphill side of a road, it should be constructed as an integral part of the road, collecting runoff from the hillside and road surface. It should be close enough to the road so a grader can

pull and clean it. Straight sections of road should visually slope to the outside edge of the road. Winding sections should be distinctly banked to direct runoff towards the inside corner of the curve and off the road. Runoff should rapidly seek the outer edge of the road and should not flow for an extended distance down the road.

xi. Avoid exceeding the capacity of the ditch by allowing runoff flowing down the ditchline to be relieved before it can overwhelm the capacity of the ditch and flood the road. As flows increase, so does their capability to cause erosion, especially on steeper grades. Runoff collected by the road drainage system needs to be spread out across the hillside to avoid erosion that would be caused by a more concentrated flow, and allow vegetation to filter out suspended sediment. To the extent feasible, direct ditchline runoff away from unstable soils and surface waters, and onto vegetative areas. Discharges should also be directed away from stream channels and intermittent stream channels. A drainage structure should be provided as close as practical to the stream crossing to relieve the ditchline before flows reach the crossing site. Drainage relief should be provided where outflows can percolate into the soil, or drainage should be directed through sufficient vegetation to remove suspended sediment before reaching surface waters.

xii. Less frequent spacing of drainage structures is permissible if the parent material of roadbed is not erodible, such as rock or gravel, or the topography is not conducive to erosion. More frequent spacing is required where soil is unstable or where peak flows require more drainage structures to prevent degradation of surface water quality. Ditchline flows need to be reduced where the grade increases, and where soils are highly erodible. Wetter hillsides require more drainage structures to handle anticipated flows. If subsurface flow dominates on a well-drained hillside, roads will usually not intercept subsurface flows, requiring fewer drainage structures. Discharges near surface waters should be minimized, potentially requiring additional relief structures to reduce the drainage area. Fewer drainage structures may be needed where the terrain prevents runoff from reaching surface waters. Sediment entering surface waters indicates a need for more drainage structures.

xiii. Water bars are needed when a skid trail causes soil disturbance or changes drainage patterns. Examples include skid trails crossing a hillside, running downhill towards a surface water, impeding overland flows (even on flat ground), causing extensive soil disturbance, or intercepting a number of ephemeral drainages.

xiii. Water bars should be constructed across the width of the skid road. They should be at an angle to the skid road with the downhill end lower to facilitate drainage. The downhill side of the upper end should be blocked as necessary to prevent runoff from going around the end of the water bar. Both ends of the water bar should be free of obstructions. On flat grades the water bar can provide cross-flow drainage for overland flows and should be dug deep enough to prevent ponding.

xiv. Water bars need to be located and spaced frequently enough to divert runoff from the skid trail before it picks up enough volume and velocity to cause significant erosion. Severely disturbed soils may need additional measures to stabilize them and prevent erosion. Measures such as re-vegetating exposed soils or covering the skid trails with slash can protect the exposed soils from rainfall-induced rill erosion.

xv. Keep all culverts and ditches functional when maintaining active roads. Keep the road surface crowned or outsloped during operations and keep the downhill side of the road free from berms, except those intentionally constructed for the protection of fill.

xvi. For inactive roads, keep the road surface crowned, out-sloped, or water barred and left in a condition that is not conducive to erosion.

U.S. Fish & Wildlife Service

Land Clearing Timing Guidance for Alaska

Plan Ahead to Protect Nesting Birds

General Information:
Under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703) (see http://ipl.unm.edu/cwl/fedbook/mbta.html), it is illegal for anyone to "take" migratory birds, their eggs, feathers or nests. “Take” includes by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof. Take and possession under MBTA can be authorized through regulations, such as hunting regulations, or permits, e.g., salvage, research, depredation, or falconry. The MBTA does not distinguish between intentional and unintentional take. In Alaska, all native birds except grouse and ptarmigan (protected by the State of Alaska) are protected under the MBTA.

Destruction of active bird nests, eggs, or nestlings that can result from spring and summer vegetation clearing, grubbing, and other site preparation and construction activities would violate the MBTA. The following timing guidelines are not regulations, but are intended as recommendations to help you comply with the MBTA. Some species and their nests have additional protections under other federal laws, including those listed under the Threatened and Endangered Species Act (ESA), and bald and golden eagles (protected under the Bald and Golden Eagle Protection Act or BGEPA). Please contact the U.S. Fish and Wildlife Service to ensure compliance with ESA and BGEPA if these species may be present in your project area.

Directions:

1. Apply timing window guidelines to your project planning, unless project-specific review results in unique guidelines from the USFWS for your project.

2. If you encounter an active nest *at any time*, including before or after the local timing window, leave it in place and protected until young hatch and depart. “Active” is indicated by intact eggs, live chicks, or presence of adult on nest. Timing guidelines should considerably reduce the risk of inadvertent nest destruction, but final compliance with the law is your responsibility: do not destroy eggs, chicks, or adults of wild bird species.

3. If you have any questions regarding the MBTA and the timing guidelines, including projects that may occur in “boundary areas” between regions described on the matrix, contact your local Fish and Wildlife Field Office for assistance:

   Anchorage (907) 271-2888 Kenai (907) 262-9863
   Fairbanks (907) 456-0203 Juneau (907) 780-1160

Recommended Time Periods to Avoid Vegetation Clearing

HABITAT TYPE → REGION ↓	Forest or woodland[1] *(i.e., trees present)*	Shrub or Open *(i.e., shrub cover or marsh, pond, tundra, gravel, or other treeless/ shrubless ground habitat)*	Seabird colonies *(including cliff and burrow colonies)*	Raptor and raven cliffs
Southeast	April 15 – July 15	May 1 – July 15 [2]	May 1 – September 15 [3]	April 10 – August 10
Kodiak Archipelago			April 15 – September 7 [3]	
Southcentral *(Lake Illiamna to Copper River Delta; north to Talkeetna)*	May 1 – July 15 [2]			
Bristol Bay/AK Peninsula *(north to Lake Illiamna)*	April 10 – July 15	May 1 – July 15 [2, 4]	May 10 – September 15	
Interior *(north of Talkeetna to south slope Brooks Range; west to treeline)*	May 1 – July 15 [2]		May 1 – July 20 [5]	April 15 – August 1
Aleutian Islands		April 25 – July 15	May 1 – September 15 [3]	April 1 – August 1
Yukon-Kuskokwim Delta *(east to treeline)*		May 5 – July 25 [2, 4]	May 20 – September 15	April 15 – August 15
Seward Peninsula		May 20 – July 20 [4]		
Northern *(includes northern foothills of Brooks Range)*		June 1 – July 31 [4]		
Pribilof and Bering Sea Islands		June 1 – July 15	May 25 – September 1	

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[1] Owl species may begin to nest two or more months earlier than other forest birds, and are fairly common breeders in forested areas of Alaska. You may wish to survey for nesting owls (or other early spring tree-cavity nesters) prior to tree-cutting. It is your responsibility to protect active nests from destruction.
[2] Canada geese and swan habitat: begin April 20
[3] Storm petrel burrow habitat: April 1 – October 15
[4] Black scoter habitat: through August 10
[5] Seabird colonies in Interior refer to terns and gulls

APPENDIX C:

Bristol Bay Region

Species List of Mammals, Fish, and Birds

Mammal Species of the Bristol Bay Region

Bats

Black Bears

Brown Bears

Beaver

Caribou

Coyotes

Fox

Hares

Lynx

Mammals- Small Mammals

Marten

Marmot

Mink and Weasel

Moose

Muskrat

Otter

Porcupine

Squirrel- Arctic Ground

Squirrel- Red

Sea Lions and Fur Seals

Seals

Walrus

Whales- Baleen Whales

Whales- Toothed Whales, Dolphins, and Porpoises

Wolverine

Wolves

Fish Species of the Bristol Bay Region

Fish Group	Scientific Name	Common Name
Salmon		
	(Oncorhynchus nerka)	Sockeye salmon
	(Oncorhynchus tshawytscha)	Chinook salmon
	(Oncorhynchus kisutch)	Coho salmon
	(Oncorhynchus keta)	Chum salmon
	(Oncorhynchus gorbuscha)	Pink salmon
Char		
	(Salvelinus namaycush)	Lake trout
	(Salvelinus alpinus)	Arctic Char
	(Salvelinus malma)	Dolly Varden
Other Resident Species		
	(Thymallus arcticus)	Arctic grayling
	(Onchorhynchus mykiss)	Rainbow trout
	(Esox lucius)	Northern pike
	(Dallis pectoralis)	Alaska blackfish
	(Lota lota)	Burbot
	(Coregonus laurettae)	Bering cisco
	(Coregonus sardinella)	Least cisco
	(Coregonus nelsoni)	Alaska whitefish
	(Prosopium coulteri)	Pigmy whitefish
	(Prosopium cylindraceum)	Round whitefish
	(Cottus aleuticus)	Coastrange sculpin
	(Cottus cognatus)	Slimy sculpin
	(Gasterosteus aculatus)	Threespine stickleback
	(Pugitius pungitius)	Ninespine stickleback
	(Catostomus catostomus)	Longnose sucker
Potential freshwater migrants		
	(Entosphenus tridentatus)	Pacific lamprey
	(Lampetra japonica)	Arctic lamprey
	(Clupea harengus pallasi)	Pacific herring
	(Thaleichthys pacificus)	Eulachon
	(Hypomesus olidus)	Pond smelt
	(Osmerus mordax)	Rainbow smelt
	(Liopsetta glacialis)	Arctic flounder
	(Platichthys stellatus)	Starry flounder

Bird Species of the Bristol Bay Region

There are 201 bird species known to occur on Togiak Refuge. In addition, there are 15 other species that have been recorded in the Dillingham area, which have not been seen on the Refuge. These species are marked with a double asterisk (**).

Scientific Name	**Common** Name
Gavia stellata	Red-throated Loon
Gavia arctica	Arctic Loon
Gavia pacifica	Pacific Loon
Gavia immer	Common Loon
Gavia adamsii	Yellow-billed Loon
Podiceps auritus	Horned Grebe
Scientific Name	**Common** Name
Puffinus tenuirostris	Short-tailed Shearwater
Oceanodroma furcata	Fork-tailed Storm-Petrel**
Oceanodroma leucorhoa	Leach's Storm-Petrel
Phalacrocorax auritus	Double-crested Cormorant
Phalacrocorax urile	Red-faced Cormorant
Phalacrocorax pelagicus	Pelagic Cormorant
Fregata magnificens	Magnificent Frigatebird
Anser albifrons	Greater White-fronted Goose
Chen canagica	Emperor Goose
Chen caerulescens	Snow Goose
Branta canadensis	Canada Goose
Branta bernicla	Brant
Cygnus buccinator	Trumpeter Swan
Cygnus columbianus	Tundra Swan
Aix sponsa	Wood Duck**
Anas strepera	Gadwall
Anas penelope	Eurasian Wigeon
Anas americana	American Wigeon
Anas platyrhynchos	Mallard
Anas clypeata	Northern Shoveler
Anas acuta	Northern Pintail
Anas formosa	Baikal Teal
Anas crecca	Green-winged Teal
Aythya valisineria	Canvasback
Aythya americana	Redhead
Aythya marila	Greater Scaup
Aythya affinis	Lesser Scaup

Polysticta stelleri	Steller's Eider
Somateria fischeri	Spectacled Eider
Somateria spectabilis	King Eider
Somateria mollissima	Common Eider
Histrionicus histrionicus	Harlequin Duck
Melanitta perspicillata	Surf Scoter
Melanitta fusca	White-winged Scoter
Melanitta nigra	Black Scoter
Clangula hyemalis	Long-tailed Duck
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Bucephala islandica	Barrow's Goldeneye
Mergus merganser	Common Merganser
Scientific Name	**Common** Name
Haliaeetus leucocephalus	Bald Eagle
Haliaeetus pelagicus	Steller's Sea Eagle
Circus cyaneus	Northern Harrier
Accipiter striatus	Sharp-shinned Hawk
Accipter gentilis	Northern Goshawk
Buteo swainsoni	Swainson's Hawk
Buteo jamaicensis	Red-tailed Hawk
Buteo lagopus	Rough-legged Hawk
Aquila chrysaetos	Golden Eagle
Falco sparverius	American Kestrel
Falco columbarius	Merlin
Falco rusticolus	Gyrfalcon
Falco peregrinus	Peregrine Falcon
Falcipennis canadensis	Spruce Grouse
Lagopus lagopus	Willow Ptarmigan
Lagopus mutus	Rock Ptarmigan
Lagopus leucurus	White-tailed Ptarmigan
Grus canadensis	Sandhill Crane
Pluvialis squatarola	Black-bellied Plover
Pluvialis dominica	American Golden-Plover
Pluvialis fulva	Pacific Golden-Plover
Charadrius mongolus	Mongolian Plover
Charadrius semipalmatus	Semipalmated Plover
Haematopus bachmani	Black Oystercatcher
Tringa melanoleuca	Greater Yellowlegs
Tringa flavipes	Lesser Yellowlegs
Tringa solitaria	Solitary Sandpiper

Heteroscelus incanus	Wandering Tattler
Heteroscelus brevipes	Gray-tailed Tattler
Actitis macularia	Spotted Sandpiper
Xenus cinereus	Terek Sandpiper
Numenius phaeopus	Whimbrel
Numenius tahitiensis	Bristle-thighed Curlew
Limosa haemastica	Hudsonian Godwit
Limosa lapponica	Bar-tailed Godwit
Limosa fedoa	Marbled Godwit
Arenaria interpres	Ruddy Turnstone
Arenaria melanocephala	Black Turnstone
Aphriza virgata	Surfbird
Calidris canutus	Red Knot
Scientific Name	**Common** Name
Calidris mauri	Western Sandpiper
Calidris ruficollis	Red-necked Stint
Calidris subminuta	Long-toed Stint
Calidris minutilla	Least Sandpiper
Calidris bairdii	Baird's Sandpiper
Calidris melanotos	Pectoral Sandpiper
Calidris acuminata	Sharp-tailed Sandpiper
Calidris ptilocnemis	Rock Sandpiper
Calidris alpina	Dunlin
Philomachus pugnax	Ruff
Limnodromus griseus	Short-billed Dowitcher
Limnodromus scolopaceus	Long-billed Dowitcher
Gallinago gallinago	Wilson's Snipe
Phalaropus lobatus	Red-necked Phalarope
Phalaropus fulicaria	Red Phalarope
Catharacta maccormicki	South Polar Skua
Stercorarius pomarinus	Pomarine Jaeger
Stercorarius parasiticus	Parasitic Jaeger
Stercorarius longicaudus	Long-tailed Jaeger
Larus philadelphia	Bonaparte's Gull
Larus canus	Mew Gull
Larus argentatus	Herring Gull
Larus thayeri	Thayer's Gull
Larus schistisagus	Slaty-backed Gull
Larus glaucescens	Glaucous-winged Gull
Larus hyperboreus	Glaucous Gull
Xema sabini	Sabine's Gull

Rissa tridactyla	Black-legged Kittiwake
Rissa brevirostris	Red-legged Kittiwake
Sterna caspia	Caspian Tern
Sterna paradisaea	Arctic Tern
Sterna aleutica	Aleutian Tern
Uria aalge	Common Murre
Uria lomvia	Thick-billed Murre
Cepphus grylle	Black Guillemot
Cepphus columba	Pigeon Guillemot
Brachyramphus marmoratus	Marbled Murrelet
Brachyramphus brevirostris	Kittlitz's Murrelet
Aethia psittacula	Parakeet Auklet
Cerorhinca monocerata	Rhinoceros Auklet
Scientific Name	**Common** Name
Bubo virginianus	Great Horned Owl
Nyctea scandiaca	Snowy Owl
Surnia ulula	Northern Hawk Owl
Strix nebulosa	Great Gray Owl
Asio flammeus	Short-eared Owl
Aegolius funereus	Boreal Owl
Aegolius acadicus	Northern Saw-whet Owl
Calypte anna	Anna's Hummingbird**
Selasphorus rufus	Rufous Hummingbird
Ceryle alcyon	Belted Kingfisher
Picoides pubescens	Downy Woodpecker**
Picoides villosus	Hairy Woodpecker
Picoides tridactylus	Three-toed Woodpecker**
Picoides arcticus	Black-backed Woodpecker**
Empidonax alnorum	Alder Flycatcher
Sayornis saya	Say's Phoebe
Lanius excubitor	Northern Shrike
Perisoreus canadensis	Gray Jay
Pica pica	Black-billed Magpie
Corvus corax	Common Raven
Eremophila alpestris	Horned Lark
Tachycineta bicolor	Tree Swallow
Tachycineta thalassina	Violet-green Swallow
Riparia riparia	Bank Swallow
Petrochelidon pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Poecile atricapillus	Black-capped Chickadee

Poecile hudsonicus	Boreal Chickadee
Parus cinctus	Gray-headed Chickadee
Sitta canadensis	Red-breasted Nuthatch
Certhia americana	Brown Creeper**
Troglodytes troglodytes	Winter Wren
Cinclus mexicanus	American Dipper
Regulus satrapa	Golden-crowned Kinglet
Regulus calendula	Ruby-crowned Kinglet
Phylloscopus borealis	Arctic Warbler
Oenanthe oenanthe	Northern Wheatear
Sialia currucoides	Mountain Bluebird
Catharus minimus	Gray-cheeked Thrush
Catharus ustulatus	Swainson's Thrush
Scientific Name	**Common** Name
Ixoreus naevius	Varied Thrush
Dumetella carolinensis	Gray Catbird
Sturnus vulgaris	European Starling**
Motacilla flava	Yellow Wagtail
Motacilla alba	White Wagtail
Anthus cervinus	Red-throated Pipit
Anthus rubescens	American Pipit
Bombycilla garrulus	Bohemian Waxwing
Vermivora celata	Orange-crowned Warbler
Dendroica petechia	Yellow Warbler
Dendroica coronata	Myrtle Warbler
Dendroica palmarum	Palm Warbler
Dendroica striata	Blackpoll Warbler
Seiurus noveboracensis	Northern Waterthrush
Wilsonia pusilla	Wilson's Warbler
Spizella arborea	American Tree Sparrow
Spizella passerina	Chipping Sparrow
Passerculus sandwichensis	Savannah Sparrow
Passarella iliaca	Fox Sparrow
Melospiza melodia	Song Sparrow
Melospiza lincolnii	Lincoln's Sparrow
Zonotrichia querula	Harris' Sparrow
Zonotrichia leucophrys	White-throated Sparrow
Zonotrichia leucophrys	White-crowned Sparrow
Zonotrichia atricapilla	Golden-crowned Sparrow
Junco hyemalis	Dark-eyed Junco
Calcarius lapponicus	Lapland Longspur

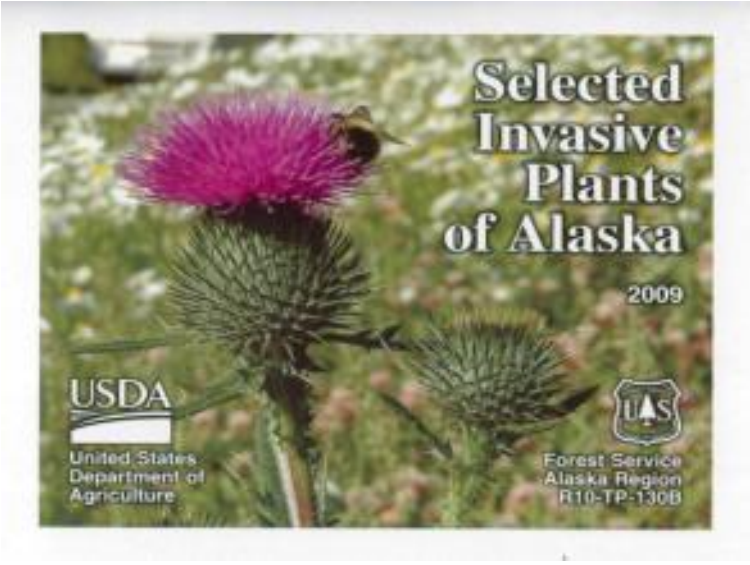
Plectrophenax nivalis	Snow Bunting
Plectrophenax hyperboreus	McKay's Bunting
Agelaius phoeniceus	Red-winged Blackbird
Euphagus carolinus	Rusty Blackbird
Molothrus ater	Brown-headed Cowbird**
Fringilla montifringilla	Brambling**
Leucosticte tephrocotis	Gray-crowned Rosy Finch
Pinicola enucleator	Pine Grosbeak**
Loxia leucoptera	White-winged Crossbill**
Carduelis flammea	Common Redpoll
Carduelis hornemanni	Hoary Redpoll
Carduelis pinus	Pine Siskin**
Pyrrhula pyrrhula	Eurasian Bullfinch**

APPENDIX D:

Bristol Bay Region

Invasive Plant Species

Selected Invasive Plants of Alaska is a pocket field identification booklet for invasive weeds in Alaska to know what that weed is in your yard, garden, farm, or to help land managers document invasive weeds on public lands. Contact us for a guide http://www.uaf.edu/ces/pests/aiswg/guide/



You can also download the pocket weed guide online at the Forest Service website.

Invasive plant species found in southwestern Alaska

Common name	Latin name
Pineappleweed	*Matricaria discoidea*
Alsike clover	*Trifolium hybridum*
Annual bluegrass	*Poa annua*
Common dandelion	*Taraxacum offcinale*
Common groundsel	*Senecio vulgaris L.*
common plantain	*Plantago major L.*
common sheep sorrel	*Rumex acetosella L.*
common tansy	*Tanacetum vulgare L.*
creeping buttercup	*Ranunculus repens L.*
crownvetch	*Coronilla varia L.*
curly dock	*Rumex crispus L.*
dames rocket	*Hesperis matronalis L.*
European bird cherry	*Prunus padus L.*
European forget-me-not	*Myosotis scrpioides L.*
European gooseberry	*Ribes uva-crispa L.*
European mountain ash	*Sorbus aucuparia L.*
fall dandelion	*Leontodon autumnalis L.*
foxtail barley	*Hordeum jubatum L.*
giant knotweed	*Fallopia sachalinensis*
Japanese knotweed	*Fallopia japonica*
lambsquarters	*Chenopodium album L.*
meadow foxtail	*Alopecurus prantensis L.*
narrowleaf hawksbeard	*Crepis tectorum L.*
narrowleaf hawkweed	*Hieracium umbellatum L.*
orange hawkweed	*Hieracium aurantiacum L.*
oxeye daisy	*Leucanthemum vulgare L.*
prostrate knotweed	*Polygonum aviculare L.*
purple foxglove	*Digitatlis purpurea L.*
red clover	*Trifolium pratense L.*
redroot pigweed	*Amaranthus retroflexus L.*
reed canarygrass	*Phalaris arundinacea L.*
rugosa rose	*Rosa rugosa*
shepherd's purse	*Capsella busra-pastoris L.*
Siberian peashrub	*Caragana arborescens L.*
smooth brome	*Bromus inermis*
tall buttercup	*Ranunculus acris L.*
timothy	*Phleum prantese L.*
white clover	*Trifolium repens L.*
yellow toadflax	*Linaria vulgaris*

Invasive Species Prevention

The Goal: *To reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships.*

Invasive Species Management Process

- Education & vigilance to prevent new introductions
- Early detection of new infestations
- Eradication (100% removal), where feasible
- Control (sustained management) when eradication not possible
- Regulation to prohibit importation of nuisance species to Alaska

Prevention Practices: Pre-activity

- **Planning**- identify activities that are potential vectors
- **Integrate**- equipment and inspection into planning
    - Determine cleaning needs for gear, vehicles, boots, etc
    - Incorporate into project plans & budgets
    - Identify locations for cleaning
- **Seek**- basic information about study area from AKEPIC database
- **Conduct site assessment**
    - Determine invasive species locations
    - Use EDRR if not widespread
    - Mark & avoid disturbing
- **Plan travel**- consider sequence of operations
    - Travel from uninfested → infested areas
    - Work from least → most invaded areas
    - *or* upstream → downstream
- **Inspect-** tools, equipment, vehicles, clothing, boots, and gear BEFORE entering worksite

Prevention Practices: During Activity

- **Minimize contact**
    - Avoid walking, driving, or sampling through weed patches
    - In water, minimize wading/disturbing invaded areas
- **Clean gear**
    - If traveling >1 site per day: inspect and clean gear
    - If cleaning not possible, bring back-up or dedicate gear to specific areas

Prevention Practices: Post-activity

- **Inspect and clean** all equipment, vehicles, and gear:
  - Remove any visible soil, vegetation, vertebrates, invertebrates, aquatic plants, algae or sediment. Separate all pieces of gear while cleaning.
  - If necessary, use a scrub brush and rinse with clean water.
- **Dry** completely all items for at least five days.
  - Smooth surfaced items– wipe until dry. *Make sure there are no cracks or crevices that could harbor sand-grain-sized particles.*
  - If drying gear completely in not possible-decontaminate!
- **Decontaminate** items that cannot be completely wiped dry or that has been in the water for > 1day.
  - Ensure wash water does not drain to surface water.
  - Freeze gear until solid;
  - Wash gear in 140°F hot water scrubbing with a stiff bristle brush;
  - If drying, freezing or heating is not feasible, use a 2% bleach solution.

BMPs for ATVs and Boats

- **Inspect** and **clean off** visible aquatic plants, animals, and mud from boat, motor, trailer, and equipment *before leaving water access*.
- **Remove gear** as needed (e.g. deck mat, dip nets, net anchors, boat anchor and line, ropes) to provide access to all areas of the boat to allow for effective cleaning.
- **Rinse** boat, trailer, and equipment.

BMPs for Floatplanes

- **Before entering aircraft:** *Remove visible plants and pump water from pontoons*
- ***At water take-off:***
  - Avoid taxiing through aquatic plants.
  - Raise and lower water rudders several times to clear off plants.
- ***After water take-off:***
  - Raise and lower rudders several times to dislodge aquatic plant fragments while flying over the waters you left or over land.
  - If aquatic plants remain visible on the aircraft, return to the same water body and clean them off.

BMPs for boots/gear

- ***Completely dry*** all equipment between field sites (5 days)
- ***Dedicate*** gear for use only at infested site

Plan your prevention kit

- Clean water supply (free of mud and debris)
- Scrub brushes, bucket and/or boot brushes
- Hand tools for removing debris from treads
- Flash light for inspecting
- Bags for plant material and disposal
- Hose adapters for flushing outboard boat motors
- Tub for soaking and/or containing cleaned fishing net.

If decontamination is required

- Pressure washer
- Thermometer to monitor temperature of treatment
- Bleach solution if chemical treatment is the decontamination method

Report invasives

- Avoid disturbing the areas
- Note the location
- GPS coordinates or mark on a map
- Take photos and specimen
  - Take entire plant in zip lock bag
  - Store in a cool place, or press plant in book or waxed paper
- Report to ADF&G invasive species hotline:

1-877-INVASIV (468-2748)

dfg.dsf.InvasiveSpecies@alaska.gov

APPENDIX E:
NEPA Documentation

Bristol Bay Native Association
PO Box 310
Dillingham, AK 99576
(907) 843-5257

Date: May 21, 2014

To: Governmental Agencies, Tribal Entities, and Persons within the Bristol Bay Region

Subject: NEPA Scoping Letter: Request for Comments on the BBNA Forest and Fire Management Plan for Native Allotments in the Bristol Bay Region

Bristol Bay Native Association, the non-profit regional Native corporation for the Bristol Bay Region, is proposing to implement a programmatic Forest and Fire Management Plan for Native Allotments. BBNA is authorized to act on behalf of the Bureau of Indian Affairs (BIA) under the Indian Self-determination and Education Assistance Act (Public Law 93-638) through a self-governance compact to provide natural resources services to Native allotment owners.

In compliance with the National Environmental Policy Act (NEPA), BBNA is soliciting comments to determine if the proposed action would significantly impact the human environment. Your comments will be considered to determine the necessary level of NEPA documentation.

PROPOSED ACTION AND ALTERNATIVES

The proposed action is the implementation of a Forest and Fire Management Plan for Native Allotments within the Bristol Bay Region. The alternative is to not implement a forest and fire management plan.

PURPOSE AND NEED

The BIA Chief Forester, Division of Forestry, has instructed all BIA Regional Offices and contractors to review existing or develop new forest management plans for all forested areas where forest management activities or expenditure of federal funds for forest management activities may occur. Forest management planning incorporates guidelines developed in the Indian Affairs Manual Part 53, Forestry. These forestry standards guide the philosophy, direction, and implementation of management planning, activities, and projects on Native trust lands.

The purpose is to present a plan for the management of the forest resources of individually owned Native allotments. This plan would provide general policy directives for forest and fire management activities to ensure adherence to statutory and regulatory requirements protecting timber, fisheries, wildlife, cultural, and other resources on Native allotments within the Bristol Bay region.

The development of this management document will be guided by NEPA with site-specific management decisions affecting Native allotments at the discretion of allotment owners. This plan will apply to approximately 1,762 Native allotment parcels. As a result, it will be beyond the scope of the plan to precisely define specific management actions needed to accomplish the goals and objectives of individual Native allotment owners. Rather, the plan will attempt to present a series of Best Management Practices (BMP's) and alternatives to implementation, intended to guide

individual Native allotment owners and BBNA land managers to make informed decisions about the management options that best meet their goals. The plan would also serve as an educational tool for forest and fire management practices for Native allotment owners and heirs, interested tribal governments, tribal members, interested members of the public and regulatory agencies.

The Native allotments within the BBNA region and under compact is an aggregate of 1,762 Native allotments comprising approximately 132,282 acres scattered amongst 31 villages throughout the Bristol Bay region. Of this acreage, approximately 18,098 acres has been determined to be forestland concentrated in the Wood River – Tikchik drainage in the Nushagak Bay Subregion, with additional forested acreage within the Nushagak River Subregion and Iliamna Lake Subregion. The proposed Forest and Fire Management Plan will address only Native allotment lands administered by BBNA and will not address other private lands or lands administered by other government or tribal entities.

ENVIRONMENTAL TOPICS TO BE ADDRESSED

The proposed programmatic BBNA Forest and Fire Management Plan for Native Allotments will address the following environmental topics:

- Air Quality
- Soil Resources
- Water Resources
- Wildlife Resources
- Fisheries Resources
- Cultural Resources
- Timber Resources

RESPONSE REQUEST AND SCHEDULE

As part of the process for determining the scope of issues to be addressed and for identifying important issues related to the proposed Forest and Fire Management Plan, we request your comments on the above environmental topics and any other issues or topics you can identify as important. It is intended that the parties receiving this document notify BBNA of any NEPA and/or National Historic Preservation Act (NHPA) related issues or concerns.

This document serves as BBNA's request for consultation pursuant to Section 7 of the Endangered Species Act to the U.S. Fish and Wildlife Service for identification of listed threatened or endangered species and for consultation to the National Marine Fisheries Service for identification of any designated essential fish habitat.

If you have any issues or concerns to address, or if you simply wish to be included in consultations during the course of this proposed undertaking, please contact me at the address listed below by June 13, 2014. No formal public scoping meeting is currently planned for this proposed Forest and Fire Management Plan. This letter and the draft programmatic Forest and Fire Management Plan for Native Allotments within the Bristol Bay Region will be posted on the BBNA website.

Sincerely,

Frank Woods, III
Forestry Program Manager
Phone: 907-843-5257 x345
Toll Free: 1-800-478-5257
Email: fwoods@bbna.com