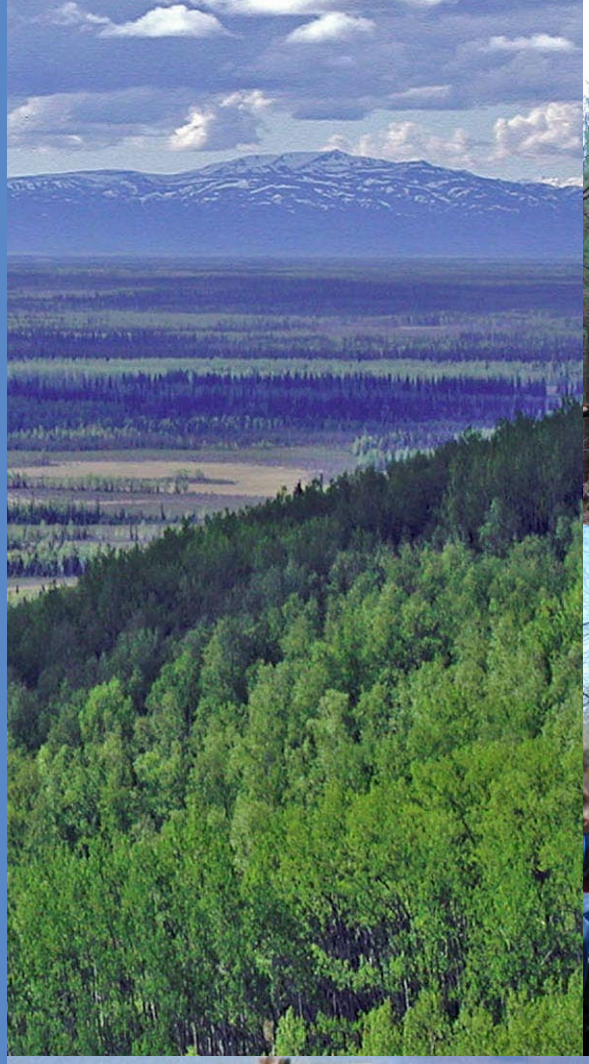
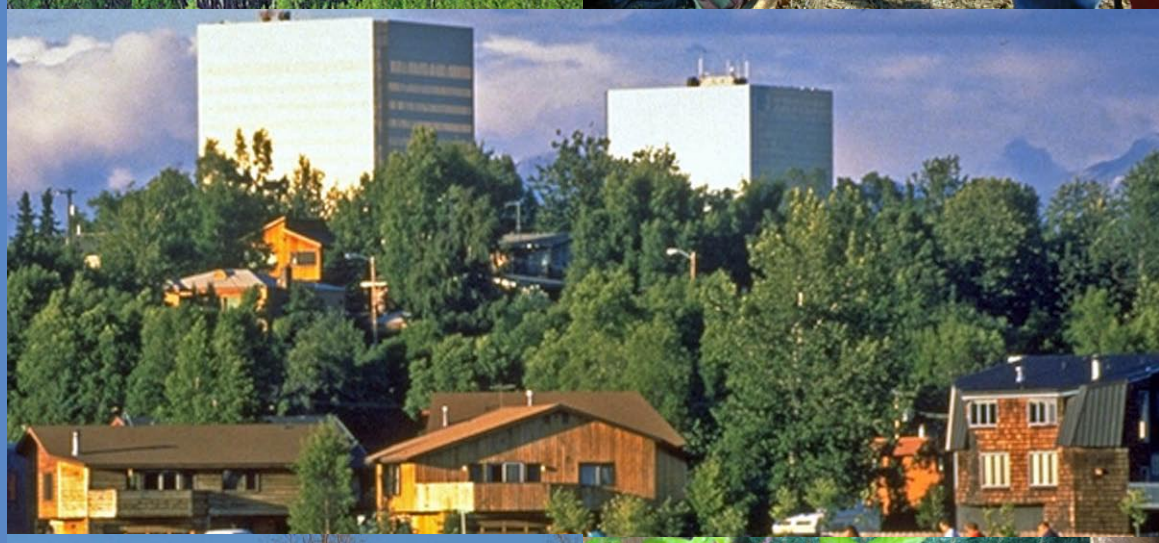
State of Alaska

Statewide Assessment of Forest Resources

Division of Forestry
2010



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Executive Summary

The 2008 Farm Bill requires states to complete a Statewide Assessment of Forest Resources and a Statewide Forest Resource Strategy. This assessment analyzes the present conditions, trends, threats, and benefits of forest resources across all ownerships and identifies priority issues and landscapes. It supports a comprehensive strategy to most effectively leverage federal dollars in support of state and national forestry objectives. The assessment focuses on all ownerships in an "all lands" approach, with emphasis on priority landscapes upon which to build a strategy to conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

The task of summarizing the condition of Alaska's forests in a single concise document is daunting. Alaska has approximately 126 million acres of forest land in diverse ecoregions from a sub-arctic boreal forest in a fire dependent ecosystem to the temperate coastal rainforest along the Gulf of Alaska coast and southeastern Alaska panhandle. Land ownership, management objectives, and the level of human and physical infrastructure vary widely across these diverse ownerships and landscapes.

Alaska has 17 percent of the nation's forestland, 26 percent of the federal forestland, and 43 percent of state owned forestland. Unique among the United States are the more than 200 Alaska Native Corporations, which own 35 million acres of non-industrial private forestland. Also unique among the United States are the hundred plus isolated communities without road access, reached only by air or water travel. Many of these isolated communities have significant populations of Alaska Natives and forests play an important role in contributing to subsistence resources and other cultural and economic benefits, particularly in rural Alaska.

Similar to Canada, Alaska has a significant wildfire season in the boreal forest, with an average of approximately 1 million acres burned each year. Alaska is a leader nationwide in that it has an Alaska Interagency Wildland Fire Management Plan that prioritizes landscapes for fire suppression resources statewide for all ownerships, public and private.

Like other western states, Alaska has had a major epidemic of bark beetles, affecting over 4 million acres in Southcentral Alaska during the 1990s. Alaska has few invasive species, primarily plants, and prevention of more serious invasive insects is a priority. Alaska is developing an early detection rapid response system as well as a forest health risk assessment and mapping strategy.

Overshadowing the ongoing challenges associated with managing the risks of wildland fire and forest pests, are the effects of climate change on these natural threats to Alaska's forests. These effects have been manifested in longer fire seasons, increased fire severity, and warmer and drier weather cycles over the past several decades. A changing climate during the same period was very likely a primary contributing factor to the severity of the spruce bark beetle epidemic across the extent of Alaska's spruce forests in the 1990s.

The forest products industry has been a major part of the economy of southeast Alaska since the 1950s. Reductions in federal timber sales, coupled with large mill closures, have greatly diminished the industry. While some stakeholders and federal policy makers are calling for a rapid transition from a forest products industry dependent on old growth timber supply from the Tongass National Forest, second-growth forests are simply too young to become commercial in significant quantities. Alaska is at risk from losing what little remains of its industrial infrastructure to support southeast Alaska communities and also provide the tools for desired restoration and wood energy initiatives.

Alaska's interior has supported a modest, but stable, forest products industry for local uses. Currently, very high fossil fuel costs are causing great interest in wood energy for both urban and rural residents. The demand for energy resources is creating new opportunities to more fully use forest resources and develop a more fully integrated forest products industry. In many areas the lack of forest products industry infrastructure is a significant barrier to implementing biomass energy projects.

Alaska's population has more than tripled in the past 50 years. More than two-thirds of Alaska's communities and more than three-quarters of the state's population live in or adjacent to forests. The Alaska Department of Labor predicts significant c ontinued population growth in south-central Alaska, particularly in Anchorage and the Matanuska-Susitna Valley. These population trends will put increased pressure on both community and rural

forests, exacerbate challenges in managing wildfire in the wildland urban interface, and increase the risk of loss of forests to pressure from urban development. Many Alaska communities have increased their management capacity to better deal with these increased pressures. As of 2009, eight Tree Cities USA have been recognized, there are 35 certified arborists, and the Municipality of Anchorage has developed an Urban Forest Management Plan and hired an Urban Forester. In addition Alaska has two nationally recognized Firewise Communities and 30 completed Community Wildfire Protection Plans covering 70 communities.

A cross-cutting challenge to assessing Alaska's forest conditions, threats, and trends and to developing and implementing a statewide strategy is the lack of basic imagery, mapping, and data. Large areas of forest land in Alaska lack imagery of even moderate resolution to map priority forest landscapes at an appropriate level of detail or accuracy. Alaska is the only state in the nation lacking current accurate high-resolution maps. Only five percent of Alaska has imagery with a special resolution of one meter or better. Unlike other states, the Forest Inventory and Analysis program of the U.S. Forest Service only covers a portion of Alaska's forest lands, and communities statewide and the vast boreal forest of Alaska's interior is underserved.

To assist in developing a geographic model to identify priority landscapes, stakeholders were engaged through several means. Northern Economics conducted interviews with 34 stakeholders. Issues derived from these interviews were further evaluated by Division of Forestry staff, the Alaska Board of Forestry, the Alaska Forest Stewardship committee, the Alaska Community Forest Council, and the Natural Resource Conservation Service State Technical Committee. A multitude of issues and themes were identified as important elements to consider in identifying priority landscapes that focus efforts to conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

Seventy-nine geospatial data sets were collected that represent the issues identified by stakeholders. Priority landscapes represent those forest lands in Alaska where the best opportunities exist to meet the conservation, protection, and enhancement objectives. After evaluating the issues and themes, these priority landscapes were identified from a combination of data layers representing four key issues: fire, sustainable forest products, forest health, and community benefits from forests. GIS data layers including the level of fire protection required, proximity to communities, opportunities for forest management including developing markets for wood energy in rural communities, and threats to urban expansion and loss of forest cover contributed to the priority landscape designation. This GIS modeling produced priority landscapes for Alaska that represent approximately 30 percent of the state's land area.

Maintaining and enhancing the host of ecosystem services that are provided by Alaska's forests including water and air quality, fish and wildlife habitat, and wild land recreation was identified as an important issue. This issue was not used in developing the priority landscape because ecosystem services by their nature occur across broad managed and unmanaged landscapes in Alaska. 27,172 miles of documented and catalogued anadromous fish streams in Alaska's forests fall within the identified priority landscape.

Introduction

The 2008 Farm Bill requires states to complete a Statewide Assessment of Forest Resources and a Statewide Forest Resource Strategy by June 2010 in order to qualify for future federal funding assistance under the U.S. Forest Service State and Private Forestry Program. The Statewide Assessment of Forest Resources along with the Statewide Forest Resource Strategy is intended to fulfill this federal requirement.

Assessing the forest resource of the 49th state presents significant challenges. Compared to other states, Alaska has substantially more land; much of which is inaccessible by road. Resource information , remote sensing imagery data, and management experiences are limited; and winter conditions are longer and more severe. However, Alaska also has opportunities not present in other states. Alaska has significant proven quantities of many natural resources including timber, minerals, oil and gas, and geothermal resources; Alaska is near Asian markets; Alaska has large and unfragmented ecosystems with no forest dwelling species that are threatened or endangered; Alaska has abundant and nearly intact wild salmon stocks; and Alaska has the land area to provide both unparalleled wilderness experiences and resources development.
This assessment is intended to summarize the conditions of Alaska's forest resources, and threats and trends affecting this valued resource. The report also serves to document the stakeholder process used to identify forest resource issues, identify priority landscapes, and provide a guideline for development of an Alaska Forest Resource Strategy.

Alaska Land History

Alaska's forest land use should be viewed in context with historical events (Department of Natural Resources, 2000). Eskimos, Aleuts, and Indians are Alaska's first peoples. Anthropologists believe that Native Americans have lived in parts of Alaska for at least 10,000 years and there is evidence that colonization initially took place many thousands of years earlier. In the mid-1700s Russian fur traders established posts and purportedly claimed Alaska. On October 18, 1867, Russia sold its interest in Alaska to the United States government for $7.2 million, or about two cents an acre. As a result, the federal government was the principle colonial power of the Alaska Territory for over 90 years.

On January 3, 1959 Alaska became a state. With the Statehood Act, the federal government granted entitlement to 28 percent of Alaska's total area to the new state. State lands were selected under three types of grants: Community, National Forest Community, and General Selection. Territorial grants for school, university, and mental health trust lands were continued with statehood. In total, federal land grants gave the State of Alaska an entitlement of 105 million acres.

Much of the land near major communities was granted to the state and then transferred to local governments or private individuals. Much of the best land for development around Alaska's communities is, or will be, privately owned. Although homesteading no longer occurs, public land sales are ongoing, mostly in remote locations without road access.

The Russian claims to Alaska and the subsequent purchase of Alaska by the United States were subject to unresolved aboriginal land claims by Alaska's first people. In 1971 Congress passed the Alaska Native Claims Settlement Act (ANCSA). This law settled aboriginal land claims in exchange for 44 million acres of federal land in Alaska and $1 billion. Generally, ANCSA gave Native selections priority over state land selections. However, under Section 17(d)(2) of that act, "the Secretary of the Interior was authorized to withdraw up to 80 million acres of unreserved public lands….which the Secretary deemed suitable as units of the National Park, Forest, Wildlife Refuge and Wild and Scenic River Systems".

On December 2, 1980 President Carter signed the Alaska National Interest Lands Conservation Act (ANILCA) designating an area larger than the State of California for conservation, implementing the (d)(2) section of ANCSA. ANILCA set aside 106 million acres of federal lands in conservation system units enlarging the federal acreage dedicated to conservation purposes in Alaska to 131 million acres. Alaska has 70 percent of all national park lands in the United States and 85 percent of all wildlife refuge acreage.

[1] In Alaska the U.S. Forest Service Forest Inventory and Analysis (FIA) program, which typically covers all forest lands in the contiguous 48 states, only covers coastal and limited south-central Alaska forest lands. The FIA budget has not supported sampling in the vast boreal forests of interior Alaska. As a result much of Alaska's forest land has never been inventoried.

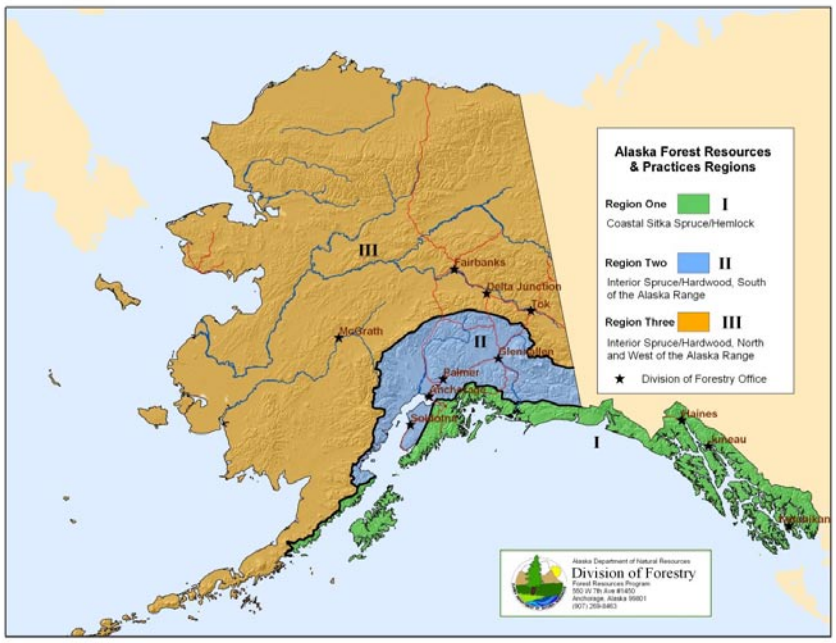


Figure 1 Alaska's three major forest regions defined by Alaska Forest Resources and Practices Act.

Forest Regions

Alaska has 16 percent of the land area and 17 percent of all forest area of the United States (Smith et al., 2009). Understandably, Alaska encompasses a diverse set of geological, climatic, and vegetative conditions. The state's 365 million acres have been divided into six ecological units: Southeast, Southcentral, Southwest, Interior, Northwest, and Arctic (Viereck et al., 1992). More comprehensive analysis has described 31 ecoregions (Nowacki et al., 2000). Recently, van Hees (2009) described three broad ecoregions (Figure 1).

Alaska forests are divided into three operational regions for implementing the Forest Resources and Practices Act (FRPA) and these are termed Coastal Rain Forest (Region I), Transitional Forest (Region II), and Interior Forest (Region III) (Alaska Division of Forestry 2006). The interior forest is part of the circumpolar boreal forest type. The boreal zone comprises about dominates 85 percent of Alaska.

The temperate oceanic climatic zone occupies the southeast and south-central coast of Alaska, making up roughly nine percent of the state's forests. The coastal forest is part of one of the most productive forest ecosystems in the world. Western hemlock/Sitka spruce is the predominant forest type but both western redcedar and Alaska yellowcedar are present. Large trees exceeding six feet in diameter and reaching nearly 200 feet in height can be found in the southern part of this forest ecosystem. Tree size decreases, generally, with increasing latitude and longitude. On the western edge, hemlock drops out and only pure Sitka spruce stands occur. A wide diversity of wildlife species are found in this forest. They include Sitka black-tailed deer, black and brown bear, marten, moose, mountain goat, five species of salmon, and the bald eagle. There are approximately 31 Alaska Native village corporations, three regional corporations, and some individual owners within the coastal forest.

Historically, the coastal forest has supported significant timber harvest (Rakestraw 2002). Native Americans and then Russian settlers were known to use timber for buildings and vessels. In 1889, the territorial governor reported 11 sawmills were operating in Alaska. Timber harvest was high during the operation of two large pulp mills, but these are now closed and harvest has greatly declined in recent years. The few remaining medium size mills in southeast Alaska have been struggling to remain open.

In south-central Alaska on the Kenai Peninsula, there is a transitional zone between the coastal and boreal forests. Elsewhere mountain ranges separate the two forest formations. The western hemlock/Sitka spruce forest typical of Southeast is found near Homer. Northward this forest type is replaced by the boreal forest of mostly paper birch, quaking aspen, and white and black spruce. Wildlife found in this blend of forest types include mountain goat, Dall

sheep, brown and black bear, lynx, marten, and moose. Streams are rich with salmon through much of the summer. There is a concentration of individual private forest owners in the boreal forest on the peninsula.

The Matanuska-Susitna Valley has the largest individual private ownership acreage, excluding Native corporations, of any area in Alaska. The original Matanuska Colony, established by the federal government in the 1930s and the federal homestead program, which ended in 1967, transferred many acres of forest land to private individuals. Much of this land is road accessible, an unusual circumstance in Alaska. Since the area is close to Anchorage, many residents own recreation property there. The "Mat-Su" Valley is within the boreal forest.

Portions of the Yukon, Southwest, and Northwest regions are in the boreal forest. There are large, important stands of white spruce and mixed stands of spruce and birch, but riparian forest and the taiga, or "land of little sticks", are most distinctive. In some stands white spruce measure over two feet in diameter and reach 100 feet in height. Stands of black spruce are also common, usually on sites where permafrost is present. Permafrost, in discontinuous pockets and extensive areas, is a significant factor. Birch and aspen stands are usually located on previously disturbed sites, generally as a result of fire. Moose, black and brown bear, caribou, marten, beaver and wolf are common species found in this forest type. There are significant numbers of spawning salmon in many of the streams during the summer. The federal government is the principal landowner in these regions, although large tracts of lands have been transferred to ANCSA corporations, to the state, and to various boroughs. Individually owned tracts are relatively few. Very remote individual Native allotments may be a significant element of private forest acreage in these regions.

Land Ownership

There are 126 million acres of forest land in Alaska (Smith et al. 2009), which is 35 percent of the state's total area. There are 11 million acres of coastal, or maritime, forest and 115 million acres of interior, or boreal, forest. More than two-thirds of Alaska's communities and more than three-quarters of the state's population live in or adjacent to these forests. Ninety percent of the Alaska Native village and regional corporations own forest land. Federal ownership of forest land is disproportionate in Alaska compared to the nation as a whole (Table 1, Figures 2, and 3).

Federal Land

The federal government is the largest landowner in Alaska, responsible for the management of 222 million acres, 60 percent of the state. More than a dozen federal agencies manage lands in Alaska. The majority of federal land is reserved for conservation of natural areas, such as national parks and wildlife refuges. The Forest Service and Bureau of Land Management (BLM) manage for multiple use including timber production and mining as well as subsistence and recreation. The remaining federal land is designated for special purposes, such as military reservations and the National Petroleum Reserve.

The BLM manages 82 million acres, the largest amount of federal land in Alaska, with a mandate for multiple use. The BLM is the federal agency in which title to federal land rests, similar to the vesting of state land in the Department of Natural Resources. As such, BLM in Alaska is responsible for adjudicating land conveyance pursuant to

Table 1 Comparison of Land Ownership in Alaska and United States
Forest land by owner in thousand of acres (Smith et al. 2009)

	All Forest Land	All Federal Land	USFS	State	Local Gov.	Private
All US	751,228	248,413	147,181	68,831	10,955	423,029
Alaska	126,869	63,423	10,455	27,469	101	35,875
Alaska % of Acres Nationwide	17%	26%	7%	40%	1%	8%

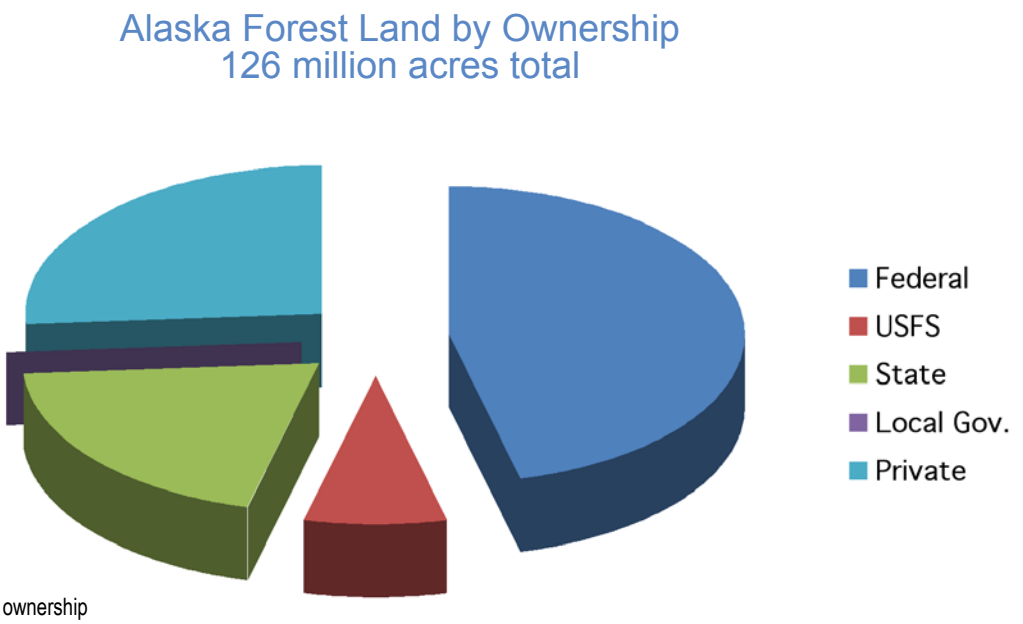


Figure 2 Alaska forest land by ownership

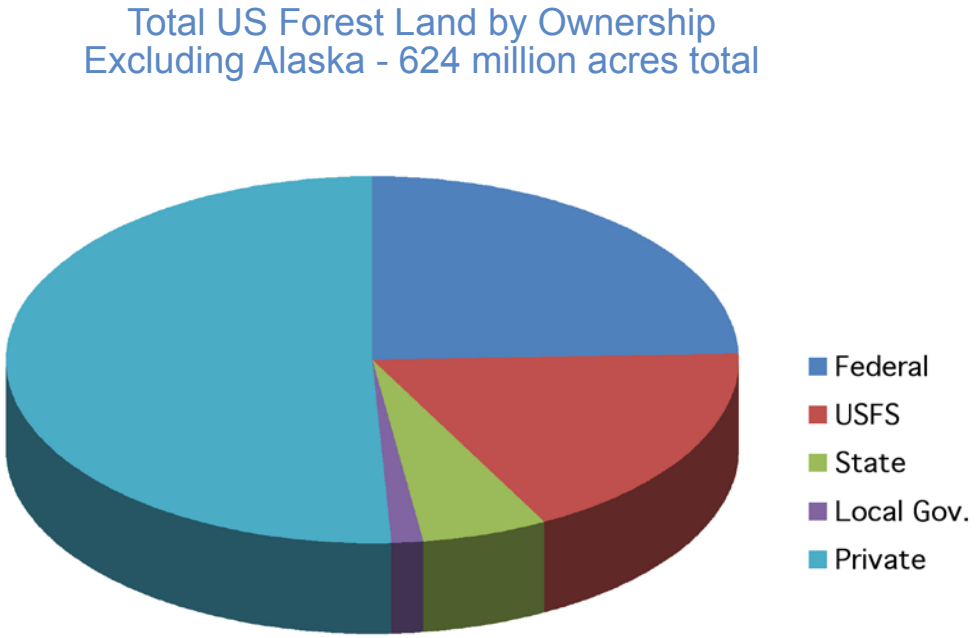


Figure 3 Total U.S. forest land by ownership, excluding Alaska

ANCSA and the Statehood Act, wildland fire management (Alaska Fire Service), and management of natural resources including administrative offices such as the Joint Pipeline Office for the Trans-Alaska Oil Pipeline. The BLM also manages the Steese National Conservation Area and the White Mountains National Recreation Area.

The Fish and Wildlife Service manages 79 million acres in 16 National Wildlife Refuges, which include the Yukon Delta National Wildlife Refuge, the Kodiak National Wildlife Refuge, the Alaska Maritime National Wildlife Refuge, and the Arctic National Wildlife Refuge. The National Park Service is responsible for management of 52 million acres in 13 national parks and/or preserves including the five largest parks in the U.S. The Forest Service is responsible for managing 22 million acres, including the two largest national forests in the U.S., the Chugach National Forest and Tongass National Forest, as well as two national monuments.

Alaska Native Lands

The Alaska Native Claims Settlement Act mandated the creation of regional and village Native corporations to accept the title of selected federal lands. Thirteen regional corporations were created; 12 shared in selection of 16 million acres while the thirteenth corporation, based in Seattle, received a cash settlement only. A total of 224 village corporations, each with 25 or more residents, shared 26 million acres. The remaining acres, which include historical sites and existing native-owned lands, went into a land pool to provide land to small villages of less than 25 people. ANCSA corporations currently have received approximately 35 million acres of land, including surface and subsurface resources. The process of transfer of title from the federal government to the corporations is still in progress. Regional corporations own both surface and subsurface resources. Village corporations own only the surface estate, while the regional corporations own the full fee estate including underlying subsurface resources, or just the subsurface resources on village corporation holdings. Several village corporations have merged with their regional corporation and some village corporations have consolidated. There is great variation in the size of corporate holdings and management objectives. Lands granted under ANCSA are private and thus not federal trust lands managed by the Bureau of Indian Affairs. Alaska does have one Indian reservation, Annette Island Reserve in Southeast Alaska.

An estimated 95 percent of the private forest acreage in Alaska is owned by ANCSA corporations. Less than one percent (about 700,000 acres) is estimated to be in approximately 5,200 individual Native allotments, which are mostly located in the boreal forest and have high subsistence and social/cultural values. Allotments were issued pursuant to the Alaska Native Allotment Act of 1906, which was ended by ANCSA, but existing allotments are still valid. Almost twice that number of allotment applications has been received and many are not yet processed. Each allotment can contain from one to four parcels with a combined aggregate not to exceed 160 acres. Allotments are trust lands under some form of Secretary of the Interior jurisdiction. The BIA has prepared land, resource, and timber inventories on some of the patented allotments.

State Land and State Forests

As of 2009, the state has received patent to approximately 96 percent (99 million acres) of its total land entitlement. The state was permitted to select lands from any federal land not already reserved for other uses, to provide land and resources to support the state's economy, for road construction, economic development, and building houses, schools, and other public and private facilities. The state chose land to meet three specific needs - settlement, resource stewardship, and development and recreation.

About two percent of Alaska's state-owned land is in two designated state forests. In 1982, the legislature established the 270,410-acre Haines State Forest in the Chilkoot, Chilkat, and Ferebee river drainages. The next year, it created the 1.8 million-acre Tanana Valley State Forest that stretches from Manley to Tok. In addition to these two designated state forests, much of the state's public domain land is available for multiple use, including forest management.

The Haines State Forest includes the watersheds of the major tributaries to the Chilkat River. Located in a transition zone between the moderate and wet coastal climate and the dry cold interior, the forest provides suitable conditions for a diversity of vegetation. The rugged topography ranges from sea level to over 7,000 feet. The forest is composed mostly of two forest types, western hemlock/Sitka spruce, and black cottonwood/willow. Lodgepole pine and paper birch occur as minor species throughout the forest. About 15 percent of the state forest (41,831

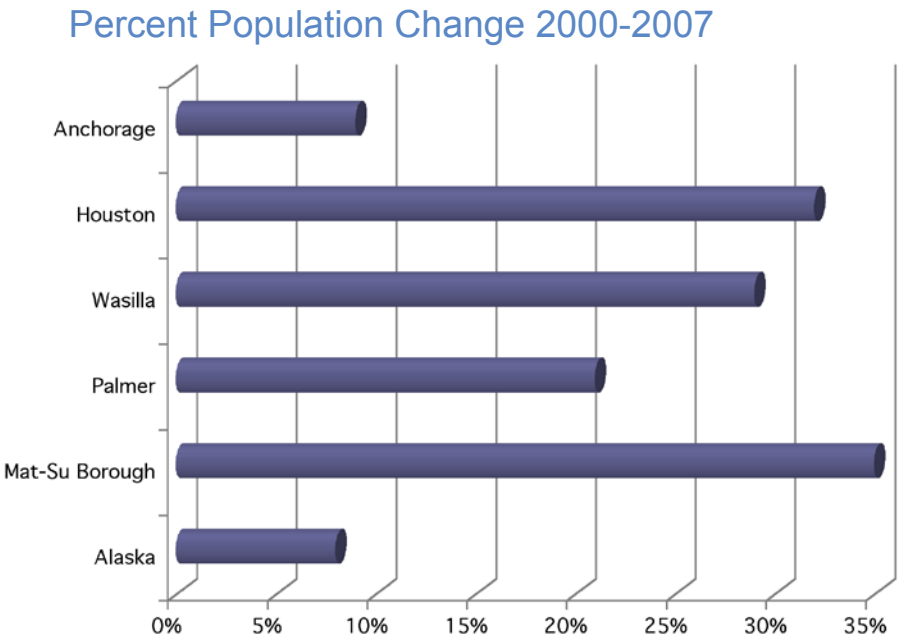


Figure 4 Population change in South-central Alaska communities (Alaska Department of Labor & Workforce Development, Research & Analysis).

acres) is dedicated to timber harvest with an allowable harvest of 5.88 million board feet per year. Although natural regeneration occurs readily, all large commercial sales have been replanted since the 1970s.

The Tanana Valley State Forest's 1.81 million acres lie almost entirely within the Tanana River Basin, located in the east-central part of Alaska. The forest extends 265 miles, from near the Canadian border west to Manley Hot Springs. It varies in elevation from 275 feet along the Tanana River to over 5,000 feet in the Alaska Range. The Tanana River flows for 200 miles through the forest. Almost 90 percent of the state forest (1.59 million acres) is forested, mostly with paper birch, quaking aspen, balsam poplar, black spruce, white spruce, and tamarack. About half of the Tanana Basin's productive forest land (1.1 million acres) is located within the state forest. About 85 percent of the forest is within 20 miles of a state highway.

Municipal Lands

Alaska is home to approximately 686,000 people. Although there are many small villages across the state, more than half of the population lives in the Municipality of Anchorage or the Matanuska-Susitna Borough. More than 60 percent of the population lives in towns with populations in excess of 5,000 people. Alaska has experienced rapid population growth (Figure 4).

Alaska's local government structure is organized by just two types of municipal government – cities and organized boroughs (Bockhorst, 2001). On average, the corporate boundaries of cities in Alaska encompass just over 27 square miles. However, there are wide variations in the size of individual cities. The City of Skagway encompasses the largest area (466 square miles), while the City of Kiana encompasses the smallest area (0.3 square miles). Current state law restricts the inclusion of large geographical regions or large unpopulated areas in cities.

Presently, there are 145 city governments in Alaska. In 2000, those cities were inhabited by 161,591 individuals or 25.7 percent of the state's population. The 2000 census indicated that the population of cities ranged from a high of 31,423 (City of Fairbanks) to a low of 24 (City of Kupreanof). The Municipality of Anchorage, with a 2008 population of 279,243, is classified as an organized borough.

Like a city, an organized borough in Alaska is a municipal corporation and political subdivision of the State of Alaska. However, organized boroughs are intermediate-sized governments – much larger than cities. Alaska's constitution requires that the entire state be divided into boroughs, organized or unorganized. The constitution also requires that each borough embrace an area and population with common interests to the maximum degree possible.

Table 2 Municipal lands in Alaska Individually Owned Private Land

Local Governments	Acres
Matanuska-Susitna Borough	383,000
Fairbanks North Star Borough	116,000
Kenai Peninsula Borough	73,600
Anchorage Borough	26,000
City and Borough of Juneau	20,000
Other	41,400
Total	660,000

Presently, there are 16 organized boroughs in Alaska, which average just over 17,400 square miles (644 times the average size of cities). Like cities, the size of individual organized boroughs varies considerably. The largest organized borough is the North Slope Borough (93,823 square miles), while the Bristol Bay Borough is the smallest (918 square miles). In 2000, Alaska's 16 organized boroughs were inhabited by 545,664 individuals, or 86.8 percent of the total population of the state. Of the 545,664 residents of organized boroughs, 98,246 (18 percent) also lived within a city government. Organized boroughs encompass about 43 percent of the geographic area of Alaska. State law provides that any area outside of an organized borough comprise a single unorganized borough. As it is presently configured, the unorganized borough encompasses 374,843 square miles and was inhabited by 83,136 residents in 2000.

Alaska's municipal and borough governments manage approximately 660,000 acres of land in Alaska (Hull, T and L. Leask).

Individually Owned Private Land

Excluding the previously discussed Alaska Native corporation and Native allotment land, individual private land comprises less than one percent of the total land in Alaska. Information about individual private forest land ownership is limited and changing. The most recent national survey reported that Alaska has an estimated 16,600 private landowners with one or more acres of forestland (Birch 1997). However, the accuracy of this report is questionable, because only 9 million acres of private forest land was reported, which is well below estimates from other reputable sources.

An estimated 413,000 acres are in the individual ownership class; however, the number of acres or the number of individual landowners suitable for Forest Stewardship Program services has not been determined. Objectives of individual forest landowners are diverse. In the boreal forest region, most have concerns about wildfire and damaging insects and diseases. Most landowners are interested in maintaining wildlife habitat. Adjoining landowners may have quite different objectives.

Some individual Native allotments occur within large public holdings. Most other private lands are in the more settled areas of the state, e.g., the Kenai Peninsula, the Matanuska and Susitna valleys and the Fairbanks area. Many of these small tracts are within large borough ownerships. Some state and borough land sales have resulted in blocks of individually owned tracts within larger public holdings.

Trust Lands

The University of Alaska and Alaska Mental Health Trust are significant land owners and enjoy quasi-private landowner status. A September 2006 determination by the Office of General Council found that lands of the University of Alaska and the Mental Health Trust are similar to private lands and can be considered private for purposes of the Forest Legacy Program. Currently, the Mental Health Land Trust holds 999,860 acres and the University Land Trust holds approximately 150,000 acres. In May 2009 the Alaska Supreme Court overturned a 2005 state law intended to grant an additional 250,000 acres to the university and a bill before the Alaska State Legislature again seeks to grant additional lands to the university.

Figure 5 Fort Yukon in 2009 (AK Division of Community and Regional Affairs)

Population Demographics

Alaska experienced an estimated nine percent increase in population from 2000 to 2008, one percentage point above the national average during the same period. (U.S. Census Bureau, 2009). Approximately one-third of Alaska census areas experienced population declines between 2000 and 2008. Many of these areas are in southeast Alaska. The Matanuska-Susitna Borough was the fastest growing census area while the Yukon-Koyukuk area had the largest population decline.

Most of Alaska's population lives along the Railbelt, extending from Seward, north to Anchorage, and paralleling the Parks Highway to Fairbanks (Northern Economics, 2009). Forecasting population growth statewide is difficult and regional forecasts may have greater volatility than the state as a whole (Hunsanger, 2007). High costs of energy and limited employment opportunities in rural areas have led to a shift to urban population centers. Both Anchorage and the Mat-Su Borough are expected to show positive net growth through 2030. Southeast Alaska, by comparison, is projected to continue its loss of population as residents migrate to other states and other parts of Alaska (Northern Economics, 2009).

Volatile fuel prices in rural Alaska may have stimulated migration to urban areas, but a recent report (Stephanie Martin 2008) suggests it may be one of several factors. Findings suggest that migration from smaller villages and towns is an ongoing phenomenon and fuel prices, by themselves, cannot be definitively linked to migration. A primary cause of migration is the pursuit of economic and educational opportunities but as of 2008, survey data were inadequate to determine other reasons.

Rural Alaska is defined as all areas except the Municipality of Anchorage and the Matanuska-Susitna, Kenai Peninsula, Fairbanks North Star, and Juneau boroughs (Alaska Department of Commerce, Community, and Economic Development. 2009). Under this definition approximately 20 percent of Alaska's population is considered rural.

Economy

This overview of Alaska's economy is provided by Goldsmith (2008). Alaska has eight main sectors: federal government, petroleum, seafood, tourism, mining, timber, international air cargo, and personal assets from outside Alaska, which are primarily federal retirement benefits. Federal government and the petroleum sector each constitute a third of the economy, with the other sectors combined contributing to the final third.

The petroleum industry comprises the state's most important natural resource development sector of the economy. However, only a small portion of the 52,000 jobs that depend on petroleum are direct production jobs. Many more jobs are found in the industries that support oil and gas exploration and development. About 17 percent of U.S. oil production is from Alaska.

Table 3 Statewide and rural housing characteristic (Northern Economics 2009).

Housing Attribute	Statewide Number	Statewide Percentage	Rural Number	Rural Percentage
Housing Occupancy				
Total housing units	279,293	100	65,134	100
Occupied housing units	233,861	100	46,154	100
House Heating Fuel				
Utility gas	112,310	48	1,700	3.68
Bottled, tank, or LP gas	3,947	1.7	860	1.86
Electricity	23,545	10.1	2,871	6.22
Fuel oil, kerosene, etc.	81,659	34.9	35,720	77.39
Coal or coke	910	0.4	90	0.19
Wood	9,164	3.9	4,699	10.18
Solar energy	42	0	0	0
Other fuel	1,301	0.6	157	0.34
No fuel used	983	0.4	57	0.12
Other Utility				
Lacking complete plumbing facilities	9,985	4.3	5,906	12.8
Lacking complete kitchen facilities	9,307	4	5,460	11.83
No telephone service available	7,170	3.1	2,088	4.52

Alaska's traditional resource industries, which supported the private sector economy before oil was discovered, are the seafood, mining, and timber industries (Table 4). Alaska's first salmon cannery opened in 1878, and the Gold Rush brought mining to Alaska toward the end of the 1800s. Large-scale timber harvesting began in the 1950s. These resource industries remain important to the economy, but their contributions are often obscured by the prominence of the petroleum industry. Alaska is among the world's top seafood producers; only eight countries produce more wild seafood that the State of Alaska. The value of Alaska's minerals—especially zinc—has climbed in recent years, as metal prices have risen. The timber industry, which has shrunk since the 1990s, is discussed in more detail in the forest products industry section of this assessment.

Table 4 Contributions of the 14 economic sectors in 2005 (Goldsmith 2008).

	Alaska Resident Employment		Alaska Resident Personal Income	
	Thousands	Share	$Billion	Share
Total	361.37		$24.270	
Traditional Resources:		15.5%		10.8%
--Seafood	37.71	10.4%	$1.481	6.1%
--Mining	12.06	3.3%	$.799	3.3%
--Timber	5.90	1.6%	$.315	1.3%
--Agriculture	0.45	.1%	$.028	.1%
New Resources:		13.3%		9.6%
--Tourism	40.22	11.1%	$1.894	7.8%
--Air Cargo	7.38	2.0%	$.415	1.7%
--Other Manufacturing and Services	0.32	.1%	$.016	.1%
Federal Government:		36.4%		40.1%
--Non-Defense Federal Government	67.01	18.5%	$5.576	23.0%
--National Defense	64.35	17.8%	$4.160	17.1%
Petroleum:		29.8%		28.5%
--Production	51.78	14.3%	$3.596	14.8%
--State/Local Revenues	50.16	13.9%	$2.538	10.5%
--Permanent Fund & CBR	5.87	1.6%	$.788	3.2%
Personal Assets:		5.0%		11.0%
--Retirees	14.53	4.0%	$2.147	8.8%
--Non-Earned Income	3.63	1.0%	$.516	2.1%

Climate Change

Climate change is increasingly in the news. In Alaska, the Scenarios Network for Alaska Planning (SNAP) is a University of Alaska Fairbanks network that provides scenarios of future conditions in Alaska for more effective planning by communities, industry, and land managers (SNAP Integration Team 2008). SNAP has employed general circulation models for projections of global climate similar to the Intergovernmental Panel on Climate Change. The projected Alaska statewide trends indicate temperatures and precipitation are expected to increase across all regions. Temperature increases are predicted for every month, and increases are expected to continue throughout the century (SNAP Integration Team 2010, Figure 6). The growing season is likely to become longer statewide, however precipitation alone does not predict ecosystem moisture limitations (Figure 7). Increased plant growth and increased evaporation due to higher temperatures may more than offset the additional precipitation, resulting in drier soils.

Climate change is expected to impact many aspects of Alaska. Related to Alaska forests, climate change may affect wildfire, insect epidemics, invasive species, regeneration and growth, and wildlife habitat. For example, the 2004 wildfire season, the largest documented since the early 1950s, was a direct result of record temperatures and little precipitation. Also, the first recorded large spruce budworm outbreak, in the early 1990s, may have resulted from elevated summer temperatures that produced drought stress in the host white spruce trees. Climate change may also impact forest management operations by causing shorter winter logging seasons, shorter windows for use of ice bridges, and thawing permafrost that will impact existing or planned roads and other infrastructure.

Some non-forest impacts of climate warming in Alaska are clearly occurring. These include coastal erosion, increased storm effects, sea ice retreat, and permafrost melt. As a consequence, the governor created a Climate Change Sub-Cabinet in 2007. The sub-cabinet has convened advisory and working groups to provide analysis and recommendations. Draft final reports were released in January 2010 for four working groups: adaptation, mitigation, immediate action, and research needs.

1) Adaptation to climate change was categorized as:

- Public infrastructure, such as construction design and monitoring.

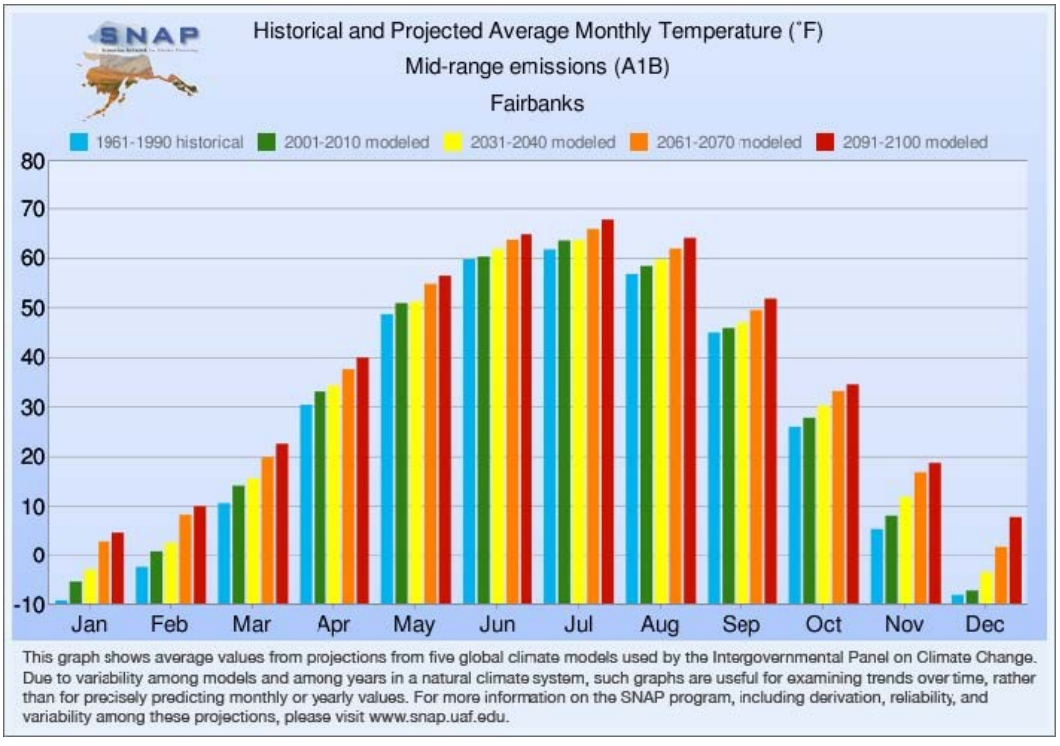


Figure 6 Temperature projections for Fairbanks (Scenarios Network for Alaska Planning)

- Natural systems management, including fisheries, wild life, and wildfire.
- Economic activities, including improve availability of mapping, surveying, charting, and imagery data.
- Health and culture, including diseases, sanitation, and community health, and coordinated community assistance and education.
- Common themes, including community climate impact assistance.

2) Mitigation activities focused on reducing greenhouse gas emissions. The working group analysis included:
- Cross-cutting issues, such as establish an Alaska greenhouse gas emission reporting program.
- Energy supply and demand policy, such as implemen tation of renewable energy.
- Forestry, agriculture, and waste management, including forest management strategies.

3) Immediate needs focus on coastal erosion impacts on rural communities.

4) Research needs identified the following broad areas:
- Data collection and management
- Monitoring
- Addressing workforce needs
- Scientific research
- The development of engineering standards, practices, and other support tools
- Infrastructure needs and improvements
- Technology development
- The assembly of traditional knowledge
- Modeling

Wildfire

Wildfire Planning

Annual acreage burned in the boreal forest ranges from an average low of about one hundred thousand to a high of over 6 million acres. Most acreage burned from wildfire is caused by lightning but the large majority of starts near communities are human caused. The Alaska Division of Forestry, Bureau of Land Management Alaska Fire Service, and the U.S .Forest Service have active fire programs and are responsible for the protection of the wildlands, both pubic and private, within the state. Legislation passed in 2007 has realigned department authority that allows fire management decision-making to include all values, not just the values of the natural resources threatened by wildland fires. All houses, cabins, commercial property, and other cultural resources can be considered when assessing the most appropriate and cost effective fire management strategies.

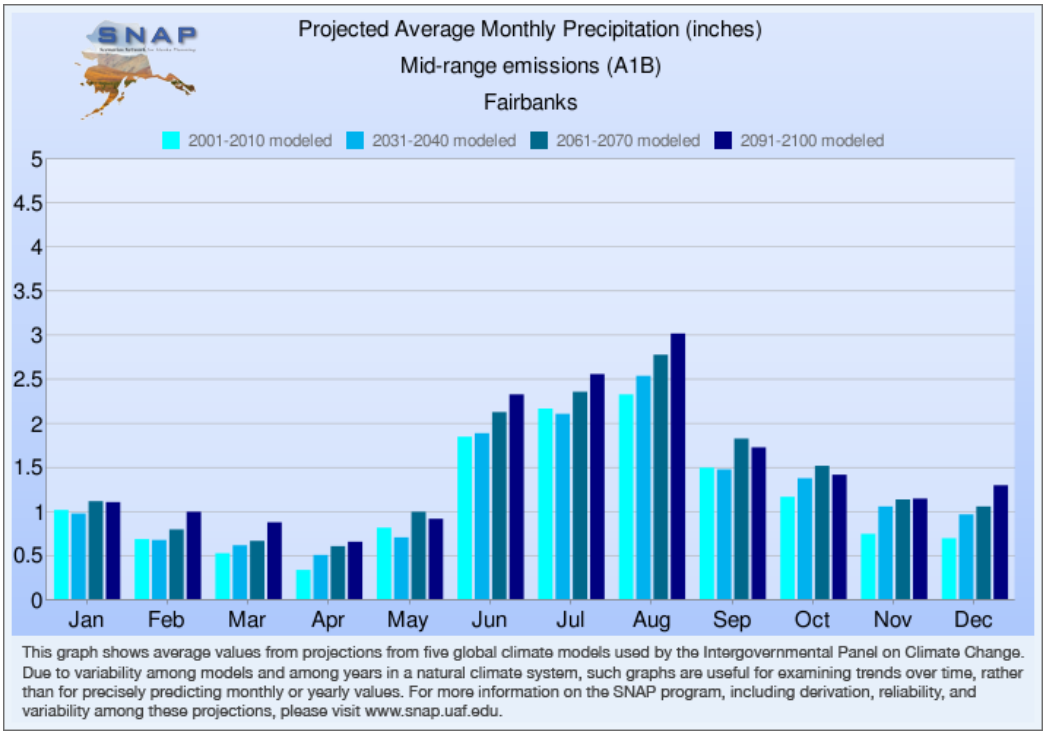


Figure 7 Precipitation projections for Fairbanks (Scenarios Network for Alaska Planning)

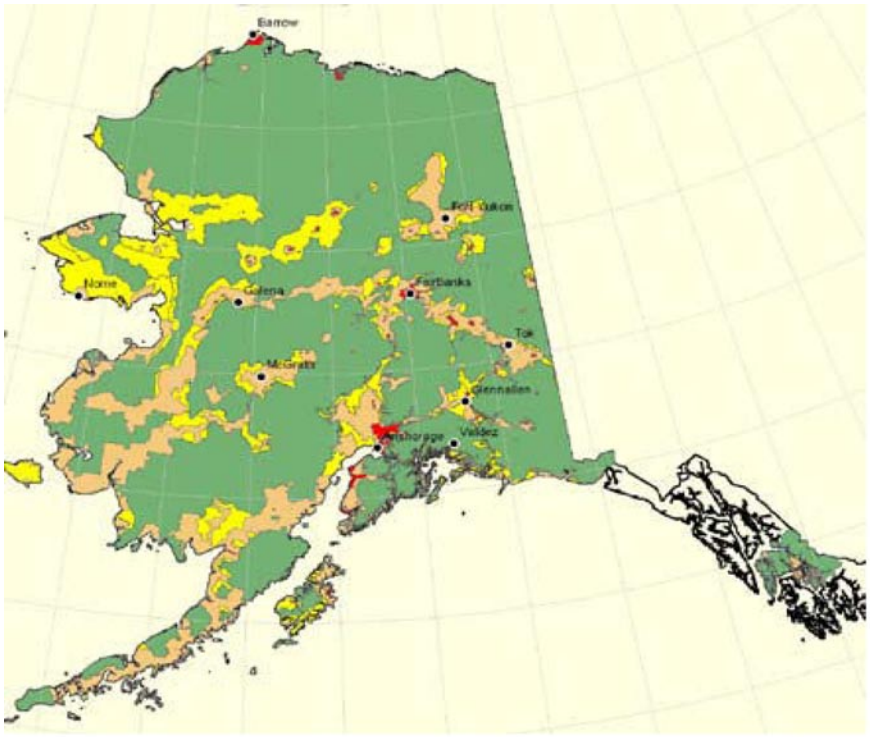


Figure 8 Alaska Interagency Wildfire Management Plan (Alaska Fire Service)

Alaska Interagency Wildfire Coordinating Group

The Alaska Interagency Wildfire Coordinating Group (AWFCG) provides a forum that fosters cooperation, coordination, collaboration, and communication for wildland fire management and related activities in the state of Alaska. This group provides a perfect avenue in which to bring forward issues and implement strategies on a broad scale, interagency basis. The AWFCG task groups include: Air Quality and Smoke Management, Fire Program Analysis, Fire Research Development and Application, Fire Training Qualifications, Fire Weather, Fuels, Prescribed Fire and Community Assistance, Operations, Safety and Health, and Wildland Fire Education and Prevention.

Alaska Interagency Wildfire Fire Management Plan

Fire suppression for all wildland fire suppression agencies in Alaska is guided by the Alaska Interagency Wildland Fire Management Plan. The plan was developed and signed in the 1980s to provide a coordinated and cost effective approach to fire management on all lands in Alaska. The plan dictates the shared management prioritization of initial attack resources by designating four protection levels for response to wildland fires (Figure 8). Fire managers are quickly able to identify the most appropriate response to new fires and allocate limited suppression resources. No other state has a similar interagency fire plan.

State, federal and Native land managers may adjust fire management protection levels for their lands every winter between fire seasons. Each suppression agency in Alaska protects specific geographical areas under cooperative agreements and follows the guidelines of the interagency plan, thus avoiding duplication of fire protection resources and efforts, while providing for the most cost effective fire response.

Levels of Protection

- **Critical Management Option (Red)** – Gives the highest priority for suppression action on wildland fires that threaten human life and inhabited property.
- **Full Management Option (Orange)** – Protects cultural and historical sites, uninhabited private property, and high value resource areas.
- **Modified Management Option (Yellow)** – Generally receives the same level of protection as land in the Full Management Option in the early fire season (evaluation date of July 10). After the conversion date fires in Modified are evaluated as Limited.
- **Limited Management Option (Green)** –Generally very remote, difficult to protect lands, have lower resource value and, as such, receive limited fire suppression. Monitoring and individual site protection consistent with agency policy is typical strategies.

Acres Protected by Agency

BLM Alaska Fire Service protects 194 million acres of state, federal, and private land (Figure 9).

Alaska Division of Forestry protects 150 million acres of state, federal, and private land.

U.S. Forest Service protects 26 million acres of state, federal, and private land.

By its very nature the Alaska Interagency Wildland Fire Management Plan restores Alaska's fire adapted ecosystems by designating lands in the Limited and Modified suppression options thereby enhancing multiple forest health values and services. Although the plan prioritizes response levels to wildland fire in Alaska by allowing some, but not all, landscapes to burn, the fire problem is still growing. Climate change is evident and recognized in Alaska as illustrated by the Alaska State Legislature officially changing the statutory start date of the fire season in 2006 from May 1 to April 1. Smoke from wildland fires has become an increasingly difficult problem and a public health concern in Alaska. Prior to development and acceptance of the interagency plan all fires were suppressed in Alaska, resulting in fuel build up and loss of biological diversity in many areas of the state, as in much of the West.

Community Wildfire Protection Plans

Alaska currently has completed 30 Community Wildfire Protection Plans (CWPPs) covering 70 communities. Ten plans, covering 16 communities, are under development and updates to some older plans are underway. Existing plans are pre-dominantly in the more heavily populated interface areas of the state, targeting communities at the highest risk of wildfire and its associated risks to human safety and property. The increase in the number of rural or "bush" communities developing CWPPs each year is a positive development.

In addition to having a CWPP in place, communities that are especially prone to the risk of catastrophic wildland fire are also identified in the Communities at Risk list and their landscapes fall within Critical or Full protection zones in the AIWFMP Hazard fuel reduction projects to reduce the risk of wildfire impacts, Firewise education and wildland fire prevention campaigns identified as needed in CWPPs are more often than not dependant on competitive and/or federal funding sources for full implementation.

Wildland Urban Interface

Alaska's population continues to expand into the forested areas of the state, which makes responding to the rising numbers of urban interface wildland fires one of the key

Figure 9 Area protected by agency (Alaska Fire Service)

issues facing the state and its cooperators. In recent years, numerous serious urban interface wildland fires have threatened homes and communities. For the 2009 Fire Season, 221 of 254 fires were in wildland urban interface areas of the state. Geographically, the urban interface fire zone continues to increase as new homes and subdivisions are built to accommodate the increasing population of Alaskan communities. 2009 was the ninth highest season for acres burned with 520 fires statewide and 2,951,582 acres burned. This was only four years after the first and third largest fire seasons in Alaska's history. In 2004, 6.6 million acres of forested lands burned in Alaska and 4.6 million acres burned in 2005. The 17-Mile Fire in Homer and the Caribou Hills Fire in 2008, the Parks Highway Fire in 2006, and three fires in 2004 were declared FEMA fires eligible for Federal Fire Management Assistance. These fires posed "significant risk to constitute a major catastrophe" to life and property.

State Land Disposal Program

The Alaska Constitution, state laws, and the Alaska Legislature all direct the Department of Natural Resources to sell state land for settlement and private ownership. Article VIII of the Alaska Constitution states that, "It is the policy of the state to encourage the settlement of its land and development of its resources by making them available for maximum use consistent with the public interest."

This policy adds to the already increasing wildland/urban interface problem fire managers are facing. Thousands of acres of state land have been sold, primarily in remote areas that are often poorly situated (such as on a ridge top) with limited or no ingress and egress, and among volatile fuels. Alaskans are building recreational cabins and primary homes in these areas. Presently, no regulations or ordinances exist requiring a reduction of hazardous fuels prior to land disposal, or require more than one way in or out of the subdivision, or require property owners to observe Firewise principles once they have built a cabin or home on the purchased land (Figure 10). Furthermore, no state general funds are available for hazardous fuels projects.

Spruce Bark Beetle Epidemic

The threat of a catastrophic wildland fire is exacerbated not only by the continued human expansion into the forestland lands of the state but by the buildup of bark beetle killed timber (Figure 11). The spruce beetle out

Figure 10 Homes outside of Fairbanks, Alaska (Alaska Department of Fish and Game)

break on the Kenai Peninsula is considered to be the most intensive outbreak documented in North America. In 1998, state aerial surveys indicated that approximately 1.1 million acres of the Kenai Peninsula Borough had been impacted. Growth of the outbreak has slowed, but the risk for catastrophic wildfire with the potential to impact private land in the urban interface will continue for decades to come.

The combination of fine fuels and sound, woody material can produce intense fires. Because they are exposed to the wind and sunlight, standing dead spruce trees dry out quickly after wet periods. These standing dead trees can torch and initiate spot fires even after the needles have been lost. If stands are open enough to allow winds to reach surface fuels, fires may spread more rapidly than in stands of live trees with a closed canopy. The present fuel conditions in spruce beetle-impacted stands of south-central Alaska may lead to severe and unpredictable fire behavior (Alaska Society of American Foresters 1997). In addition to the heavy fuel loads, several other conditions in south-central Alaska contribute to the higher than normal fire hazard. Temperatures over the last several decades have been warming thereby resulting in a longer fire season. Also, the growing population in South-central is leading to increasing probabilities of human-caused fire ignitions. (Ross et al. 2001)

Another area of significant infestation is the Copper River Valley between Glennallen and McCarthy where 680,500

Figure 11 Spruce bark beetle devastation on the Kenai Peninsula. (Division of Forestry)

acres has been impacted. The remainder of the most significant infestation has been along the lower Yukon and Kuskokwim rivers and tributaries, the Lake Clark/Iliamna region, the Cook Inlet west of Anchorage (including 88,000 acres within this municipality) and in southeast Alaska, predominantly near Haines, Juneau, and Gustavus.

Climate Change and Wildland Fire

Climate changes, with trends to warmer and drier summers, are having an effect on the length of the wildland fire season in Alaska (Figures 12, 13). Fire activity tends to begin earlier and has increased activity into the fall beyond the historical norms. Along with an earlier fire season, an increase in lightning in portions of the state, all-risk incidents, and increased urban interface, wildland fire has occurred with the growth in population. There has been a trend towards larger fires impacting towns and communities with smoke (Figure 14). This has brought some temporary interruptions in tourism and increased health concerns. A longer growing season could improve forestry yields but warmer temperatures and increased summer drying will also increase the amount of flammable vegetation, thus increasing the potential for more wildland fires. The lengthening fire season and increased fire activity requires the constant rotation of firefighting personnel, including incident management teams and suppression crews. In the past five years in Alaska, there have been 18 requests for Incident Management Teams for 17 different fires and fire complexes. Eight of these requests were in 2009 alone.

Mega Fires

The concept of the "mega-fire" has evolved over the last two decades. Mega-fires are extraordinary in terms of their size, complexity, and resistance to control. They often burn into the wildland-urban interface where values to be protected are high. It is not unusual that fire severity in these stands is exacerbated following years of drought, insect infestations, and disease. These few wildfires, often burning under extreme fire weather conditions and exhibiting extreme fire behavior characteristics, exceed all efforts at conventional control until relief in weather or a break in fuel occurs." (Brookings Institute, 2005)

Alaska is experiencing its share of mega fires; beginning in 1994 when the Miller's Reach # 4 Fire burned more than 400 structures. This fire was Alaska's "wake up call" to the wildland urban interface problem it now faces. Since Miller's Reach, Alaska has faced numerous mega-fires, particularly in 2004 with the Boundary Fire just outside of Fairbanks, and the Taylor Complex outside of Tok, and in 2009; the Railbelt Complex, outside of Nenana, and the Crazy Mountain Complex, outside of Circle.

Lack of Known Sites Database & Geospatial Data

With the passage of legislation in 2007, department authority allows fire management decision makers to include all values, not just the values of the natural resources threatened by wildland fires. All houses, cabins, commercial property and other cultural resources can be considered when assessing the most appropriate and cost effective fire management strategies, not just the natural resources. Many of these values lie outside of organized boroughs and the locations of these values at risk are not captured in any databases. Incident management teams are constantly discovering cabins, homes and other resources while trying to manage a fire, necessitating a constant change of tactics. (Figure 15). In order to most effectively apply fire management strategies, identifying and inventorying those values must be done, preferably prior to the start of a wildland fire.

The ability to inventory and display the location of values at risk is hampered by the minimal Geographic Information System (GIS) capability and lack of underlying geospatial data. Sound fire management requires access to data, from vegetation type, to land ownership, to improvement locations. In order to build this capability, GIS systems and databases need to be developed. The cost of acquiring the necessary underlying geospatial data

Mean Annual Temperature Departure for Alaska (˚F), 1949-2008

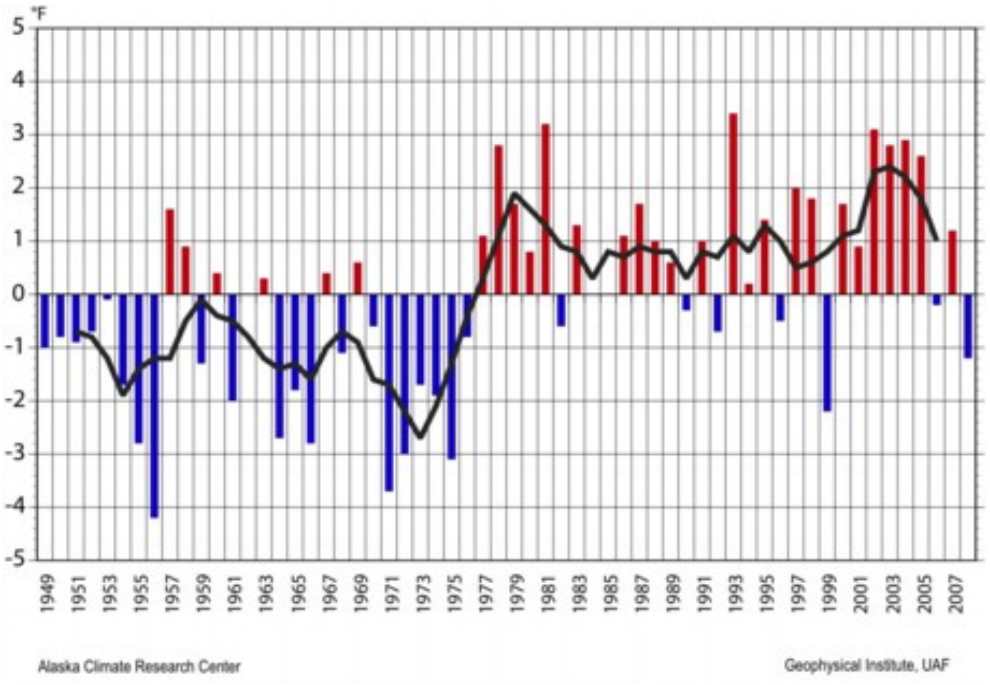


Figure 12 Mean annual temperature departure for Alaska

Total Change in Mean Annual Temperature (˚F), 1949-2008

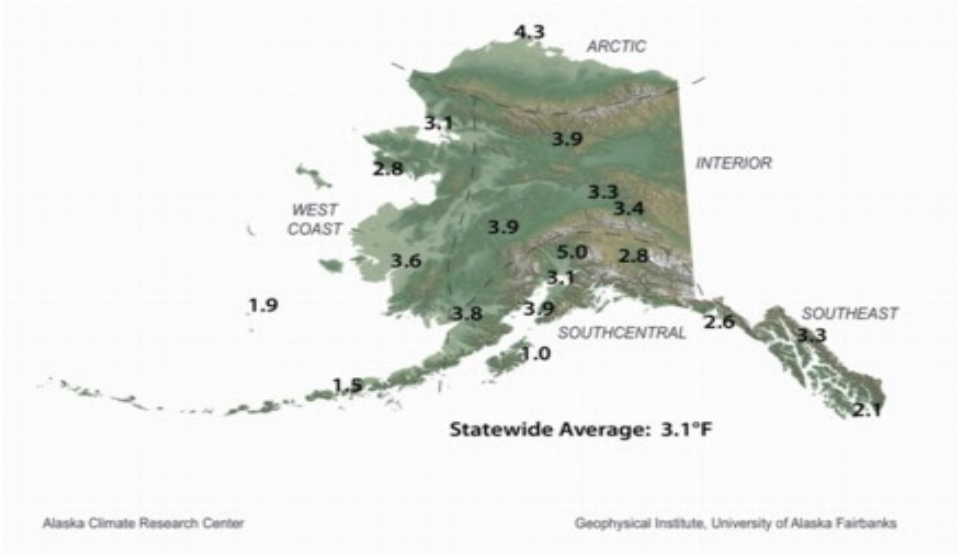


Figure 13 Map of total change in mean annual temperature 1949-2009

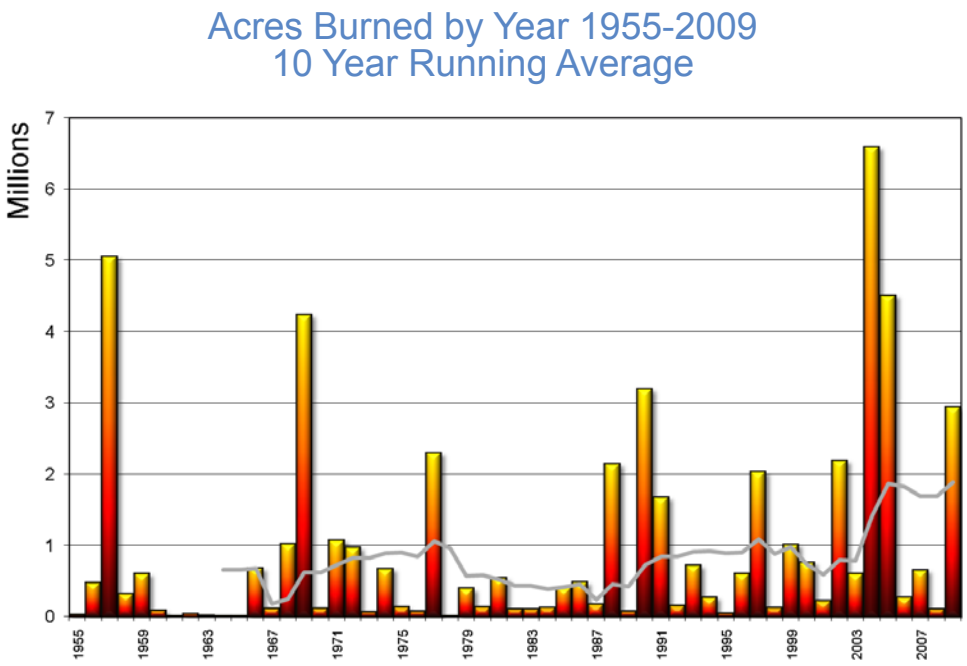


Figure 14 Acres burned, 10 year running average 1955-2009 (Alaska Fire Service)

for the entire state of Alaska is estimated at $70 million, a cost too steep for the state to bear. To date, Landfire data has proven to be inaccurate for many fuel types.

Geographical, Social, and Political Conditions

Most of Alaska is accessible only by air or river and the distance and isolation between communities is considerable. Alaska does not have the physical or social infrastructure most states have. Unemployment in rural areas is as high 16 percent. Many communities lack basic infrastructure such as running water and sewer systems, and cell and internet service is limited. Population in rural villages is small and firefighting on a village Native crew can be the sole source of income for local residents. Local government structure, nonprofits, community associations, and environmental groups so prevalent in the lower 48 states are all but nonexistent in rural Alaska, and even in the populated regions are found at a much lower percentage that the rest of U.S.

Communities are hard pressed to form viable partnerships and more often than not are unable to meet minimum matching requirements for Western Wildland Urban Interface and Volunteer Fire Assistance grant programs. In addition, state agencies are in "competition "with federal agencies offering funds related to wildland fire mitigation that have no matching requirements, such as the funds the Bureau of Indian Affairs and U.S. Fish & Wildlife Service distributes for fuels mitigation. These factors compound an already challenging situation. State and federal agencies can leverage each others projects, but if a community can not come up with a nonfederal matching share, often at 50 percent, opportunities for leverage and for working on a landscape scale with partner agencies diminish.

Economic Conditions

The state faces unprecedented economic challenges which are having an effect on the ability to deliver the fire program and will ultimately hinder suppression efforts. Vacancies in key fire management positions, unavailability of firefighting aircraft, decreased federal capacity, and increased vendor and contractual cost will all takes a toll on the ability to effectively and safely fight fire.

Employee Retention

Competition for personnel from municipal and federal positions offering significantly higher wages is no longer offset by the state's benefits since the advent of Tier III and Tier IV employment plans. Recruitment for firefighting positions is a major problem and openings continue to be recruited within Alaska and nationally with very poor results. Critical shortages in dispatch, logistics, and experienced professional level fire managers have necessitated

Figure 15 Site protection on the Taylor complex fire, 2004. (Division of Forestry)

national recruitment, often without success. Salaries and benefits are not competitive. The expected loss due to retirement of two-thirds of the division's fire managers, supervisors, and fire personnel in the lead technician class within the next five years is alarming.

Contractual Costs

Alaska's vast distances and lack of roads necessitates the use of air resources when responding to many wildland fires in the state; air tankers, helicopters, lead planes, smokejumpers, and reconnaissance aircraft are essential to the success of fire management programs. Initial attack and the ability to support remote fires in Critical, Full or Modified Protection Areas with supplies, crews, and equipment can be logistically complicated and requires aircraft and sometimes watercraft. This accounts for the high cost of remote incidents. Reconnaissance aircraft are needed to monitor staffed fires and fires in the limited management option zones.

Cost increases due to market pressures on vendors, particularly those supplying contractual fire fighting aircraft, are seen in much higher than anticipated bids on all aviation contracts. Due to the limited road access, the division relies heavily on aircraft to support fire management activities. Availability of aircraft has been severely impacted by increased mining and oil and gas exploration in the state. In addition, changes in the aviation industry caused by fuel, labor, and liability insurance have increased overall costs. Forestry received funding in Fiscal Year 2009 to fund aviation shortfalls, although increased costs (as new contracts are due for rebid) are anticipated in future years.

Costs of the fire program vary not only directly with the intensity and length of the fire seasons, but with unavoidable increases in service contract costs such as catering, fresh food boxes, showers, and emergency rental vehicles. Costs for private sector services, on which the state relies heavily during the fire season, continue to escalate with liability, energy, and additional labor costs. The earlier and longer fire season has resulted in the baseline historic expenditures no longer being indicative of the previously normal fire season. Suppression cost trends are based on the average fire costs over a ten-year period, eliminating the high and low years. The 2004 fire season established a new high year, which increased the expenditure trend even more above the budgeted funding level.

Decreased Federal Capacity

The Bureau of Land Management Alaska Fire Service, the Division of Forestry's primary cooperator, has experienced a significant reduction in its operational capability due to federal budget reductions. While the state has relied on federal cooperators for support in the past, there is now reduced ability to use federal resources to augment state resources on wildland fires. In addition, U.S. Forest Service State Fire Assistance (SFA) grants have been a significant source for funding key preparedness programs. Large fire costs experienced by the Forest Service have caused, at times, re-direction of SFA funds to cover the expense of fire suppression on national forest lands.

Non-Wildfire Response

Personnel with Incident Command System (ICS) training and experience are increasingly being used for all risk incident response both instate and nationally. These responses range from the 9/11 terrorist attack in New York City, to hurricanes, such as Katrina and Rita, to windstorms, floods, fuel spills, and earthquakes (Figure 16). The state is increasingly relying on Division of Forestry availability in disaster planning and all risk incident management. The division provided extensive assistance to the Division of Homeland Security and Emergency Management in the 2009 response to flooding of villages along the Kuskokwim and Yukon rivers. The division provided logistical and warehouse support, which was an integral part of the most significant interagency flood response experienced in the last several years. The division sent water, rations wall tents, and other supplies to sites

Figure 16 Alaska Type 1 team members, World Trade Center disaster, 2001. (Alaska Fire Service)

from Akiachak to Eagle, and provided a Type 3 Incident Management Team. However, the majority of these personnel are not budgeted for the duration of the fire season to ensure their availability for fires. The division has a large cadre of trained and experienced personnel that can be used for all-risk management. This increased workload falls to fire managers who have full-time fire management responsibilities; however, it assists in retaining seasonal employees by increasing work opportunities.

Forest Products Industry

FRPA Region I (Coastal Rain Forest, Southeast Alaska, Southcentral Coast)

A historical context is helpful to fully appreciate the present condition, threats, and trends associated with the forest products industry in Alaska. Figure 17 shows historic timber harvest levels in Alaska from 1940 through 2006. In Alaska's coastal region (Region I) the past century has seen the rise and fall of a major industrial player. This graph shows the peak in Forest Service harvest in 1973 and the peak in total harvests from all lands in the late 1980s. Since that time timber harvest has plummeted to a 50-year low.

Brackley et al., 2009, describes the early pre-World War II industry in Southeast as follows:

The Tongass National Forest was created by a proclamation signed on September 7, 1907 and timber sales reported in 1909 and 1910 averaged 13 million board feet (mmbf) of logs per year. Much of this supported local consumption and a thriving wooden box industry for shipping canned salmon to world markets (Heintzleman 1954). Annual volumes of timber harvested following World War I and prior to World War II ranged from 14 to 57 mmbf. This rose during World War II to more than 90 mmbf in southeast Alaska to support the war effort. About 45 percent of this war-year volume was shipped to Seattle for use in airplane construction. The remaining amount was sawn and used in construction in Alaska.

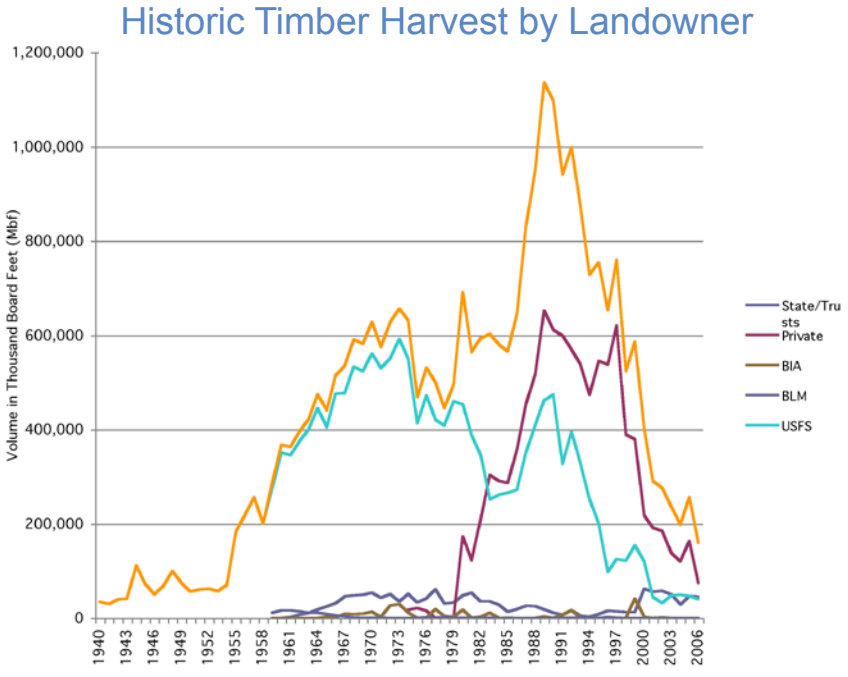


Figure 17 Harvest in Alaska. (Brackley et al. 2009)

It was after major efforts by the U.S. Forest Service to attract industrial investment to the region as authorized by The Tongass Timber Act (TTA 1947) that two long-term timber sale agreements were signed in the early 1950s, each of which required construction of pulp mills, the first in Wards Cove in Ketchikan, and the second in Sitka. As production ensued an integrated industry was developed with sawmilling capacity in addition to the pulp mills. By the early 1970s, Alaska producers accounted for a major share of west coast lumber exports, and timber harvest from the National Forest Lands in Alaska peaked in 1973.

The 1971 Alaska Native Claims Settlement Act (ANCSA 1971: PL 92-203) was passed by Congress to settle outstanding aboriginal land claims by Alaska Natives, created Native land ownerships that resulted in a reduction in the area available for producing timber on the Tongass, but led to a thriving industry developed from timber available from the newly formed Alaska Native Corporations. Timber harvests from Native corporation lands in Southeast as well as south-central Alaska boosted the industry with corporation timber harvests peaking in 1989.

Concurrent with the shift of timber harvest to private lands and an export trade, timber supply from the Tongass National Forest became less certain. Changes in national priorities for the forest began to impact timber supply. Efforts to retool the industry to modern plant and equipment were frustrated by both economic challenges and uncertainty in future log supply. After 40 years in operation the Sitka mill closed in April 1994 and the Ketchikan mill closed in March 1997.

Region I Threats

Since the mill closures, smaller sawmill operators have struggled to continue operating as log supply has been further constrained, and the industry that was once integrated with both pulp and sawlog operations was now burdened with a lack of market for low quality logs that had previously been used for pulp production.

Timber and related products from the Tongass National Forest have long played an important role in the economy of Southeast Alaska. Their importance was formally recognized in 1990 with passage of the Tongass Timber Reform Act. This act requires the Forest Service to seek to provide a supply of timber in a sustainable balance with all multiple resource objectives on the Tongass. The Tongass Forest Plan guides the management of all resources on the forest. (U.S. Forest Service 2008). The 16.8 million-acre Tongass has about 9.4 million acres of old-growth forest, about 5 million acres of which are of commercial size. The forest also has about 400,000 acres of young growth stands that are the result of timber management activities initiated primarily in the 1950s. Under the current Tongass Forest Plan, about 3.6 million gross acres of land are zoned to allow for some level of timber management; however, only 676,000 acres are programmed for long term timber management. This amounts to about four percent of the Tongass land base and less than 15 percent of the original commercial sized old growth forest.

Even this dramatically reduced target for output from the Tongass has been elusive, with a series of appeals and legal challenges to both the Tongass Land Management Plan and individual sales. To compound these difficulties, a significant decline in timber available from Native corporation lands, began in the late 1990s. This coupled with significant structural shifts in the log export market have resulted in the industry's infrastructure, including human expertise, capital, and support services, declining to a critical mass. The very survival of the timber industry hangs in balance with total industry harvest levels reaching their lowest level in a half century.

Compounding timber supply threats are market related challenges for log export and manufactured forest products. Alaska has disproportionately high production costs due to many factors including the remote nature of operations, high cost of labor and energy, and often costly road and infrastructure costs. Alaska forest products are competing in global markets, and suppliers from other regions have significant cost advantages. In the late 1990s the premiums that were once paid for Alaska's fine grained old growth timber declined significantly, compounding the economic challenges of managing coastal forest resources in Alaska.

Region I Trends

As discussed in preceding discussion of industry threats, the decline in timber supply has affected every aspect of the forest products industry in southeast Alaska. The industry is at a critical turning point and the next few years will determine whether this trend can be reversed. In 1990 the Alaska Department of Labor reported 3,450 logging, sawmilling pulp mill, and wood products jobs in Southeast. For October 2009 only 200 jobs were reported in this sector statewide. (Alaska Department of Labor, December 2009).

A transition to young growth on federal, state, and Native corporation lands in southeast Alaska will be a significant trend for a future forest products industry. The challenge is to provide sufficient economic timber from older forests to fill the gap while the legacy stands, harvested since the mid 1950s, mature. This is further complicated by restrictions that have put many of the older second growth stands off limits to a second entry, such as stands along the beach fringe that are now restricted by standards and guidelines in the Tongass Land Management Plan. Because Native corporation harvests didn't ramp up until the 1980s young growth on corporation lands won't be available in significant quantities for decades, presenting a further gap in timber availability.

In 2005, the American Lumber Standards Committee approved new strength values for Alaska softwoods species, which were developed at the Ketchikan Wood Technology Center. The committee also approved grade stamps for Alaska spruce, hemlock, and yellowcedar lumber. These advances have allowed Alaskan softwood species to gain recognition for their aesthetic values as well as their exceptional structural properties. Should sufficient reliable log supply become available to enable investment in processing capacity, the new grade stamps for Alaskan species may help facilitate an increase in the use of local wood in Alaska. For example, Alaskans use about 120 million board feet of construction-grade lumber each year. While demand for construction-grade lumber is currently met through imports, we now recognize that Alaskan species can provide a suitable, if not superior, substitute for imported wood products.

Land tenure in Alaska will become more settled as the state and Native corporations receive their final federal land entitlements. Unless the ongoing gridlock regarding federal timber supply from the Tongass National Forest can be resolved, state, Native corporation, and trust lands will become the dominant working forests to provide for a forest industry in Alaska. Timber availability from the Tongass National Forest may become more dependent on forest stewardship contract, which are dependant on federal appropriations.

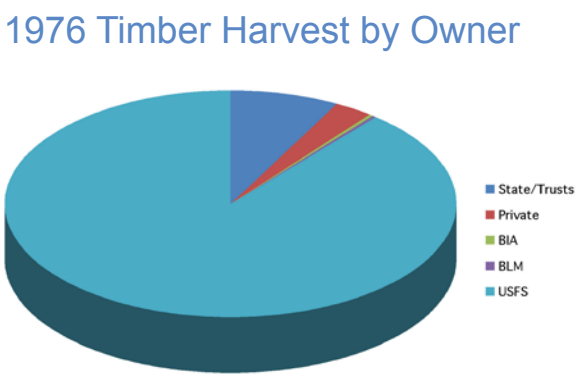


Figure 18 Timber harvest by landowner 1976

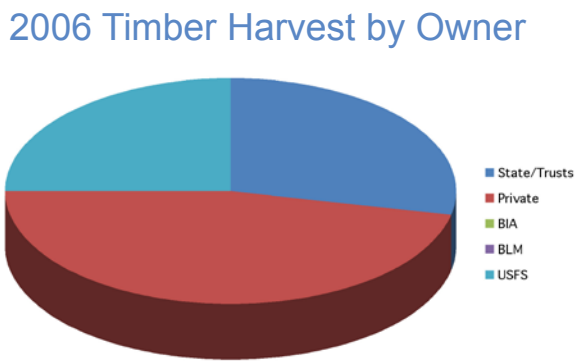


Figure 19 Timber harvest by landowner, 2006

In addition to the decline in timber harvest over the past 30 years, a significant shift in the land ownership supporting the industry demonstrates the trend towards state and Native corporation lands supplying a higher proportion of timber to the forest products industry. Because federal lands dominate Alaska's most productive forest lands, which are those in Southeast, timber from state and private lands cannot offset the reduction in timber supply from federal lands.

It will become increasingly difficult for private and public landowners to maintain roads, bridges, and log transfer facility infrastructure in previously harvested areas without regular stumpage returns to support these land management costs. In the past, federal dollars were invested in road construction and maintenance either through appropriations or timber sale purchaser credits.

South-Central and Interior Alaska (Regions II and III)

The potential for forest products industry growth in south-central and interior Alaska is significant. The forest products industry in South-central and Interior presently serves a small percentage of local demand for wood products and a more significant portion of the demand for fuel wood. During times of robust export markets, white spruce logs from interior Alaska were exported via rail to the ports of Seward and Anchorage. Chip export operations were established in Tyonek in late the 1970s and early 1980s and in Homer in the 1990s in response to timber salvage efforts in the wake of bark beetle outbreaks. More recently, wood chips were exported from the Mat-Su Valley from Point MacKenzie.

The state is the major timber owner in interior Alaska, including 1.8 million acres in the Tanana Valley State Forest. Native corporations, the University of Alaska, and the Fairbanks North Star Borough also have significant timber holdings. Local forests have supplied lumber, logs, and firewood for use in the region since the days of the gold rush. Interior forests once served as a major supplier of transportation fuel, with more than 50 steamboats operating on the Yukon River in 1900. Steamboats of the Northern Commercial Company used 48,438 cords of wood between 1897 and 1902. In recent years, local mills have added kilns and planers to their facilities. Currently, high oil prices are raising interest in wood energy from biomass. Extensive hardwood forests offer potential for a variety of manufactured products and energy sources.

The paper birch and spruce forest in the Susitna Valley, north of Anchorage, historically has had little economic value due to a high defect rate. This had made it difficult to create more than the few jobs offered by log home builders and very small sawmills. Growing interest in wood chips, biomass for energy, and hardwood saw timber may provide wider opportunities for use of South-central forests. Farther south, on the Kenai Peninsula, continued deterioration of beetle killed spruce has limited the amount of useful timber to the local mills. This has forced some mills to move out of the area or cease operations entirely.

Silviculture and Forest Products

Silviculture investigation of second growth forest in Alaska has been underway for many years (Taylor 1934, Farr 1967, Zasada 1976). Regeneration of forests following timber harvest in Southeast is generally abundant. Southeast second growth forests often have densities far above optimum for individual tree and value growth. Thinning, pruning, and fertilization are silvicultural techniques that may be applicable. Thinning allows greater diameter growth and hence lumber production. Thinning can increase browse and hasten the time for the forest to have mature forest habitats. It also allows modifying species composition in regeneration often dominated by western hemlock. Pruning the basal eight-foot log can produce a more knot free and valuable log. Forest fertilization has been very limited in Alaska, but is believed to have promise when combined with thinning. Forest fertilization has been used operationally in British Columbia and the Pacific Northwest states for years. In the Haines State Forest, tree planting has been found beneficial to ensure prompt regeneration. Nonetheless, thinning and basal pruning are sometimes used to improve forest product values.

Reforestation on boreal forest sites can be problematic and some sites can become dominated by bluejoint reed grass for many years. Mechanical scarification or fire can be effective for site preparation and natural regeneration, but winter logging can have little site preparation effect. Tree planting has been used effectively on boreal sites, but planting nursery grown seedlings may be too costly for many rural boreal sites. Spruce seed has been collected and stored to provide nurseries with Alaska seed sources. Although spruce seed can retain viability for 20 years, new seed collections are advisable when good cone crops occur.

Tree improvement to produce faster growing trees by genetic gain has been considered for many years in Alaska. In Southeast Alaska, abundant natural regeneration and high logistical cost has limited tree improvement development. In interior Alaska, lower growth rate for white spruce has limited tree improvement due to investment concerns. Nonetheless, tree improvement to develop hybrid poplars for boreal sites may be re-considered. Also, newly developed hybrid poplars from Canada may have sufficient cold tolerance for interior Alaska. Hybrid poplars grow substantially faster than parent types and planting poplar stem cuttings may be a low-cost method of biomass reforesting. In addition to providing energy, regeneration of hardwood species should enhance moose browse.

Region II-III Threats

In fast growing areas of the state, particularly portions of the Matanuska-Susitna Borough (Mat-Su), forest fragmentation, urbanization, and associated conflicts with timber harvest and processing operations and forest management present a significant threat to the ability of the forest products industry to reach its potential. The Mat-Su is the fastest growing area in Alaska with a population increase of 35 percent between 2000 and 2007 compared to 9 percent growth in Anchorage and 8 percent statewide.

Statewide Threats

While short term salvage efforts have increased forest product industry activity on the western Kenai Peninsula and on the west side of Cook Inlet, the long term impact of epidemics such as the spruce bark beetle present significant threats to the long-term resource values necessary to support a viable forest products industry. Much of the hardwood in south-central Alaska is well beyond its economic maturity and many stands have high levels of defects, which results in further economic challenges to development.

The lack of roads and other infrastructure threatens to limit the potential economic contribution of the forest products industry. Active forest management is limited to areas with existing infrastructure; lower cost winter road construction; or sufficient resource values to pay for new access development.

The ability to effectively manage public and private forest lands is largely dependent on public understanding and acceptance of forest management activities. A lack of public acceptance of management practices is in part responsible for the decline in harvest levels on national forest lands. This "social license" to practice forest management and support a forest industry in Alaska can not be taken for granted, and a loss of public acceptance of forestry activities is a threat.

Statewide Trends: Wood Energy

Increasing costs of energy in interior and rural Alaska combined with energy policy initiatives at the state and federal levels to increase the use of renewable energy and decrease carbon emissions will increase demand on Alaska forest resources for energy production. Between 2002 and 2006 in rural communities the median price of diesel power fuel increased 67 percent to $2.35 per gallon and the median residential power costs increased by 20 percent to $0.47/kWh before the power cost support subsidy provided through the State's power cost equalization program (PCE). (Crimp, Alaska Energy Authority, 2007). Demand for personal use firewood permits from state lands increased almost five fold from FY 07 to FY 09.

The Alaska Wood Energy Development Task Group is a coalition, formed in 2004, to explore opportunities to increase the use of wood for energy in Alaska. The group provides funding and expertise for selected projects that promote the use of biomass over fossil fuels. It provided the following information (Alaska Department of Natural Resources, 2008).

With national heating and electricity costs increasing yearly, Alaskan communities are experiencing drastic fiscal impacts. In some communities, use of excess woody biomass from Alaska's forests has risen from being a prominent issue to a necessity for survival. Economic and environmental stressors promote developing markets for alternative biomass energy. In both the short and long term, alternative energy will save money; however, the fiscal resources required to cover the up-front costs for transitioning from fossil fuels to wood or wood-chip/wood-pellet burning appliances and support infrastructure are limited.

Alaska's forests provide an abundance of locally-grown, sustainable wood products. Broader use of forest resources creates economic opportunity, beyond traditional sawmill uses, through a wood-based bioenergy industry. Renewable wood energy products are also considered carbon neutral from a climate change perspective. Additional benefits from a more holistic use of forest resources

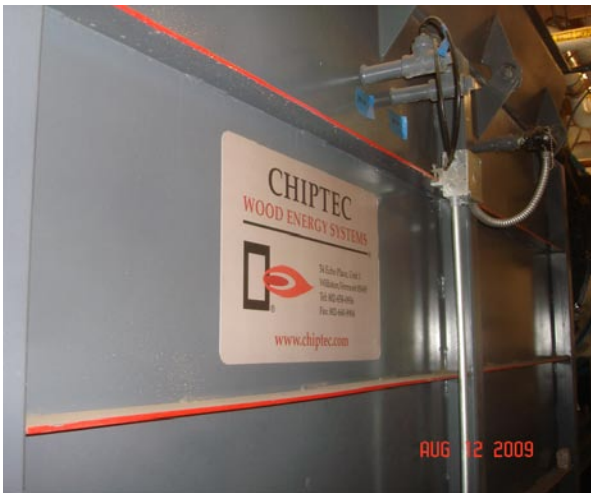


Figure 20 Chiptec Wood Energy System, installed at Craig, Alaska (Karen Petersen, Cooperative Extension Service)

include habitat improvements for a wide range of wildlife that depend on a mosaic of forest age classes, and fuels management in the wildland urban interface from a wildland fire risk management perspective. Wood energy projects are now operational in Craig (Figure 20), Kasilof, and Tanana.

Emerging markets for biomass for energy may encourage the development of a more fully integrated forest products industry. Efforts to encourage major industrial investment, such as the "New Growth" initiative in interior Alaska (Alaska Division of Forestry et al.) have been frustrated by global economic recession. Emerging biomass demand may create opportunities to serve markets for low grade material alongside saw logs and house logs. This is providing opportunities for an integrated industry at a smaller scale than that required to develop larger scale manufacturing facilities. Like other potential markets for forest products, enterprises serving energy markets using biomass face the economic challenges related to dependable supply, lack of infrastructure, and high costs of production.

Air quality concerns in communities such as Fairbanks may lead to an accelerated shift to cleaner burning wood based fuels such as wood pellets. Pellet stoves are gaining acceptance and pellet manufacturers are investing in manufacturing facilities in interior Alaska.

Markets for wood fiber for biomass energy may create opportunities to better manage and reduce threats to forest ecosystem health and reduce risks of wildfire impacts. Established and viable forest enterprises that are providing biomass for energy will be well positioned to help implement Community Wildfire Protection Plans.

Forest Products Industry Benefits and Services

The socioeconomic benefits of a vibrant and integrated forest products industry have long been recognized. Economies in rural Alaska are challenged and creating opportunities for employment in harvesting, transporting, and manufacturing of forest products has been a goal of state and federal policy makers since statehood. As described previously, the recent decline in timber harvest and associated manufacturing in coastal Alaska has contributed to significant decline in socioeconomic benefits as compared with prior decades.

A vibrant forest products industry provides forest landowners with economic incentive to keep working forests working and invest in increase yields of forest products from working forests. Without an outlet for forest products landowners lack the means to manage forest lands for long-term economic gain.

The infrastructure supporting the forest products industry is necessary for many management activities that support other objectives including: habitat enhancement and restoration; hazardous fuels mitigation; wildfire suppression and management; providing cost competitive delivered biomass fuels to emerging markets; forest health early detection and rapid response; and access for other uses such as recreation, hunting, and subsistence.

The lack of a fully integrated forest products industry in many parts of Alaska limits management options and benefits and response strategies available to forest managers.

Forest Health

Statewide

The condition of forest health in Alaska is assessed, compiled, and published annually as an interagency effort. Due to the size of Alaska, much of the assessment is by aerial survey and even then only about a quarter of the state is covered each year. The focus of the aerial detection survey has been on native insect pests, but the conditions report also addresses diseases, declines, invasive insects and plants. Widespread decline in alder health has the potential to significantly alter riparian habitat across much of south-central and interior Alaska. Sawfly defoliation and dieback and mortality due to the canker causing fungus Valsa melanodiscus are associated with decreased physiological performance and nitrogen fixation.

Coastal South-central & Southeast Alaska

The Alaska coastal forest, including forested areas south of the Alaska Range and the southeastern Alaska panhandle, occupies a vast, largely inaccessible area. The coastal forests of south-central and southeast Alaska experience periodic disturbance from several forest pests. Spruce beetle (Dendroctonus rufipennis) and northern spruce engraver beetles (Ips perturbatus) are the primary tree-killing species with another 50+ species of bark beetles having secondary effects. Spruce aphid, spruce budworms, and black-headed budworm, cause growth loss but usually not tree mortality. Stem, butt, and root decays reduce tree volume, cause wood defects, and contribute to mortality in every tree species across millions of acres throughout the state. Hemlock dwarf mistletoe cause growth loss, top kill, and mortality in Southeast Alaska and contributes to canopy wildlife habitat. Yellow-cedar decline has been a long-term perplexing phenomenon in the southeast Alaska forests. Other known forest disturbances also include strong winds, flooding, avalanches, wildfires, ice and snow events and other associated factors that predispose stands to forest pest outbreaks.

Spruce beetle outbreaks in Alaska have historically been associated with wind events (1,000+ acres of spruce stem breakage/windthrow) and spruce slash accumulations from right-of-way clearing (utility lines, seismic line exploration), general land development clearing, and/or timber harvest. Fire is not a significant threat in the coastal forest due to the cooler and wetter climate regime, but windthrow can be extensive. However, as a result of changing climate, spruce beetle outbreaks and catastrophic wildfire events are expected to become more frequent in spruce forests of south-central (e.g., Kenai Peninsula) and western (Iliamna and Lake Clark regions) Alaska.

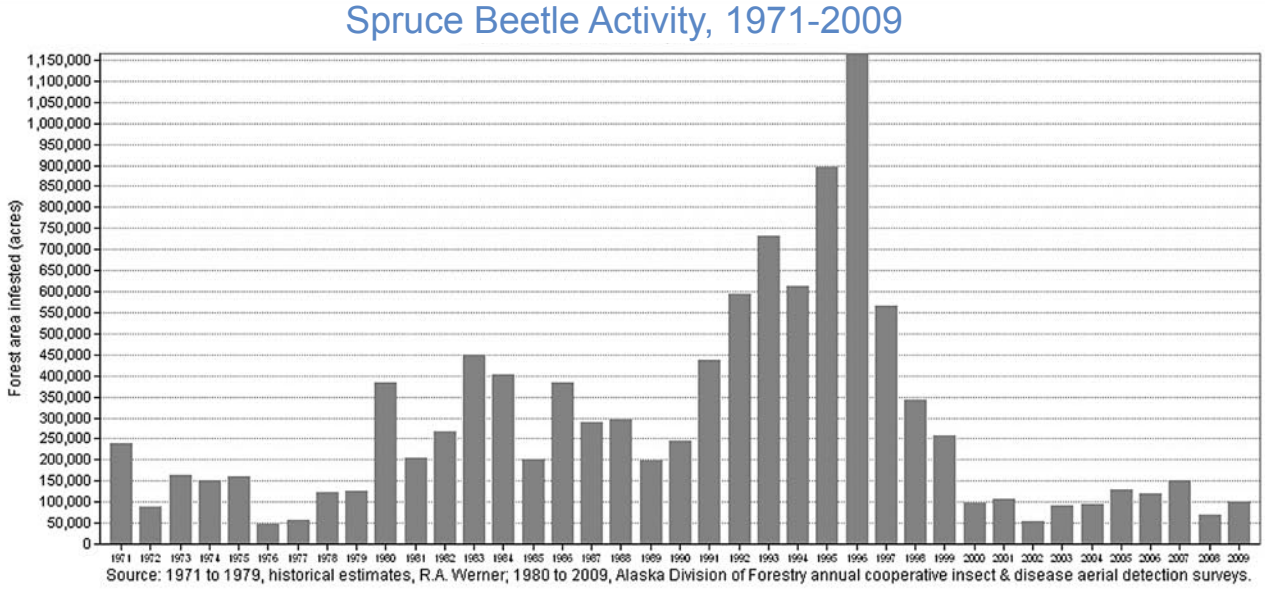


Figure 21. Forest area infested by spruce beetles per year by time period in Alaska from 1971 to 2009 (data prior to 1980 is estimated for the annual statewide totals from early aerial surveys on the Kenai Peninsula and historical accounts from published U.S. Forest Service conditions reports).

Natural regeneration in South-central forests is significantly delayed by accumulation of bluejoint reed grass (Calamagrostis canadensis) in the beetle-impacted stands. Natural forest regeneration is generally not an issue in southeast Alaska.

Besides improving general health and vigor, thinning of very dense second growth forests can enhance fish and wildlife habitat and commercial value of forest stands. For example, the northern goshawk is a species of special concern that nests in old growth forests of southeast Alaska. Also, road construction and maintenance can impact fish populations, and road work should be designed to protect water quality and fish passage.

Interior Alaska

While the more temperate coastal forests of southcentral and southeast Alaska have been impacted by infestations of the spruce beetle (Figure 21), the boreal forest of Alaska's interior region has been less affected by this major spruce-killing species. The extremes of longer, colder winters in the interior regions, less influenced by the warmer ocean influence from the southern coastal areas, have minimized the spruce beetle's impact by keeping localized beetle population expansions in check. However, the northern spruce engraver (Ips perturbatus) has become more prominent than the spruce beetle.

The engraver beetle (Ips perturbatus) has become more prominent than the spruce beetle, especially over the last 20 to 30 years, in Alaska's interior spruce forests. Northern spruce engraver beetles have a relatively short life cycle compared to the spruce beetle (one year vs. two+ years) and tend to respond more aggressively than spruce beetles, though on a smaller scale, to attack individual trees that are stressed because of drought, flooding, mechanical damage, insect defoliation (e.g., spruce budworms/coneworms), soil compaction, windthrow, or fire scorching. Consequently, engraver beetle populations build up rapidly in response to a forest disturbance. The effects of climate change and bark beetle response to climate-induced (abiotic) stressors in their plant hosts can be expected to be most pronounced in the northern-most forested areas of interior Alaska.

Spruce beetle epidemic

During the 1990s a historic spruce beetle epidemic occurred in south-central Alaska on more than 4 million acres of both pure and mixed spruce-hardwood forest (Figure 22). The spruce beetle epidemic on the Kenai Peninsula that began in the late 1980s and continued into the 1990s was most likely triggered by the significant climatic shift to longer and drier spring-summer periods (Berg et al. 2006, Werner et al. 2006). During the epidemic, the mainland Kenai Peninsula alone sustained over 80

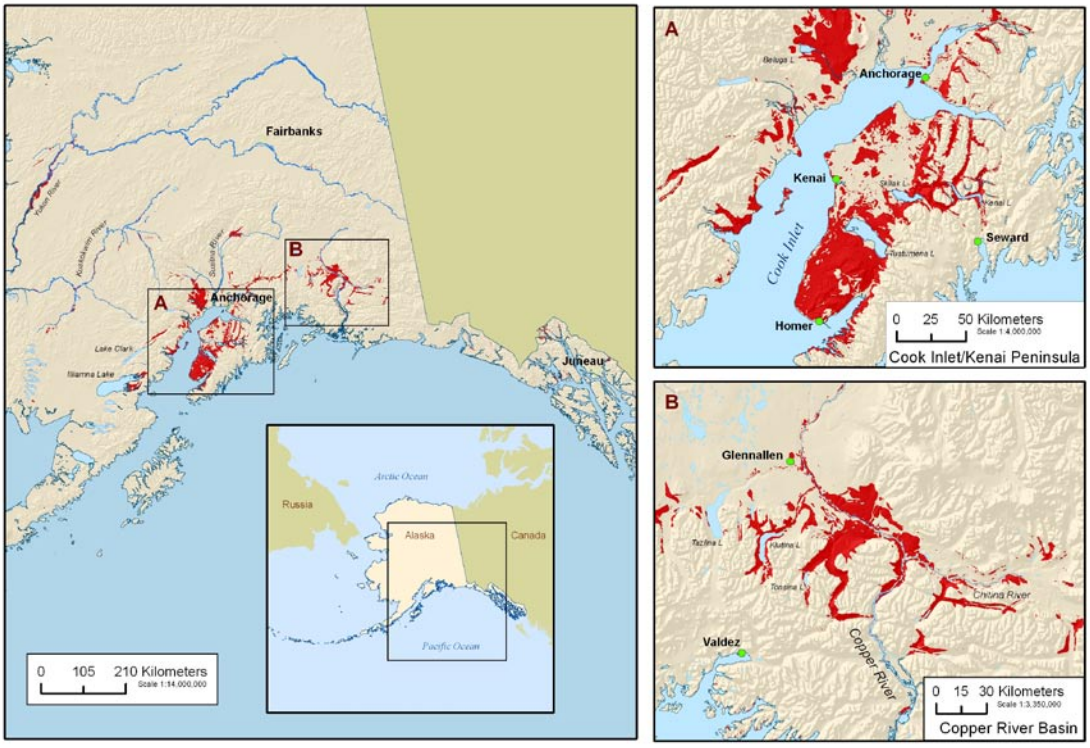


Figure 22. Location of spruce beetle outbreaks in Alaska from 1980 to 2003. Outbreaks totaled 4,268,500 acres during this time and were concentrated in south-central Alaska in the (A) Cook Inlet-Kenai Peninsula (2,279,200 ac) and (B) Copper River Basin (757,700 ac).

percent beetle-caused mortality on approximately 1 million acres of mature spruce forest. Spruce beetle mortality was also extensive in the Copper River Valley between Valdez and Glennallen, including areas of the 1920s outbreak that had mature spruce trees again susceptible to beetle attack. The Haines State Forest in northern southeast Alaska also sustained a spruce beetle outbreak during this period.

Given the extent and magnitude of the south-central and northern southeast Alaska spruce beetle outbreaks and the absence of an existing infrastructure to harvest the mostly inaccessible, damaged trees (especially in South-central), approximately 12 percent of the beetle-killed spruce were salvaged, mostly for pulp and chips that were exported to Japan and Asian markets. Spruce beetle-kill salvaged from the Haines outbreak in southeast Alaska was used for pulp and some dimensional lumber products at then existing local mills.

Knowledge gained by studies conducted after the epidemic helped to explain root causes for these insect epidemics. Warmer temperatures increase overwinter survival and shorter maturation rates of beetles, thus, increasing the potential for epidemics (Berg et al. 2006). In addition, increased summer temperatures can cause drought stress in trees, favoring successful beetle attacks, and it shifts beetle generation times to a shorter and more compressed bark beetle brood development period (Werner and Holsten 1985). So, the changing climate may have impacted beetle outbreaks, which increased the abundance of dead fuel, which in turn may have influenced fire behavior and its effects (Berg and Anderson 2006). Human influences in the wildland urban interface impacted both fire ignition and fire extent through active suppression. Fire effects will interact with natural regeneration, plant competition, and climate to determine the future path of succession.

Changes in spruce beetle activity trends are most easily illustrated from the Kenai Peninsula spruce beetle epidemic, which expanded from approximately 40,000 acres mapped in 1989 to over 1 million acres of cumulative beetle activity as of the 1997 aerial surveys. The Kenai Peninsula region of south-central Alaska has seen the most dramatic increases in bark beetle mortality during the past 50 years. An illustration of the rapid expansion of this outbreak is seen in a comparative beetle activity map prepared during the peak of the 1990s spruce beetle epidemic. The map depiction below (Figure 23) illustrates the expansion of new and ongoing beetle activity in relation to older (brown/gray) beetle activity as a means to illustrate graphically the expanding bark beetle epidemic in relation to cumulative forest damaged. Another way to compare and contrast local pest activity trends and forest effects across larger geographic areas (in this case Kenai

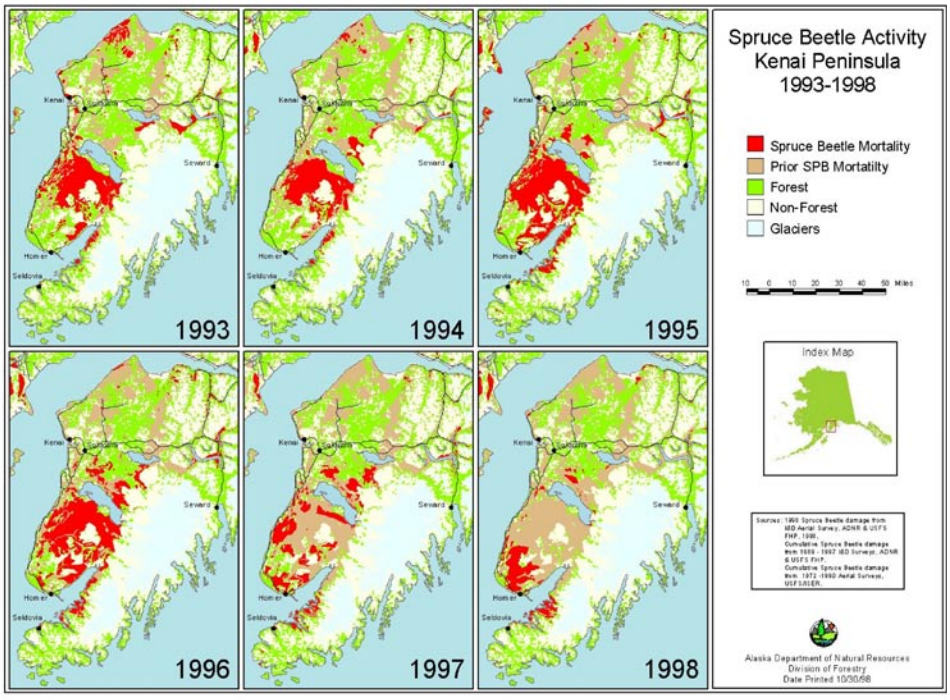


Figure 23. Spruce beetle activity on the western Kenai Peninsula mapped from USFS/AKDOF annual Aerial Detection surveys during the peak of the 1990s epidemic (1993-1998). Areas of cumulative older mortality (brown areas) contained no significant, observable new beetle activity, for each respective survey year during this 6-year period.

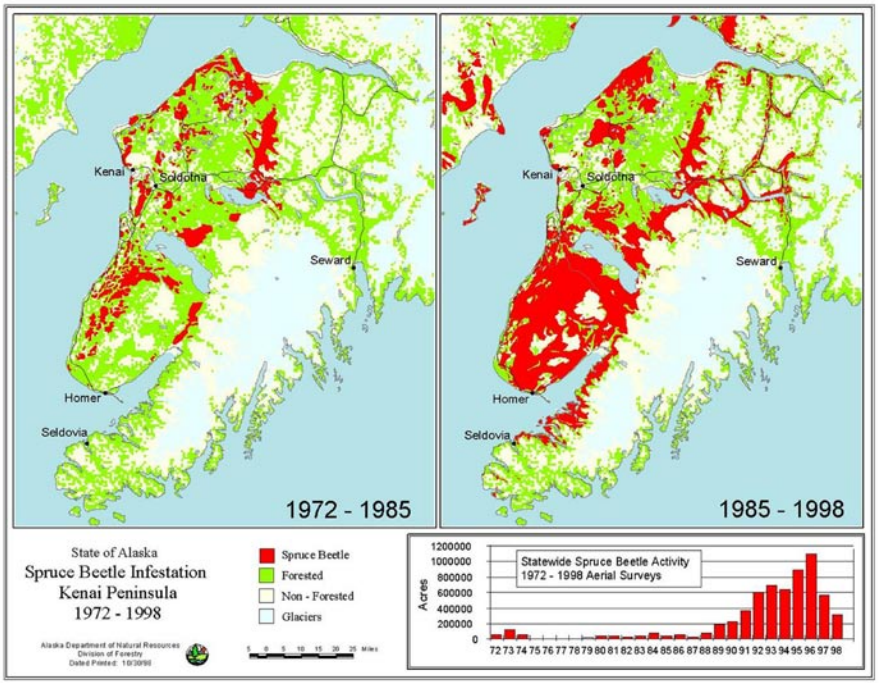


Figure 24. Historical depiction of cumulative spruce beetle activity during two time periods on the Kenai Peninsula compared to statewide spruce beetle activity in total acres on a statewide basis (1972-1998).

Peninsula vs. statewide cumulative spruce beetle activity during the same periods of time) is to look at time sequences from AKDOF's forest damage geospatial datasets (Figure 24). It is important to note that the U.S. Forest Service and Alaska Division of Forestry were able to rely on extensive experience in the development of Geographic Information System technology and archiving of the annual Aerial Detection Survey data into GIS mapping systems during the 1990s spruce beetle epidemic. This expertise ended up being essential to assist various state, federal and municipal land managers in the development of forest land resource planning, as well as timber harvest and salvage operations as a result of the 1990s spruce beetle epidemic.

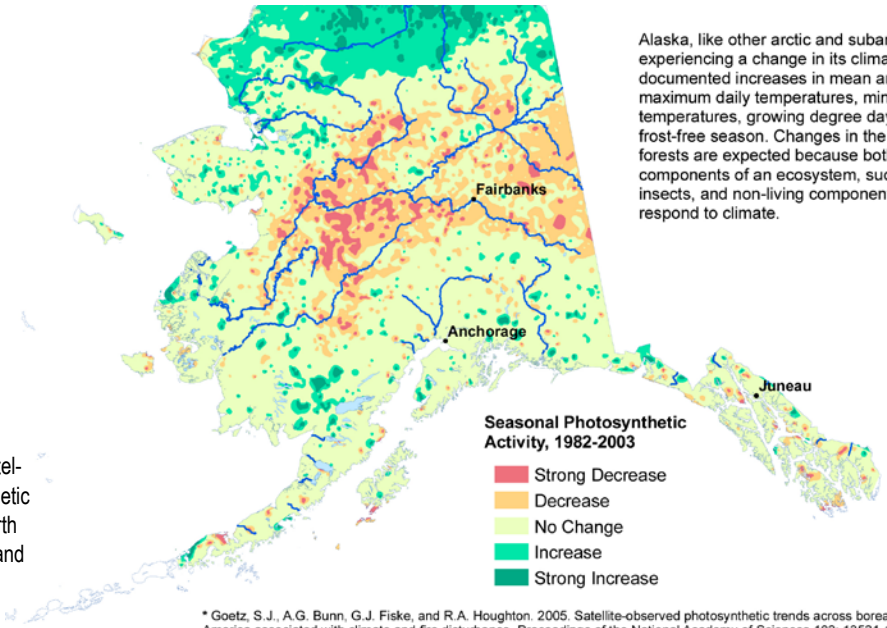
Climate Change and Forest Health

Alaska, like other arctic and subarctic regions, is experiencing a change in its climate, with well-documented increases in mean annual temperatures, maximum daily temperatures, minimum daily temperatures, growing degree days, and the frost-free season. Changes in the health of Alaska's forests are expected because both the living components of the ecosystem, such as trees and insects, and non-living components, such as fire, respond to both short- and long-term changes in climate. The first recorded large spruce budworm outbreak, in the early 1990s, may have resulted from elevated summer temperatures that produced drought stress in the host white spruce trees. The 2004 wildfire season, the largest documented since the early 1950s, was a direct result of record temperatures and little precipitation. In the discontinuous permafrost regions of south-central and interior Alaska, increasing temperatures have been associated with both the loss of wetlands and increasing rates in development of thermokarst topography, both of which resulted in permafrost thawing. Thermokarsting – the collapse of ice-rich ground surfaces – in forested landscapes, can lead to the loss of forested land area. For example, remotely sensed data analyzed across the fringe of boreal North America from 1982 to 2003, demonstrated that much of Alaska's boreal forest sustained reduced photosynthetic activity, possibly due to factors such as fire disturbance, drought stress, nutrient limitation, and insect and disease damage (Figure 25)

Tracking and monitoring forest health

Forest pest detection and/or forest health assessment surveys are scarce. Since only a small percentage of Alaska is accessible by roads, estimates of pest extent, distribution, and impacts are mostly made from data collected by visual observations from airplanes. Also, constraints of weather, wildland fires, smoke and availability of agency staff resources do not make it possible to survey all of Alaska's 127 million acres of forest land each year. Thus, the area covered during the annual Aerial Detection Survey can only be a fraction of the actual forested land

Climate Change and Forest Health



Alaska, like other arctic and subarctic regions, is experiencing a change in its climate, with well documented increases in mean annual temperatures, maximum daily temperatures, minimum daily temperatures, growing degree days, and the frost-free season. Changes in the health of Alaska's forests are expected because both the living components of an ecosystem, such as trees and insects, and non-living components, such as fire, respond to climate.

Figure 25. LANDSAT satellite-observed photosynthetic trends across boreal North America between 1980 and 2003.

* Goetz, S.J., A.G. Bunn, G.J. Fiske, and R.A. Houghton. 2005. Satellite-observed photosynthetic trends across boreal North America associated with climate and fire disturbance. Proceedings of the National Academy of Sciences 102: 13521-13525.

acreage (Figure 26). Undoubtedly, the incidence of insect pests in Alaska's forests is much greater than the aerial surveys estimate. Many of the most destructive disease agents (i.e. stem decays, root diseases, dwarf mistletoe, etc.) are not readily detectable by air, therefore, significant pathogen-affected acreage is generally unreported.

The state collaborates with the U.S. Forest Service to conduct the aerial detection survey across Alaska's forests each year. Prioritized local and route-based forest damage surveys are completed on a 25 to 40-million-acre subset of Alaska's 127 million acres of forested areas in order to map and track current pest activity. Current year information, along with data from the past 5 to 10 years, and other GIS-archived aerial survey data, is used to develop a statewide assessment of current forest pest damage trends, and published by the U.S. Forest Service in its Alaska Forest Health Protection Report (Tables 5 and 6).

The U.S. Forest Service, Forest Health Protection staff also partners with the State of Alaska to help track the status and trends of forest health conditions at the national level. The U.S. Forest Service has developed a suite of leading forest health indicators to enable a periodic assessment of the overall health of America's forests and provide potential solutions to some of the greatest threats to U.S. forests. Leading forest health indicators may also be used to compare and contrast forest health conditions in Alaska, at least for those indicators that can be readily analyzed and summarized from current datasets of geospatial data. These indicators may also be tracked on a periodic basis and represent some of the key stressors of forest ecosystems. These indicators include:

- Tree Mortality
- Fire
- Weather/Climate
- Forest Cover/Fragmentation
- Invasive Forest Pests

Challenges with mapping forest health risk and pest trends

Despite increasing availability of moderate to high resolution satellite imagery and digital elevation modeling products, there is still no program in Alaska for regular acquisition and updating of imagery and digital elevation modeling products that can provide the level of forest vegetation mapping needed for even general forest health risk and pest trend assessments. The state has reached consensus to start a Statewide Digital Mapping Initiative that will acquire moderate and higher resolution imagery for critical areas with periodic refreshes of the geospatial data. High resolution satellite imagery is available for some areas of the state and that data will be used for this assessment, and as it becomes available, to provide a higher confidence for mapping forest health trends of the more common leading forest health indicators.

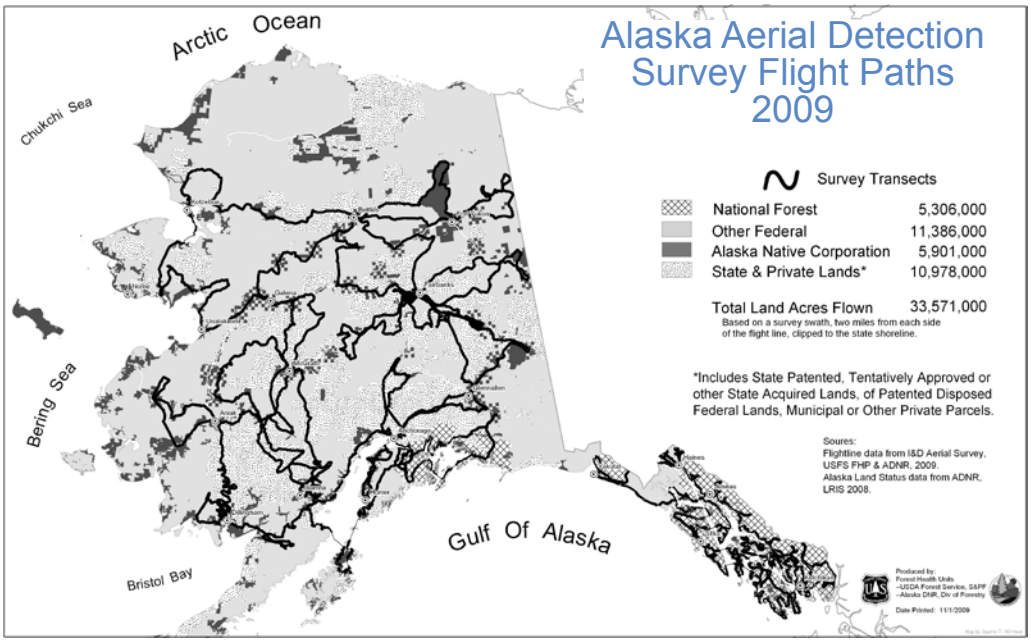


Figure 26. Flight paths of July 2009 Alaska aerial forest damage detection survey with an estimate of acres flown by landowner type for the survey (U.S. Forest Service 2010).

Forest health risk assessment

At present, Alaska lacks any consistent medium- to fine-resolution base vegetation datasets for analyzing forest pest risk on a landscape level over most of the state. The state has partnered with the U.S. Forest Service, Forest Health Protection staff in the development of the U.S. Forest Service National Risk Map project since early 1999. Risk Map 2006, the latest revision of this national insect and disease risk assessment effort (U.S. Forest Service 2007), developed a methodology for assigning mortality risk to a prioritized list of native forest pest species and susceptible host types with the primary goal being to provide a strategic assessment for risk of tree mortality due to major insects and diseases.

Threats from exotic and invasive insects and diseases

Invasive insect and disease species have become a serious threat in forests in other states. Invasive plants documented in Alaska include European bird cherry (Prunus padus), spotted knapweed (Centaurea stoebe), and bird vetch (Vicia cracca). Exotic plant disease, such as the current situation with several non-native sawflies in association with alder dieback and decline across Alaska, is a concern due to the importance of alder as an important slope and riparian cover and wildlife habitat species. To date, no destructive non-native beetles or wood boring insects have become established in Alaska, based on detection monitoring conducted by state and federal partners since the early 2000s (see also EDRR section below). Monitoring for noxious and potentially destructive forest moths such as the North American Gypsy Moth and Asian Gypsy Moth has detected an occasional specimen (only the N. American variety) since monitoring trapping coordinated with APHIS Plant Protection and Quarantine started in the mid-1980s. Regardless, Alaska's extensive marine coastline and the increase in both recreational and commercial marine transportation and foreign trade in recent years have increased the risk of potential, damaging exotic pest movement and establishment across Alaska's "borders". For example, Gypsy moth (Lymantria dispar) egg masses have been detected in the last few years on vessels arriving in Alaska from Asian ports. Given the experiences of east coast and other Pacific Northwest having to deal with expansion and unintended movement of established exotics, primarily insects, over the past decade, it will be imperative that Alaska increase its non-native pest monitoring efforts as additional pathways for pest movement are identified. Prevention of invasive plant and destructive non-native insect species introduction will also require close cooperation among many state and federal agencies, universities, municipalities, private land managers, citizen networks, and the general public to maximize the effectiveness of detection efforts. Climate change may also exacerbate the impact of invasive species in Alaska by extending non-native pests' movement into new habitats as pest host species distributions and ranges also change.

Table 5. Forest insect and disease activity mapped from the 2009 cooperative U.S. Forest Service/Alaska DOF statewide Aerial Detection Survey.

2009 forest insect and disease activity as detected during the annual Alaska aerial detection survey by land ownership[1] and agent.[2] All values are in acres.[3]

	National Forest	Native	Other Federal	State & Private	Total
Alder defoliation[4]			1,208	2,202	**3,410**
Alder mortality		207	319	791	**1,317**
Aspen Leaf Miner		67,680	106,363	136,558	**310,601**
Black-headed budworm	535			593	**1,128**
Cedar decline faders	15,626	174	12	485	**16,297**
Cottonwood defoliation[4]	325	2,758	5,730	2,338	**11,152**
Flooding/high-water damage	106	138	802	301	**1,346**
Hemlock sawfly	2,539	35		981	**3,555**
IPS and SPB[5]		4,407	739	1,451	**6,596**
Ips engraver beetle		9,226	18,865	3,581	**31,673**
Landslide/Avalanche	426			20	**447**
Porcupine damage	792	14		146	**952**
Spear-marked black moth		13,913	251	146	**14,310**
Spruce beetle	210	28,502	45,855	26,075	**100,642**
Spruce/Larch budmoth	694		20	12,485	**13,199**
unknown hemlock mortality	1,916			220	**2,136**
Willow defoliation[6]		54,142	66,777		**120,920**

1 Ownership derived from 2008 version of Land Status GIS coverage, State of Alaska, DNR/Land records Information Section. State & private lands include: state patented, tentatively approved, or other state acquired lands, and of patented disposed federal lands, municipal, or other private parcels.

2 Acre values are only relative to survey transects and do not represent the total possible area affected. Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) which are not detectable in aerial surveys. Damage acres from animals and abiotic agents are also not shown in this table.

3 Aerial forest damage survey is not 100% of all forested land in Alaska. Acreage represents only areas flown during July 2009 (approx. 25%-30% of the total forested area of Alaska).

4 Significant contributors include leaf miners and leaf rollers for the respective host. Drought stress also directly caused reduced foliation or premature foliage loss.

5 These acreage values are the cumulative effect of IPS engraver beetle (*Ips perturbatus*) and spruce beetle (*Dendroctonus rufipennis*) working in tandem on the same stands of trees.

6 Acres recorded for willow defoliation are primarily from leaf miners. The affected acreage is much more extensive then can be mapped.

Early detection and rapid response monitoring for injurious bark beetles and wood boring insects

Non-native bark and ambrosia beetles, forest defoliators, and tree-killing wood borers are the most serious threat to our nation's urban and rural forests. Case histories of exotic insects already established in North America (e.g. Asian long-horned beetle, emerald ash borer, and Sirex wood wasp) have demonstrated the importance of earlier detections of non-native species. The most effective and lowest cost defense against exotic species introductions is to have an effective monitoring system designed to detect introductions early and allow for rapid response actions.

The Early Detection and Rapid Response (EDRR) Pilot Project was started by the U.S. Forest Service, Forest Health Protection in 2001. In 2007 this project began national implementation. EDRR monitoring trapping has been supported in about 17 states each year. From 2007 through 2009, most of the 50 states have participated in the EDRR project (Rabaglia et al. 2008). Since 2002, non-native scolytids have not been identified near ports in the key population centers of Alaska. The state initiated efforts with U.S. Forest Service Forest Health Protection in 2009 to expand EDRR monitoring off the road network and major port areas to better manage the risk of any unintended exotic beetle species introductions (Figure 27).

The recent introduction of the amber-marked birch leaf miner into communities of South-central Alaska with road access has highlighted the increasing risk to Alaskan forests. While most forest defoliators, such as the birch leaf miner, are not directly responsible for tree mortality, the less obvious effects such as the accumulation of chemicals in the environment from indiscriminate and inappropriate use of pesticides against noxious non-native pests can be just as serious to urban forest ecosystems as the more obvious and direct ecosystem effects from the tree-killing invaders.

Threats from invasive plants

Presently the State of Alaska has growing numbers of invasive plants, but has fewer invasive plant-related natural resource declines compared to other parts of North America. However, studies have shown that Alaska is not immune to invasions and resulting resource losses, rather Alaska is lagging behind the rest of North America in the frequency of introductions (Carlson and Shephard

Figure 27. Funnel trap with ultra-high release "sponge" lure devices.

2007). Climate change models produced by partners have shown that several invasive plants both present in and not yet introduced to Alaska will expand to suitable habitats in northern areas of Alaska (Bella 2009). Alaska has a unique opportunity to take advantage of lagging introductions, to prevent new infestations and manage the ones that are currently present in the state.

Invasive plants can affect natural resources in forested areas by direct competition with trees and understory vegetation. Some plants such as reed canarygrass (Phalaris arundinacea) crowd out seedling trees and understory vegetation, potentially affecting forest regeneration. Plants such as cheat grass (Bromus tectorum), which has a limited distribution in Alaska, are known to increase fire frequency causing an ecosystem shift that favors grasses over trees. Invasive plants that have climbing growth habits such as bird vetch (Vicia cracca) and English ivy (Hedera helix), both of which occur in Alaska, have potential to smother seedlings and understory vegetation. English ivy is considered a nuisance to mature trees in the Pacific Northwest where it smothers mature conifers. Invasive trees such as Russian olive (Eleagnus angustifolia) and European bird cherry (Prunus padus) can directly compete with more desirable forest trees and understory vegetation. Invasive plants that infest forested areas have shown the ability to significantly impact forest structure and function to the detriment of natural resources humans depend upon.

Table 6. Affected forest damage for each forest plant host group and damage agent mapped during the 2009 Alaska statewide Aerial Detection Survey.

Comparative area of forest insect and disease activity as determined from the Alaska statewide aerial detection survey (in thousands of acres) for each host group and damage type over the six years prior to 2009; and a 10-year (2000-2009) cumulative sum.

Host Group / Damage Type[1]	2003	2004	2005	2006	2007	2008	2009	Ten Year Cumulative[2]
Alder Defoliation	2.8	10.5	17.3	10.6	10.0	0.7	3.4	61.0
Aspen Defoliation	351.4	591.5	678.9	509.5	796.0	219.7	310.8	3,097.3
Birch Defoliation	217.5	163.9	47.5	13.2	1.5	0.1	14.3	463.8
Cottonwood Defoliation	13.1	16.7	8	24.6	11.5	13.2	11.2	121.5
Hemlock Defoliation	0.2	0.5	0.2	0	0.1	0.1	3.6	12.0
Hemlock Mortality	0	0	0.1	0	0.0	2.0	2.1	4.5
Larch Defoliation	0.6	14.2	16.8	2.7	0.1	0.2	0.1	117.2
Larch Mortality	22.5	11.8	0	0	0.0	0.2	0.1	39.5
Spruce Defoliation	61.5	93.4	31.9	68.1	41.9	6.9	0.8	429.7
Spruce Mortality	92.8	145.2	93.8	130.6	183.9	129.1	138.9	1,006.4
Spruce/Hemlock Defoliation	15.1	1.5	1.4	1.5	10.3	2.8	1.1	82.2
Spruce/Larch Defoliation	0.3	0	0.3	2.8	0.0	0.0	13.2	16.6
Sub Alpine Fir Mortality	0	0.2	0.8	0.5	0.1	0.0	0.0	1.7
Willow Defoliation	83.9	111.2	44.5	50.7	92.7	76.8	139.7	608.6
Total damage acres - thousands	**861.7**	**1,160.5**	**941.5**	**814.8**	**1148.1**	**451.8**	**639.3**	**6,062.0**
Total acres surveyed	25,588	36,343	39,206	32,991	38,365	36,402	33,571	
Percent of acres surveyed showing damage	**3.4**	**3.2**	**2.4**	**2.5**	**3.0**	**1.2**	**1.9**	

1 Summaries identify damage, mostly from insect agents. Foliar disease agents contribute to the spruce defoliation and hemlock mortality totals. Damage agents such as fire, wind, flooding, slides and animal damage are not included.

2 The same stand can sustain active infestation for several years. The cumulative total is a union of all areas from 2000 through 2009 and does not double-count acres.

Several invasive plants that have a long history of introduction to Alaska are showing their potential to affect forest related resources and key ecosystems. Narrowleaf hawksbeard (Crepis tectorum) and white sweetclover (Melilotus officinalis formerly M. alba), were discovered spreading to forested landscapes after fires had spread through the area (Cortes-Burns et al. 2008, Villano 2008). White sweetclover is presently spreading from roadside river crossings to glacially fed streams where it is impacting recruitment of species important to wildlife, such as willows, in early successional flood plain habitats (Spellman 2008). Reed canarygrass, a notorious ecosystem changer capable of preventing establishment of woody vegetation and hindering restoration activities has a long history of introductions in Alaska. During stream surveys, Reed canarygrass infestations were discovered in several salmon bearing streams on the Kenai Peninsula, where it has potential to impact salmon habitat (Figure 28). Invasive woody plants are on the rise in Alaska, including European bird cherry, which is found throughout urban forests and riparian areas in the Anchorage Bowl and in

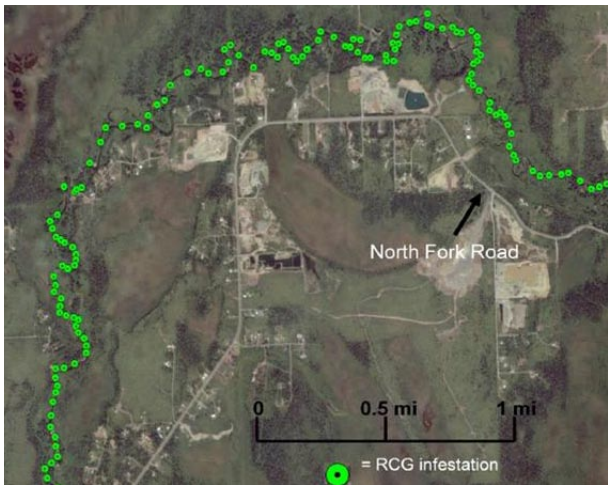


Figure 28. Reed canarygrass (Phalaris arundinacea) infestations on the North Fork of the Anchor River a salmon bearing stream located on the Kenai Peninsula, Alaska. Reed canarygrass is an invader that has proven problematic to land managers involved in habitat management and restoration, primarily for salmon. Map Courtesy of Spellman, 2009.

Table 7. A subset of plants that are known in Alaska to invade natural areas, and a subset of invasive plants that are present in Alaska, but are confined to the human footprint. *Ranks are for relative invasiveness from 0-100 where 100 is most invasive. Ranks come from system developed for invasive plants in Alaska (Carlson et al. 2008).

Invading natural area	Rank*	Confined to human footprint	Rank*
Reed canarygrass, Phalaris arundinacea	83	Spotted knapweed, Centaurea stoebe	86
Narrow leaved hawkweed, Hieracium umbellatum	54	Japanese knotweed, Polygonum cuspidatum	87
Orange hawkweed, Hieracium aurantiacum	79	Garlic mustard, Alliaria petiolata	70
White sweetclover, Melilotus officinalis (formerly alba)	81	Yellow toadflax, Linaria vulgaris	61
European bird cherry, Prunus padus	74	Scotchbroom, Cytisus scoparius	69
Bird vetch, Vicia cracca	73	Himalayan blackberry, Rubus amerianus	77
Purple loosestrife, Lythrum salicaria	83	Canada thistle, Cirsium arvense	76
Narrowleaf hawksbeard, Crepis tectorum	54	Perrenial sowthistle, Sonchus arvense	72

Fairbanks. Numerous other highly invasive plants are present in Alaska, however, are predominately infesting roadsides urban areas and other places within the human footprint (Table 7).

Analysis of spreading invasive plants in Alaska leads to identification of urban areas, roadsides, and recent burns as key areas to prevent impacts from invasive plants to forested areas and key ecosystems. Urban areas such as Anchorage, Fairbanks, the Matanuska-Susitna Valley, Juneau, and Ketchikan are hot spots for introductions. These areas host some of the largest densities and diversity of invasive plants in Alaska. Some of these urban hot spots host invasive plants such as garlic mustard (Alliaria petiolata),

Scotchbroom (Cytisus scoparious), and spotted knapweed (Centaurea stoebe) that are new invaders to the state with great potential to affect forest resources. These urban areas with large infestations of Japanese knotweed (Polygonum cuspidatum), European bird cherry and Siberian pea shrub (Caragana arborescens) demonstrate the potential for these plants to spread to natural areas. Rapidly expanding urban areas provide the increased propagule pressure necessary to accelerate the spread of invasive plants to natural areas and along roadsides to rural areas of Alaska.

Roadsides represent key corridors of invasive plant movement that are continuously disturbed through construction and maintenance activities. Inventory results for invasive plants in Alaska depict the use of roads as corridors for invasive plant movement (Figure 29). Further, the evidence from numerous studies and surveys indicates that forested areas are threatened by invasive plants spreading from roadsides to natural areas (Villano 2008, Cortes-Burns 2008, Spellman 2008). Implementing invasive plant control and best management practices to prevent introduction and spread of invasive plants during roadside maintenance, construction, and plant management activities are considered high priority activities to reduce threats to forest health from invasive plants. Roads are areas that cross streams, wetlands and other water bodies are of particular concern.

Areas of high susceptibility to forest fires present another priority for invasive plant management. The source of invasive plants that will spread to recently burned areas is primarily from roadside infestations (Villano 2008, Cortes-Burns 2008). Preventing impacts from invasive plants to burned areas involves ensuring that roadside infestations of species capable of long distance dispersal via wind or other vectors are managed. Narrowleaf hawksbeard has proven its ability to move from roadsides into burned areas (Villano 2008). Of possibly more concern are highly invasive species with similar methods of dispersal that are increasing in numbers along roadsides (e.g. orange hawkweed, Hieracium aurantiacum, perennial sowthistle, Sonchus arvensis, and Canada thistle, Cirsium arvense).

Management plans for invasive plants are being developed at both the statewide and local levels. The Division of Agriculture is nearing completion of Alaska's first invasive plant management plan which will identify priorities for prevention, management, research, education and early detection and rapid response activities. At the local level, strategic management plans are being developed by Cooperative Weed Management Areas (CWMA). Some CWMA groups, such as the Kenai Peninsula CWMA have already developed their management plans and are in the process of implementing them (http://www.homerswcd.org/invasives/FINCWMAStrategy120107.pdf). Other CWMA groups located in Juneau, Anchorage, and Kodiak Island are presently working to create management plans. The University of Alaska Fairbanks and the Municipality of Anchorage are developing their own long-term invasive plant management plans. Working with established management plans and continuing to support the establishment of new management plans will increase partnering and enhance efforts to manage infestations in priority areas.

Continuing efforts to engage the public and connect them to the forests that surround them is a key priority to invasive plant prevention and management. As noted earlier, urban areas are hot spots for invasive plants in the state, a status that in part is due to increased purposeful and accidental introductions from private landowners. Ongoing deliberate introductions of invasive plants may include species such as Japanese knotweed and European bird cherry. Accidental introductions most often include species such as Canada thistle, and perennial sowthistle that may contaminate potting soils, ornamental plants, or imported hay and straw. Educating the public about the connection between their managed landscape and forested landscapes is a priority that helps the public make the connection between their actions and consequences to natural areas. This knowledge allows us to educate the public about ways to avoid accidental introductions and alternatives to ornamentals that are purposely introduced. Engaging the

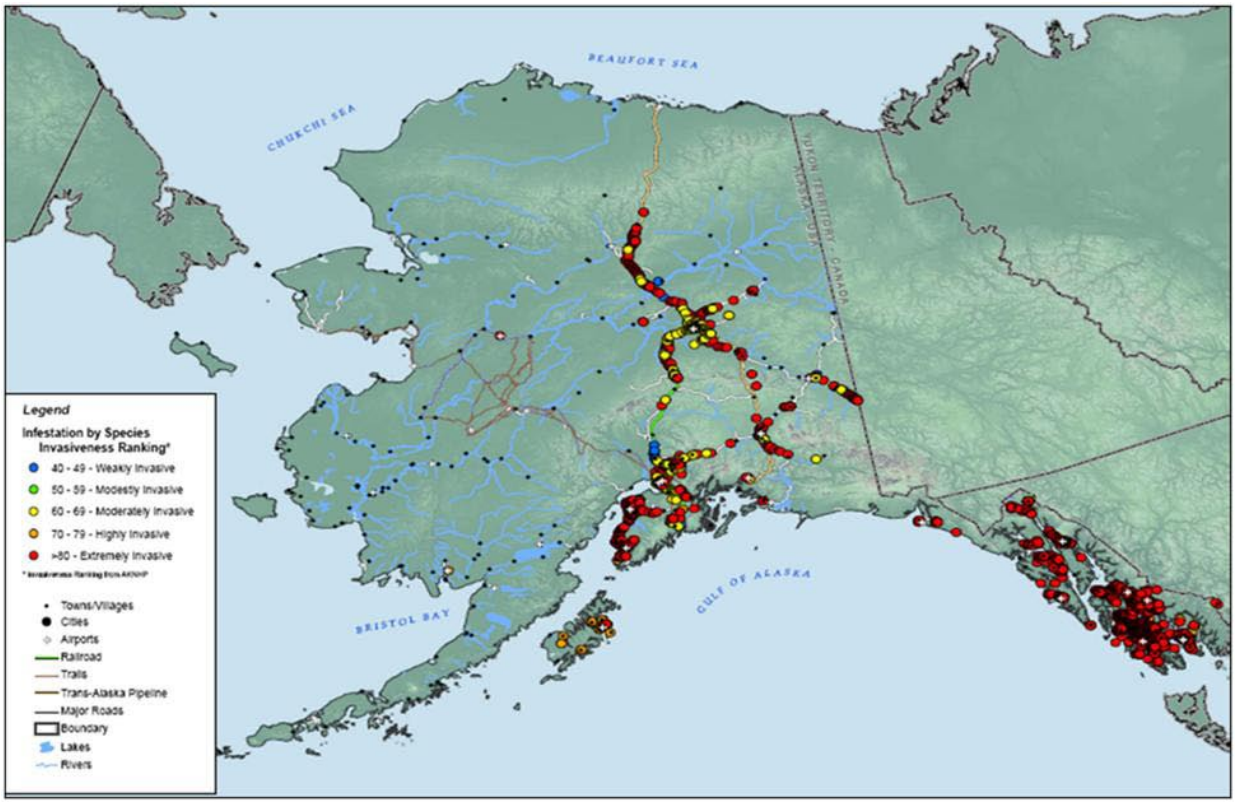


Figure 29. Invasive plant infestations recorded in Alaska, as of 2008, prioritized by a ranking system developed for invasive plants in Alaska (Carlson 2008). Notice the clear example of infestations following roads throughout Alaska. Map courtesy of Bella 2009.

public is an ongoing priority to help prevent the accidental and deliberate introductions of invasive plants.

Ongoing invasive plant management projects are primarily undertaken by Division of Forestry partners including the Division of Agriculture and the Soil and Water Conservation Districts (SWCD), federal agencies and other conservation groups. SWCDs in Alaska led in the formation of CWMA groups throughout the state. Consequently SWCDs are the primary local coordinating bodies and typically implement education and control work in the areas they work. The Division of Agriculture has several active projects it is working on in relation to invasive plants including: Spotted knapweed, Centaurea stoebe, eradication; Canada thistle management in Anchorage; working with horticulture businesses in Alaska to prevent introductions and foster cooperation; inventory of gravel pits for invasive plants. As the invasive plant management programs of the Division of Agriculture and SWCDs grow, priorities for forest health protection in Alaska will be addressed.

Urban and Community Forests

Community forests are the trees and other vegetation in a village, town, or city. They include trees along streets and streams, in parks and cemeteries, on school grounds, and around homes and businesses - anywhere trees grow in and around a community of any size.

Conditions

Alaska is home to 686,000 people and more than 60 percent live in towns with populations above 5,000. More than half of the population lives in the Municipality of Anchorage or the Matanuska-Susitna Borough. Trees in communities require extra care to be healthy, beautiful, and safe but they reward this effort by providing many economic, environmental, and social benefits to residents and visitors.

A healthy community forest doesn't happen by chance; it is the result of planning, management, and community investment. The planning begins with the collection of data on the condition of the forest, which is used to develop long-term management plans and annual work plans. Inventories and plans allow communities to identify and reduce threats to forest and ecosystem health. Professional management helps communities maximize

the benefits provided by trees and forests and to operate more cost effectively.

Most Alaskan cities have abundant forest resources but no, or few, professionals, and limited funds for management. There is little data available to make even basic assessments. For example, Anchorage has 10,000 acres of municipal park land, eighty percent of which is undeveloped and most of that forested; however, there is no baseline data and there are no management plans. The state is taking steps to remedy this problem. Anchorage began an inventory of its publicly managed trees in 2009 and it will continue in 2010 with an estimated 30,000 trees to be inventoried. A management plan for the street and public facility trees was completed in 2009 and the state and municipality will complete an assessment and plan for the forested areas in 2010.

The Ketchikan Gateway Borough completed an inventory in 2009 and a management plan in early 2010. Juneau and Sitka have inventories and management plans, and Homer and Wasilla will undertake inventories in May 2010. The state will continue to support these cities in implementing their plans through technical assistance, training, and small grants.

In many Alaska communities forests are comprised mostly of forest types that existed prior to community settlement. As Alaska's communities have rapidly grown in and around forests over the past 50 years, some forests have been intentionally preserved in parks and green belts, some trees have been retained on developed public and private lands, and other areas have been cleared with various levels of landscape management following development.

Many community forests in Alaska transition into the adjacent wildland forests and a clear demarcation of where the community forest ends is more defined by a political boundary than a specific forest condition or characteristic. For example, Anchorage's forests on the foothills of the Chugach Mountains, both in developed residential areas and parks transition into Chugach State Park and Far North Bicentennial Park, which is managed by BLM, each with large tracts of forest land. Far North Bicentennial Park and much of the state park are within the boundaries of the Municipality of Anchorage.

Figure 30 Anchorage is one of eight Tree Cities USA in Alaska, which means it has met four standards demonstrating a commitment to managing its public trees.

Threats

As communities grow, so too does the need to retain, maintain, and plant trees and expand community forests. However, in a state where natural resources appear limitless, citizens, elected officials, and managers often do not appreciate the services and benefits provided by community forests and the need to manage these resources. Lack of understanding of how a forest, or even a tree, functions as a natural system is a serious and under appreciated threat. This lack of recognition and attention results in inadequate funding and support for management programs, which threatens the sustainability of Alaska's community forests.

The Anchorage Urban Forestry Management Plan describes conditions, threats, and opportunities and it makes recommendations for improvements. These issues are similar to those in other Alaska communities. An action plan was developed to address the following threats to the community forest resource:

- Impact of high risk trees to public safety.
- Need for appropriate selection, planting and care for young trees.
- Need for proactive management for mature trees including a two- to five-year pruning cycle.
- Need to adopt, implement, and update five-year and 20-year community forestry management plans.
- Lack of adequate funding to support trained and

dedicated professional staff.

- Need to collaborate and inform the public on community forestry issues.
- Need to increase the support by elected officials, administrators, and citizens for implementing and maintaining comprehensive urban forest management.
- Need to adopt an effective tree ordinance that provides authority, defines responsibility, and establishes minimum standards for management and maintenance of the community forest.

Other threats to community forests are not unlike threats to Alaska's forests in general as discussed elsewhere in this statewide assessment. In communities the impacts of these threats can be more severe and immediate given the close proximity to population centers.

The insects and diseases, both introduced and endemic, addressed in the forest health section are also found in communities. Pests in community forests are as serious, and in many cases more serious, than in uninhabited areas. Death and loss of trees in developed areas causes serious safety and quality of life implications. It can be expensive to treat and remove large numbers of trees and management across the patchwork of owners and land management objectives in urban areas makes control even more challenging.

Invasive species that threaten forests throughout the state most often begin in cities as they arrive on vehicles and are imported with nursery material. Invasive species travel with people to other communities and into wildlands and areas managed for habitat, recreation, and timber products, thereby threatening their environmental and economic value.

As the climate changes, more exotic species are able to survive in Alaska and more may become invasive. The increase in imported nursery material can result in an increase in pests unless precautions are taken to avoid their introduction. As climate changes impact habitat, plants and animals may be added to the threatened and endangered species list, which will affect how we manage forests and what species we plant.

Development that fragments habitat and wildlife corridors has led to conflicts between wildlife and humans. Encounters with moose and bear, in particular, can be hazardous for humans and pets. Moose are also one of the most serious threats to trees planted within communities. Protecting newly planted trees and shrubs is labor intensive and expensive, as is replacement of those destroyed by moose. Hares and voles also present less serious threats. Communities are losing canopy cover at a time when they need to increase it for carbon sequestration and to protect air and water quality. Salmon need forest cover to provide shade and woody debris, and to prevent stream bank erosion and the silt and pollutants that stormwater carries into streams.

Figure 31 The University of Alaska Anchorage was the first Alaska university to meet the standards for the Tree Campus USA program. The campus has long been used as an outdoor classroom for activities like this tree walk and identification class led by the Alaska.

Increases in fires due to climate change, with resulting threats to life, property, natural resources, and air and water quality is most serious where people live. This is addressed in the fire section.

Trends

An assessment of the level of community forest management expertise and commitment by Alaska's communities is important to assessing the threats and supporting strategies for success. The Division of Forestry has made significant progress in developing a community forestry program that enhances community health and livability. When the Alaska Community Forestry Program was established in 1991 there were no Tree Cities or Tree Lines USA, no local community forestry programs, nonprofit tree planting groups, or urban foresters, and only one certified arborist in the state.

By 2001, there were three Tree Cities USA in Alaska, and in 2009 the number had grown to eight - Eielson Air Force Base, Fort Wainwright, Fort Richardson, and the cities of Wasilla, Sitka, Juneau, Ketchikan Gateway Borough, and Anchorage. More than 80 percent of Alaskans live in communities that have taken steps toward developing a sustainable community forestry program.

The three major electric utilities serving communities, Golden Valley Electric Association, Matanuska Electric Association, and Chugach Electric Association are recognized as Tree Lines USA.

The number of arborists in Alaska certified by the International Society of Arboriculture has grown from 1 in 1991 to 35 in 2009. Six communities now have arborists, foresters, or natural resource managers employed in their community forestry programs. The Municipality of Anchorage hired the state's first urban forester in November 2008. All these steps are the direct result of technical, educational, and financial assistance provided by the state and made possible by grants from the U.S. Forest Service.

The increasing level of management by cities is a notable trend in Alaska. Characteristics of communities managing their community forests are:

- Active community tree and forest management plan developed from professionally-based resource assessments/inventories
- Employ or retain through written agreement, the services of professional forestry staff that have a degree in forestry or related field and/or ISA arborist certification
- Adopted local or statewide ordinances or policies that focus on planting, protecting, and maintaining community trees and forests;
- Local advocacy/advisory organization such as active tree board or commissions, or non-profit organizations that are formalized or chartered to advise and /or advocate for the planting, protection, and maintenance of community trees and forests.

Alaska communities at the managing level:

- Municipality of Anchorage
- Eielson Air Force Base

Figure 32 Community Forestry Program staff provide technical assistance and training to local governments, agencies, and businesses. This class on tree planting and pruning was for facility managers at the Ted Stevens International Airport.

- City & Borough of Sitka
- City of Wasilla

Communities that are in the developing phase of management have achieved at least one of the above four standards. Alaska communities at the developing level:

- Fairbanks North Star Borough
- City of Fairbanks
- City & Borough of Juneau
- Ketchikan Gateway Borough
- City of Homer

Support for community forests is essential if communities are to ensure sustainable benefits from forests and trees in communities. A trend towards increased community support for community forestry is demonstrated by the level of citizen advocacy and/or advisory groups that are active in Alaska communities. The Juneau Urban Forestry Partnership, Sitka Tree & Landscape Committee, Anchorage TREErific, and the Fairbanks Arbor Day Committee plant trees, provide information to the public, and support local government management efforts. Wasilla, Ketchikan Gateway Borough, Elmendorf and Eielson Air Force bases, and Fort Wainwright have advisory bodies that make recommendations to local government or military leaders.

On a statewide level the Alaska Community Forest Council helps determine goals and priorities of the state's community forestry program and provides expertise and

advice to the state forester and program staff. The 15 members represent the geographic and cultural diversity of the state and a broad spectrum of interests and professions.

Benefits of Community Trees and Forests

Community forests, like forests in rural settings provide a multitude of benefits and services. Because of their close proximity to population centers, community forests directly improve the quality of life for a majority of Alaskans. Among the ecosystem services community forests provide are:

- Reducing runoff, flooding, erosion, and the need for costly storm water treatment
- Helping recharge ground water and keep sediment and pollutants from streams
- Trapping and filtering dust, smoke, and other airborne pollutants
- Absorbing carbon dioxide and other greenhouse gases, storing carbon, and releasing oxygen
- Providing summer shade and protection from winter winds and blowing snow
- Blocking unsightly views and reducing noise;
- Providing windbreaks and snow fences
- Providing habitat for birds, mammals, fish, and other organisms
- Increasing property values and making towns more attractive to residents, businesses, and tourists
- Creating visual variety and seasonal changes
- Providing natural areas where people can relieve stress and improve their health by recreating, relaxing, and socializing
- Bringing the natural environment closer to where people live and work

In addition to ecosystem services, community forests are working forests in need of conservation and management to provide products in close proximity to where people live and work. These include:

- Timber for lumber, and other forest products
- Biomass for energy production – cordwood, chips, pellets, etc.
- Non-timber forest products including berries, fruit and mushrooms
- Habitat for fish and other wildlife

Wildlife

This Forest Resource Assessment cannot adequately cover Alaska's wildlife. Fortunately, the Alaska Department of Fish and Game has prepared a comprehensive wildlife conservation plan (Alaska Department of Fish and Game, 2006). The goal of the strategy is to conserve the diversity of Alaska wildfire resources, focusing on those species with the greatest conservation need. The plan notes that 53 percent of Alaska has been designated in some form of conservation unit. This high percentage is credited with helping ensure there is little need for threatened and endangered species listing in Alaska.

Figure 33 The Fairbanks Arbor Day Committee has planted hundreds of trees during the past 20 years. A typical Arbor Day sees volunteers holding celebrations and planting trees at more than a dozen locations in Fairbanks and surrounding communities.

Common themes identified in the comprehensive wildlife conservation strategy are: information gathering to improve knowledge of Alaska's wildlife and habitats; data needs including GIS capability, database systems, habitat classification; long-term monitoring such as for selected species; climate change impacts, and water quality and quantity.

Forest lands in Alaska provide significant and important habitats to important wildlife species. For species that depend on early successional vegetation types, there are opportunities for forest management practices geared towards enhancing wildlife. For example, ruffed grouse habitat improvement forests are actively managed to benefit wildlife as well as timber production.

The Alaska Division of Forestry, Ruffed Grouse Society (RGS), and Alaska Department of Fish and Game (ADF&G) started a cooperative effort aimed at improving wildlife habitat in Alaska in 1994. Since 1994, the cooperative has raised funds and completed habitat enhance-

Figure 34 The Juneau Urban Forestry Partnership supports local efforts to ensure healthy and safe public trees that improve quality of life in Juneau. Members also sponsor educational programs and tree planting events such as this one at the downtown cemetery.

ment. Project managers in the Interior have constructed 7.5 miles of forest roads for hunter access, felled 476 acres of mature aspen in 42 cutting units ranging from 6 to 20 acres, and conducted prescribed burns on 140 acres.

Moose populations can also benefit from disturbances such as fire or timber harvest that encourage early successional stages of hardwood browse species. Relatively complete over-story removal associated with timely exposure of mineral soil favors establishment of early successional hardwoods important to moose. A combination of clear cutting and soil scarification on mesic or dry sites mimics fire, windfall, and fluvial erosion, natural forces responsible for browse regeneration. (INFEST).

In coastal forests in Region I, the high density of regeneration following disturbance, including timber harvest, tends to shade out much of the understory forage preferred by Sitka black-tail deer. Pre-commercial thinning is a silvicultural treatment used in Region I to enhance growth and yield of merchantable forest products and shorten the forest management rotation length. This practice has also been found to encourage browse species in the forest understory and can result in favorable silvicultural response both in terms of timber production and wildlife habitat improvement.

Non-Timber Forest Products and Ecosystem Services

Forests provide goods and services other than timber that are important to human health and livelihood. These benefits are increasingly termed ecosystem services and include wildlife habitat and diversity, watershed services, carbon storage, cleaner air, and scenic landscapes. Since these goods and services have often been non-monetary, both public and private forest landowners may have forgone compensation for providing these public benefits. The federal 2008 Farm Bill calls these environmental services benefits and takes a first step towards facilitating landowner participation in emerging markets for ecosystem services.

Alaska public and private forest lands provide a host of ecosystem services, both near communities and population centers and in remote areas. Alaska's forests contribute to the high quality habitats that produce world renowned salmon fisheries that have significant economic, social, and ecological value. These fish support commercial, sport, personal use, and subsistence fisheries. Alaska has an estimated 71,498 miles of catalogued anadromous fish streams, 27,172 miles of which are in forestry priority landscapes. These streams support five species of pacific salmon in migration, spawning, and rearing stages of their life cycle.

In areas where active timber management occurs, the maintenance of water quality is vital to the continued health of this important fishery resource. The Alaska Forest Resources & Practices Act sets standards for timber harvesting, reforestation, and timber access on all ownerships, and is the standard for timber harvest in Alaska's coastal zone under the Alaska Coastal Zone Management Program. Regulations under the act govern road construction and maintenance, harvesting practices, and reforestation to keep water bodies clean, protect fish habitat, and ensure that forest harvesting is sustainable. The act mandates riparian buffers on public and private forest lands for water bodies supporting anadromous and high value resident fish species. The act also requires public land owners to manage forest land with consideration of important scenic areas and wildlife habitat.

In addition to timber, many non-timber products can be harvested from Alaska's forests. For many years non-timber forest products have been recognized as forest outputs. In recent years the industry has grown both

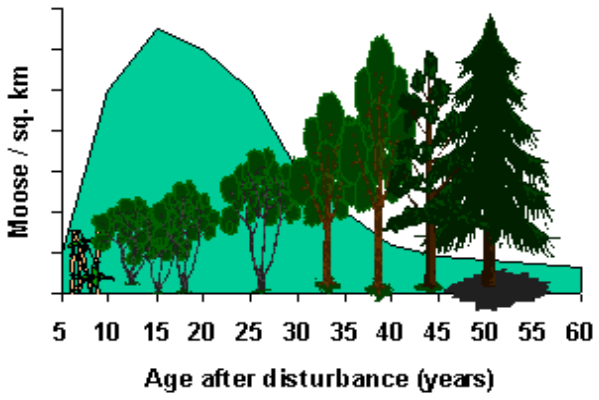


Figure 35 Relationship of moose density and successional stagea

internationally and in the United States. In Alaska these forest products include herbs, sap, mushrooms, berries, and materials for crafts and decorations. One especially delicious forest product is Alaskan birch syrup, made by boiling spring-collected sap of birch trees. To make maple syrup, the sap to syrup ratio is 40:1, but according to Alaskan syrup producers birch sap to syrup's ratio is closer to 100:1.

Bird populations and habitats are important ecological components as birds help control damaging insects and provide viewing opportunities for residents and tourists. As demand for non-timber forest products grows, Alaskans have the potential to participate in viable economic opportunities for their forested lands.

Tourism and Recreation

The Alaska Division of Parks and Outdoor Recreation provides the following summary of Alaska's affinity for outdoor recreation and the 49th state's vast opportunities. This excerpt is from the executive summary for the 2009-2014 Statewide Comprehensive Outdoor Recreation Plan:

Love of the outdoors is a major part of the fabled "Alaskan lifestyle." Alaskans participate in wildland recreation at twice the rate of the rest of the country. Wildland recreation in Alaska includes a wide spectrum of popular activities, from fishing, hunting, hiking, skiing, spelunking, bird watching, snowmobiling, ORV riding, wildlife viewing, recreational mining, to mountaineering, whitewater rafting, dog mushing, ocean kayaking, and power boating.

While most of Alaska's 322 million acres of public lands are available for recreation, about 168 million acres, or 46 percent of Alaska, is managed for wildland recreation. Sixty percent of America's national park acreage, the country's largest state park system, and the nation's two largest national forests are located in Alaska. Twenty-five Alaskan rivers and over 3,200 river miles are protected under the National Wild and Scenic River designation. Additionally, there are six legislatively designated state Recreation Rivers, encompassing 460 river miles and 260,000 upland acres. Approximately 12 percent of state land is under some form of legislative designation that protects or enhances wildland recreation. Approximately 82.4 million acres of federal land and 400,000 acres of state land are designated as wilderness. (Alaska Division of Parks and Outdoor Recreation, 2009)

Alaska's state parks offer 119 park units for use by residents and tourists alike. Park units range in size from the largest, the 1.6-million-acre Wood-Tikchik State Park, to half-acre sites of historical significance with a total of over 3.2 million acres, the largest state park system in the United States. The state parks offer a variety of recreational experiences ranging from rugged wilderness to historical sites, as well as a variety of habitat types ranging from the marine to alpine tundra, accommodating 4.4 million visits per year.

Alaska's state parks also offer a number of cabins, both remote and easily accessible, for rent by the public. Alaskan residents and tourists alike depend on Alaska's forests for a variety of exceptional recreational experiences, panoramic vistas, and the wildlife the forest habitats support.

The national forests in Alaska are a popular destination for residents and visitors. Some of the most visited sites in the state are on national forests. Recreational use on Alaska's national forests has grown 70 percent in a decade. Outstanding scenery and the undeveloped natural landscapes of Alaska are primary draws for Alaska's 1.5 million visitors.

The Alaska Region has an extensive visitor services program that serves more than 1 million visitors a year. This includes visitor centers, information centers, and interpretive programs aboard the state ferries of the Alaska Marine Highway System. These programs provide op-

portunities to interpret national forest resources to Alaska residents and visitors. The U.S. Forest Service and the State of Alaska partner on many of these programs, such as the Southeast Alaska Discovery Center in Ketchikan and the resource interpretation program offered on the state ferries of southeast and south-central Alaska.

The Tongass and Chugach national forests offer 197 remote recreation cabins available for rent by the public. Cabins are located near good fishing, hunting, and terrific scenery. Renters need to hike, fly, or boat to reach the cabins. The forests also protect heritage resources. Alaska's Native people have made their home and life among the bounty of Alaska's forests and sea. Archaeologists know of more than 3,500 historic and prehistoric sites on the Chugach and Tongass national forests. These sites bear witness to more than 10,000 years of Alaska Native and 250 years of European and American settlement. The Alaska Region has four national historic landmarks and lists 32 sites on the National Register of Historic Places.

The Bureau of Land Management (BLM) is generally responsible for the management of federal lands outside of Conservation System Units. In Alaska, BLM administers approximately 80 million surface acres of federal land. BLM's mission is to sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations. BLM's mandate is to manage for multiple use and as such, recreation and subsistence use are important components of the agency's land use planning and management strategies. Millions of acres are managed to support recreational use.

Forest resources, while not typically harvested commercially, are available for personal use and are considered an important landscape attribute. Visual resource management strategies prevent alteration of the landscape when doing so would negatively impact the users' experience. BLM maintains recreational facilities including public use cabins, hiking trails, and trailheads in areas such as the Denali Highway, White Mountains National Recreation Area, the Tangle Lakes area, and along a variety of Wild and Scenic Rivers such as the Delta and the Gulkana.

Forest Conservation

Despite the large number of parks and refuges in Alaska, some additions to publicly owned conservation units have been occurring. Federal and state partnership programs that allow easements or purchase of land include National

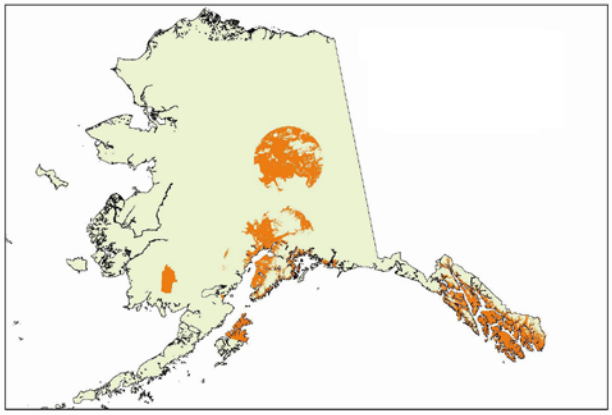


Fig. 36 Forest Legacy Area

Coastal Wetlands Grant Program, Land and Water Conservation Fund, North American Wetlands Conservation Act, and Recreational Trails Program. The Forest Legacy Program is a U.S. Forest Service Cooperative Program for protection of environmentally important forest lands threatened with conversion to non-forest use. In Alaska, the DNR-Division of Parks and Outdoor Recreation is the lead state agency for Forest Legacy.

A Forest Legacy Assessment of Need was prepared in 2002 and renewed in 2008 (Alaska Division of Parks and Outdoor Recreation. 2002). The assessment of need analyzed areas potentially benefitting from public protection and established a Forest Legacy Area. Generally, parcels submitted to Congress for acquisition are within the Forest Legacy Area. Since Forest Legacy has distinct requirements, this Forest Resource Assessment will continue the current assessment and Forest Legacy Area without modification.

Forest Issues

To assist in developing a geographic model to identify priority landscapes and the statewide strategy, stakeholders were engaged through several means. Northern Economics conducted interviews with 34 stakeholders. Issues derived from these interviews were further evaluated by Division of Forestry staff, the Alaska Board of Forestry, the Alaska Forest Stewardship Committee, the Alaska Community Forest Council, and the Natural Resources Conservation Service State Technical Committee.
Five core issues were identified as important elements to consider in modeling priority landscapes and developing a strategy that will focus the state's efforts to conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

Issue 1: Maintaining capacity to control and mitigate risks of wildfire

- Longer fire season and increased fire intensity resulting from climate change (mega fires)
- Expanding wildland urban interface and associated challenges for fire management
- Difficult fuel types resulting from spruce bark beetle epidemic

Issue 2: Maintaining and expanding sustainable output of forest products

- Declining timber supply resulting in loss of industrial capacity and infrastructure to conserve working forest in Southeast Alaska
- Barriers to effective management of second growth forest, including maintaining access roads
- Development of biomass energy facilities in Alaska
- Need for dependable and sustainable timber supply to industry
- Lack of Infrastructure, which constrains opportunities for public benefits
- High costs of production and barriers to market entry

Issue 3: Mitigating threats to forest health

- Providing effective early detection and response to invasive forest pests
- Mitigating impacts of damaging pest species, (insects, pathogens, and plants)
- Adapting management to changing climate with uncertain and varying scenarios

Issue 4: Maintaining and enhancing community benefits from forests

- Land transfers, forest conversion and demographic changes
- Increasing demands for fire wood for home heating
- Need for management that maximizes services provided by community forests

Issue 5: Maintaining and expanding output of ecosystem services

- Maintain best management practices on all ownerships through administration of the Forest Resources and Practices Act.
- Logistical and financial barriers to cost effective habitat management for community and personal uses.
- Maintaining recreation, tourism, fish and wildlife, agriculture, water quality, and development concurrently with forest management

Issue 6: Non spatial cross cutting issues
In the process of developing the core issues and themes, several issues and needed strategies reoccurred regardless of the particular issue or geographic area involved. These cut across issues and programs, and have been categorized as "cross cutting issues". These non-spatial elements, common across a broad range of issues and programs, are listed below and will provide a common frame of reference in developing strategies for the five core issues.

- Maintaining and increasing public support of forest management (social license)
- Need for better data and information
  > Greater coverage of high resolution imagery
  > Improved forest inventory
  > Software based science and technical bibliography
  > Problem analyses to identify research and training needs
  > Gaps in known sites database to manage fire suppression priorities
- Maintaining state, federal, and private management capacity for fire and resource management
  > Employee retention and recruitment
  > Increases in contractual costs
  > Uncertain future state and federal funding
  > Increasing demand for fire personnel with Incident Command System training for non wildfire response
  > Lack of land management plans for some large

landowners including rural village corporations and local governments

- Unique geographical, social and political challenges in Alaska
  - > Delivery of training, education and assistance in Alaska due to distance between communities and access to rural areas
  - > Building adequate fire suppression capacity in rural Alaska
  - > Delivering technical assistance in Alaska often requires expensive travel across vast distances.
  - > Maintaining current inventory of forest conditions and pests across vast and dynamic landscapes
  - > Access, transportation, and infrastructure limitations that impact every program

Table 8 GIS layer summary
Data was obtained or derived from several sources and combined in additive method.

Core Issue	# of Layers	Priority Landscape
Maintaining capacity to control and mitigate risks of wildfire	2	96.3 million acres
Maintaining and expanding sustainable output of forest products	6	21.4 million acres
Mitigating threats to forest health	3	17.5 milliion acres
Maintaining and enhancing community benefits from forests	3	2.4 million
Maintaining and expanding output of ecosystem services	1	27.1 thousand miles
All issues priority landscape		112.1 million acres

GIS Modeling and Priority Landscapes

In response to the stakeholder involvement described above, 79 geospatial data sets were collected that represent the issues identified. Priority landscapes represent those forest lands in Alaska where the best opportunities exist to meet the conservation, protection, and enhancement objectives. After evaluating the issues and themes, these priority landscapes were identified from a combination of data layers representing four key issues: fire, forest health, sustainable forest products, and community forests.

GIS data layers used to determine priority landscapes are as follows:

- the level of fire protection required
- proximity to communities
- opportunities for forest management including developing markets for wood energy in rural communities
- threats to urban expansion and loss of forest cover

This GIS modeling produced priority landscapes for Alaska that represent approximately 30 percent of the state's land area.

Maintaining and enhancing the host of ecosystem services that are provided by Alaska's forests including water and air quality, fish and wildlife habitat, and wild land recreation was identified as an important issue. This issue was not used in developing the priority landscape, as ecosystem services by their nature occur across broad managed and unmanaged landscapes in Alaska. As a proxy to represent this issue, 27,172 miles of the 71,498 miles of documented and catalogued anadromous fish streams in Alaska's forests fall within the identified priority landscape.

The complete list of GIS layers is available at Division of Forestry, but is summarized in Table 8.

GIS Layer One: Maintaining capacity to control and mitigate risks of wildfire.

- The Alaska Fire Management Plan protection levels obtained from BLM Alaska Fire Service. GIS polygons include protection levels critical, full, and modified
- Community Wildfire Protection Plans obtained from Division of Forestry GIS staff. GIS polygon shown is 2-mile radius of community centers, however protection levels polygon includes all communities with

wildfire protection plans except the community of Seldovia.

GIS Layer Two: Maintaining and expanding sustainable output of forest products.

- Division of Forestry's past harvest and planned harvest received from the division's area and regional GIS staff. This includes general state lands with forestry use classification.
- Haines and Tanana Valley State Forest boundaries received from area and regional GIS staff.
- U.S. Forest Service projected management actions received from Tongass and Chugach National Forests.
- Alaska Native Corporations' past harvest and planned harvest received from corporation staff.
- Other forest harvesting including that by boroughs, individual private landowners, and the University of Alaska.
- Community wood energy zones around communities listed in the Alaska Energy Plan for communities with wood energy potential. For communities along a river, GIS polygons extend 30 miles up and 30 miles down river from community center and two miles inland from river. For coastal communities, GIS polygon extends for 2-mile radius around community, excluding marine zone.

GIS Layer Three: Mitigating threats to forest health.

- Cumulative forest damage mapped from aerial detection surveys from 1980 to 2009.
- Invasive beetle introduction risk GIS data received from U.S. Forest Service, Forest Health Technology Enterprise Team of Fort Collins, CO. Potential entry points are included such as ports at Barrow and Kotzebue.
- The Alaska Forest Health Risk Map was received from the Forest Health Technology Enterprise Team assisted by data supplied from Division of Forestry and Forest Service Region 10 Forest health Protection.

GIS Layer Four: Maintaining and enhancing community benefits from forests.

- Southeast Alaska communities with current or developing management plans (Juneau, Ketchikan, Sitka) with GIS polygon extending 1-mile from all public roads.
- Major cities of Anchorage and Fairbanks with GIS polygon extending two miles from all public roads.
- All other communities within 10 miles of forest cover with GIS polygon extending for 1-mile radius of community center.

GIS Layer Five: Maintaining and expanding output of ecosystem services.

- Catalogued anadromous streams for 2009 obtained from Alaska Department of Fish and Game.

The priority landscape is developed based on on forest resource issues and is irrespective of ownership. Consequently, the priority landscape is cross-boundary. Over 58% of the priority landscape is Alaska Native and State ownership (Table 9).

Table 9. Land ownership in priority landscape.

	All Issues	Wildfire	Forest Products	Forest Health	Community Forests
Ownership	Million of Acres				
ANCSA Native Corporation	30.7	29.4	7.2	3.7	0.2
Bureau of Land Management	19.5	18.2	1.6	1.9	0.0
Department of Defense	0.7	0.4	0.0	0.4	0.2
National Park Service	4.9	4.0	0.5	0.8	0.0
Non ANCSA Private & Local Government	5.8	5.2	1.5	2.1	1.1
State of Alaska	26.0	23.0	5.8	4.3	0.8
U.S. Fish & Wildlife Service	19.6	16.7	2.7	2.7	0.0
U.S. Forest Service	4.9	1.5	2.2	1.5	0.1
Totals	112.1	96.3	21.4	17.5	2.4

Conclusion

Alaska's forest resources, ecosystems, and issues are vast, complex, and changing. A Statewide Forest Resource Assessment is inevitably incomplete and needs regular updating. Nonetheless, for this current assessment, six key issues were identified by stakeholders and five were depicted geospatially. A priority landscape was developed by overlaying geospatial layers, mostly in an additive manner. To comply with federal expectations, the priority landscape represents no more 30 percent of the state. This should not be interpreted that the remaining 70 percent is unimportant. Rather, the priority landscape is where limited federal forestry assistance will be focused in the upcoming five years. This Statewide Forest Resource Assessment and resulting priority landscape is intended to comply with requirements of the 2008 Farm Bill.

List of Tables

List of Figures

Appendix A ~ GIS Maps

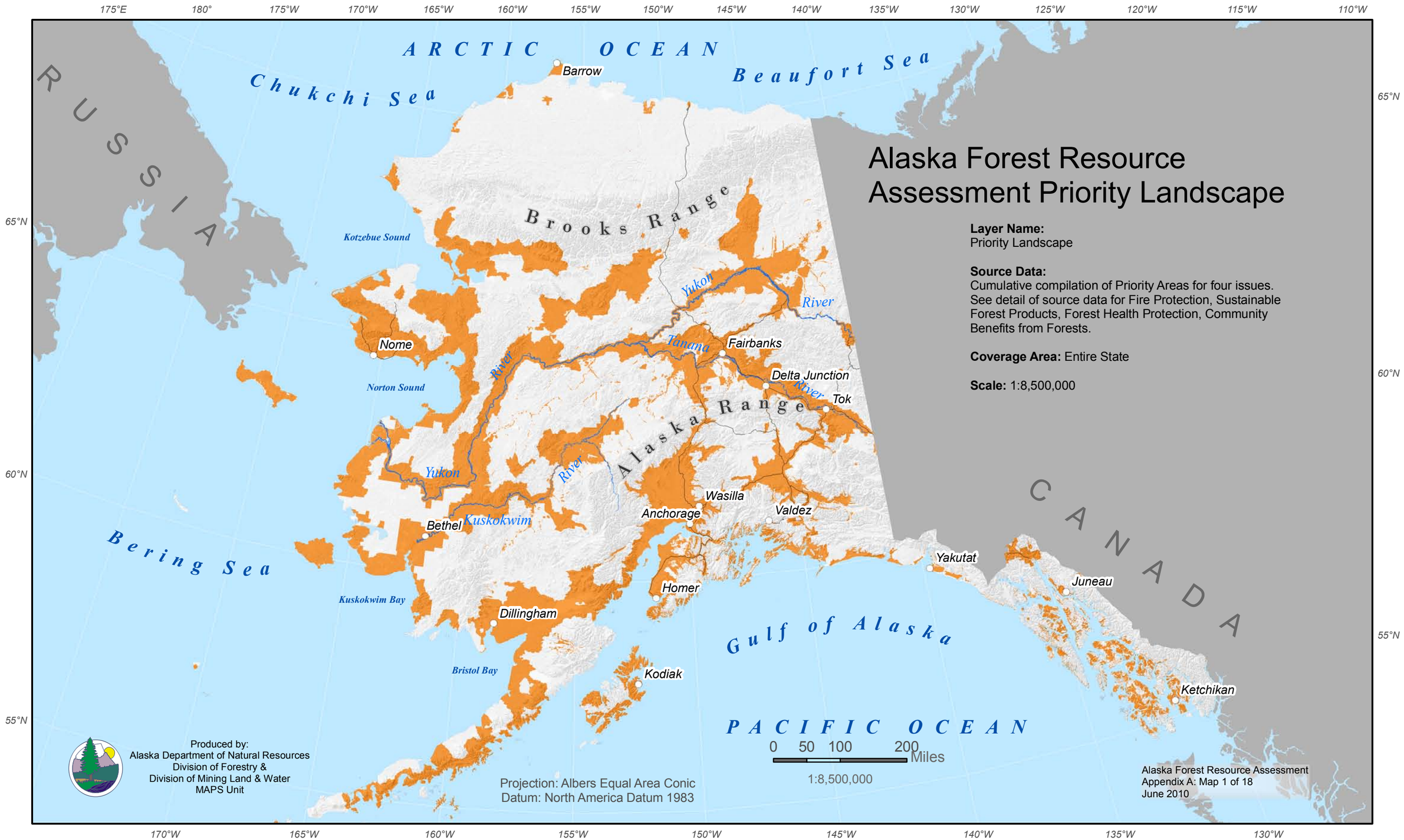
Alaska Forest Resource Assessment Priority Landscape

Layer Name:
Priority Landscape

Source Data:
Cumulative compilation of Priority Areas for four issues. See detail of source data for Fire Protection, Sustainable Forest Products, Forest Health Protection, Community Benefits from Forests.

Coverage Area: Entire State

Scale: 1:8,500,000



Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

Alaska Forest Resource Assessment
Appendix A: Map 1 of 18
June 2010

Issue One
Fire Protection

Layer Name:
Cumulative Priority Areas
Fire Protection Critical
Fire Protection Full
Fire Protection Modified

Source Data:
Alaska Fire Service, Alaska Interagency Wildland Fire Management Plan.

Coverage Area: Entire State

Scale: 1:8,500,000

Legend
- Fire Protection Priority Area
- Cumulative Priority Landscape

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 2 of 18
June 2010

ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
RUSSIA
CANADA
Bering Sea
Gulf of Alaska
PACIFIC OCEAN
Brooks Range
Alaska Range
Barrow
Kotzebue Sound
Nome
Norton Sound
Yukon River
Tanana River
Fairbanks
Delta Junction
Tok
Wasilla
Anchorage
Valdez
Bethel
Kuskokwim River
Kuskokwim Bay
Dillingham
Bristol Bay
Homer
Kodiak
Yakutat
Juneau
Ketchikan

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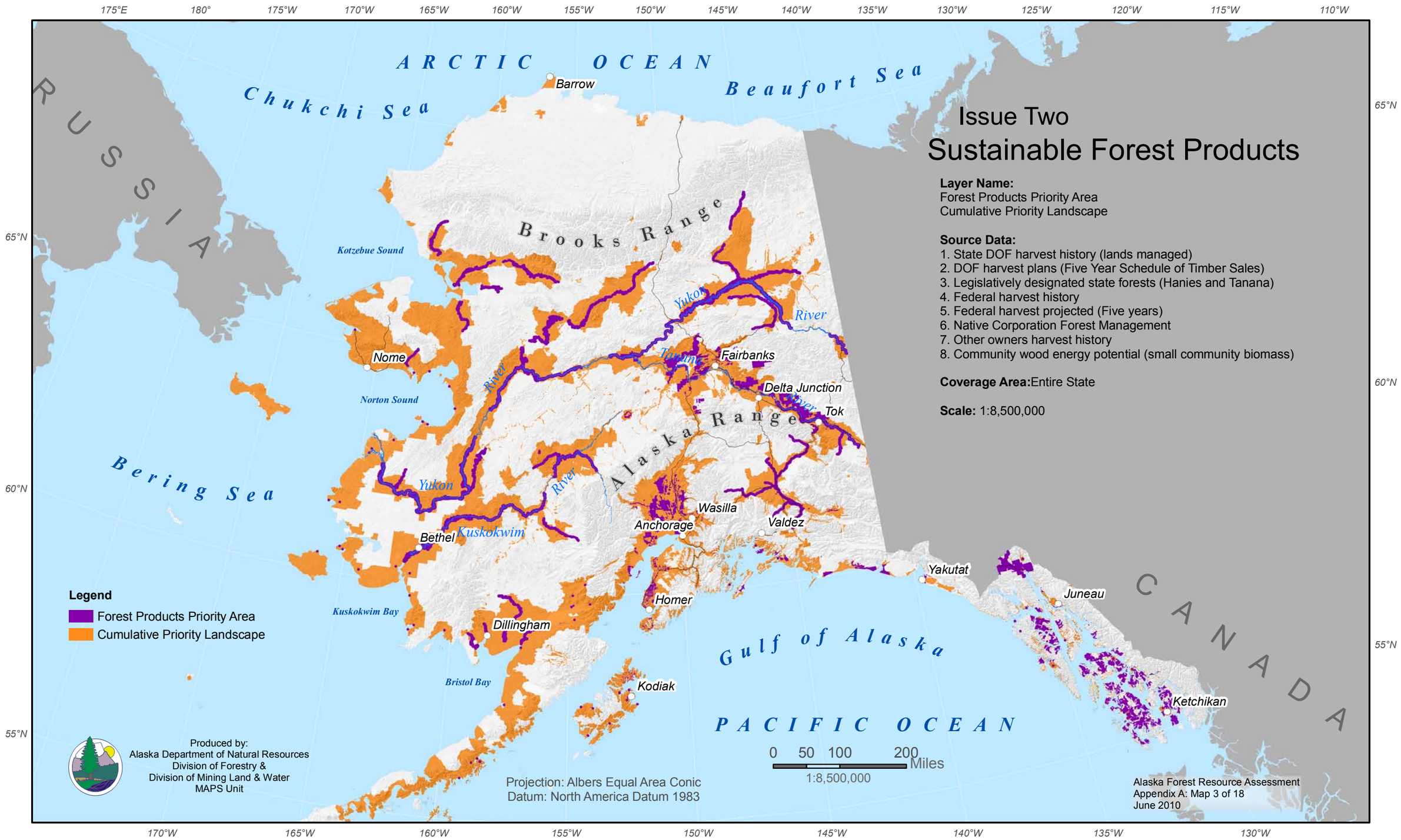
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Valdez
Bethel
Kuskokwim River
Yakutat
Juneau
Homer
Kuskokwim Bay
Dillingham
Gulf of Alaska
Bristol Bay
Kodiak
Ketchikan
PACIFIC OCEAN
Legend
Forest Products Priority Area
Cumulative Priority Landscape
0 50 100 200 Miles
1:8,500,000
Projection: Albers Equal Area Conic
Datum: North America Datum 1983
Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit
Issue Two
Sustainable Forest Products
Layer Name:
Forest Products Priority Area
Cumulative Priority Landscape
Source Data:
1. State DOF harvest history (lands managed)
2. DOF harvest plans (Five Year Schedule of Timber Sales)
3. Legislatively designated state forests (Hanies and Tanana)
4. Federal harvest history
5. Federal harvest projected (Five years)
6. Native Corporation Forest Management
7. Other owners harvest history
8. Community wood energy potential (small community biomass)
Coverage Area:Entire State
Scale: 1:8,500,000
Alaska Forest Resource Assessment
Appendix A: Map 3 of 18
June 2010

Issue Three
Forest Health Protection

Layer Name:
Forest Health Proctection Priority Area
Cumulative Priority Landscape

Source Data:
1.1980-2009 Cooperative Aerial Detection Survey (USFS and AKDOF) forest pest activity mapping of Alaska's forests.
2.USFS Forest Health Monitoring Program, National Insect and Disease Forest Health Risk Map (NIDRM) for Alaska-2006 update; NDIRM 2012 in progress (forest at risk to economic pests 15 year projection).
3.USFS, FHM/Forest Health Technology Enterprise Team, Non-native Invasive Bark Beetle (Ips typographus) Introduction Potential (based on hierarchical prioritization and modeling of specific risk factors-2007 dataset).

Coverage Area: Entire State

Scale: 1:8,500,000

ARCTIC OCEAN
Chukchi Sea
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Barrow
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Juneau
Ketchikan
Gulf of Alaska
PACIFIC OCEAN

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Legend
- Forest Health Proctection Priority Area
- Cumulative Priority Landscape

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MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

Alaska Forest Resource Assessment
Appendix A: Map 4 of 18
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Issue Four
Community Benefits from Forests

Layer Name:
Community Benefits Priority Area
Cumulative Priority Landscape

Source Data:
1. Southeast Alaska communities with current or developing management plans (Juneau, Ketchikan, Sitka) with GIS polygon extending 1-mile from all public roads.
2. Major cities of Anchorage and Fairbanks with GIS polygon extending two miles from all public roads.
3. All other communities within 10 miles of forest cover with GIS polygon extending for 1-mile radius of community center.

Coverage Area: Entire State

Scale: 1:8,500,000

Legend
- Community Benefits Priority Area
- Cumulative Priority Landscape

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

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Alaska Forest Resource Assessment
Appendix A: Map 5 of 18
June 2010

Issue Five
Ecosystem Services

Layer Name:
Alaska National Landcover
Anadromous fish streams
Cumulative Priority Landscape

Source Data:
Anadromous Streams data is derived from Alaska Dept of Fish and Game's GIS shapefiles for the "Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes"and the "Atlas to the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes".

Alaska National Landcover is a Landsat-derived, 30 meter spatial resolution digital land cover map that describes the land cover using consistent land cover classes.

Coverage Area: Statewide

Scale: 1:8,500,000

Legend
- Cumulative Priority Landscape
- Open Water
- Glacier
- Developed
- Non-Forest/Non-Wetland
- Deciduous Forest
- Coniferous Forest
- Mixed Forest
- Shrub
- Wetlands/Herbaceous
- Anadromous streams

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

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1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 6 of 18
June 2010

Land Management

Layer Name:
General Land Status Statewide Land Ownership
Cumulative Priority Landscape

Source Data:
Bureau of Land Management (BLM) and
the State of Alaska Department of
Natural Resources (ADNR).

This coverage uses data extracted
from BLM's records, stored in Alaska
Land Information System (ALIS) and
ADNR's land records stored in the
Land Administration System (LAS).

Coverage Area: Entire State

Scale: 1:8,500,000

Supplemental Datasets:
Parcel Data (Municipality of Anchorage
Kenai Peninsula Borough, Mat-su Borough, Fairbanks Borough)
Conveyance

Legend

Cumulative Priority Landscape

General Land Status

- U.S. Forest Service
- National Park Service
- U.S. Fish & Wildlife Service
- Department of Defense
- State of Alaska
- Bureau of Land Management
- ANCSA Native Corporation (Private)
- Non ANCSA Private & Local Government

ARCTIC OCEAN
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RUSSIA
CANADA
Bering Sea
PACIFIC OCEAN
Gulf of Alaska
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MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

Alaska Forest Resource Assessment
Appendix A: Map 7 of 18
June 2010

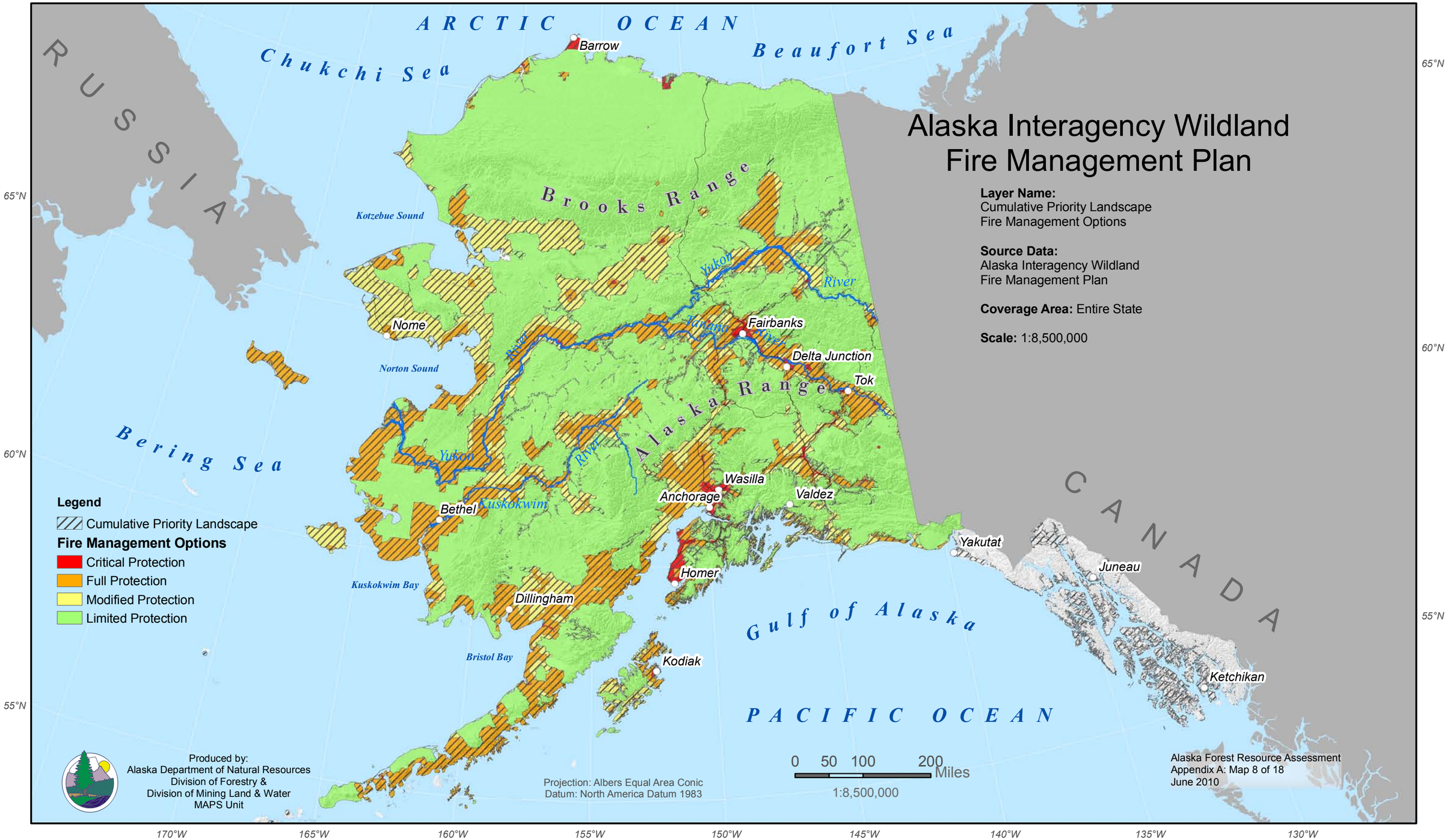
Alaska Interagency Wildland Fire Management Plan

Layer Name:
Cumulative Priority Landscape
Fire Management Options

Source Data:
Alaska Interagency Wildland
Fire Management Plan

Coverage Area: Entire State

Scale: 1:8,500,000



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Division of Mining Land & Water
MAPS Unit

Alaska Forest Resource Assessment
Appendix A: Map 8 of 18
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Fire History

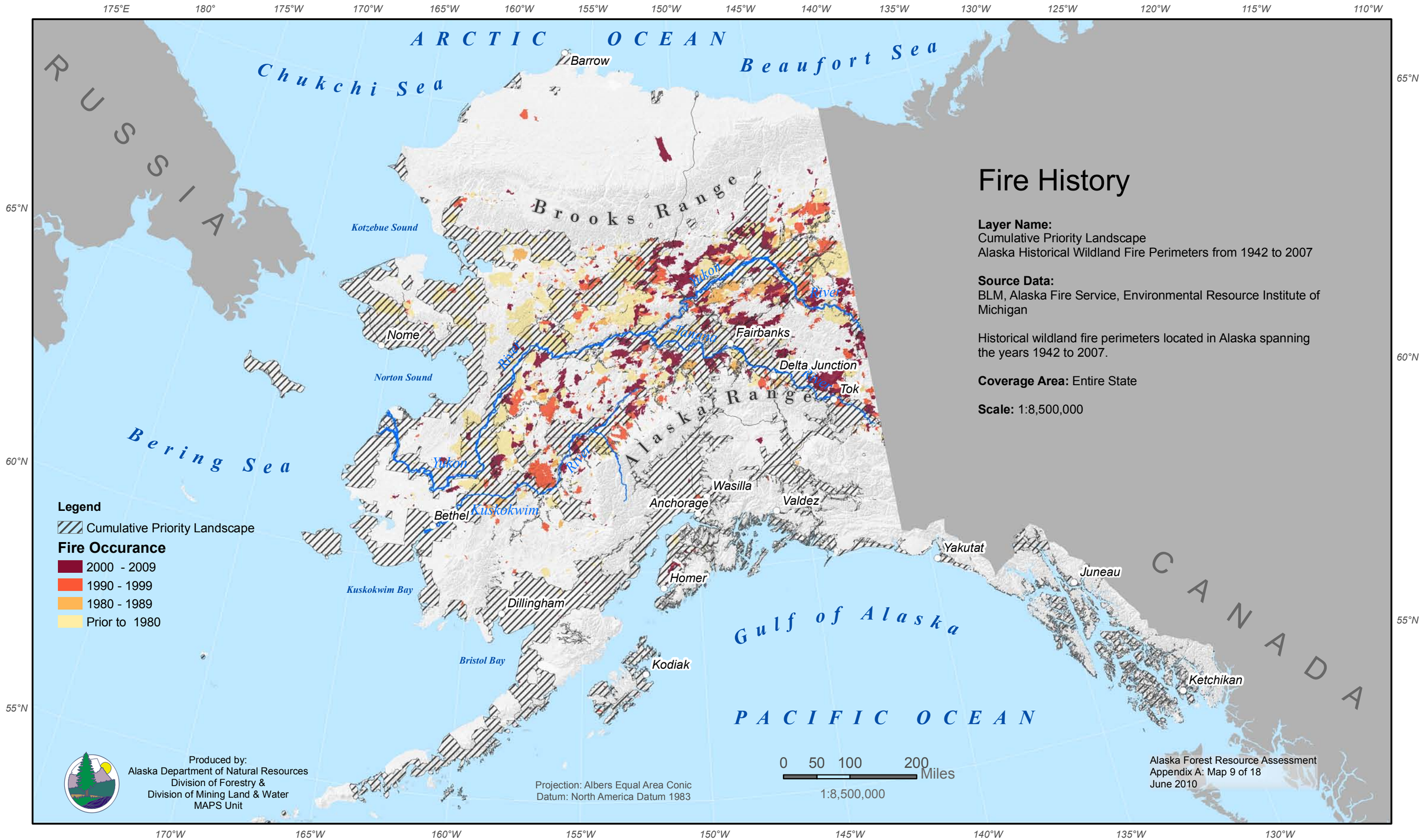
Layer Name:
Cumulative Priority Landscape
Alaska Historical Wildland Fire Perimeters from 1942 to 2007

Source Data:
BLM, Alaska Fire Service, Environmental Resource Institute of Michigan

Historical wildland fire perimeters located in Alaska spanning the years 1942 to 2007.

Coverage Area: Entire State

Scale: 1:8,500,000



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Division of Mining Land & Water
MAPS Unit

Alaska Forest Resource Assessment
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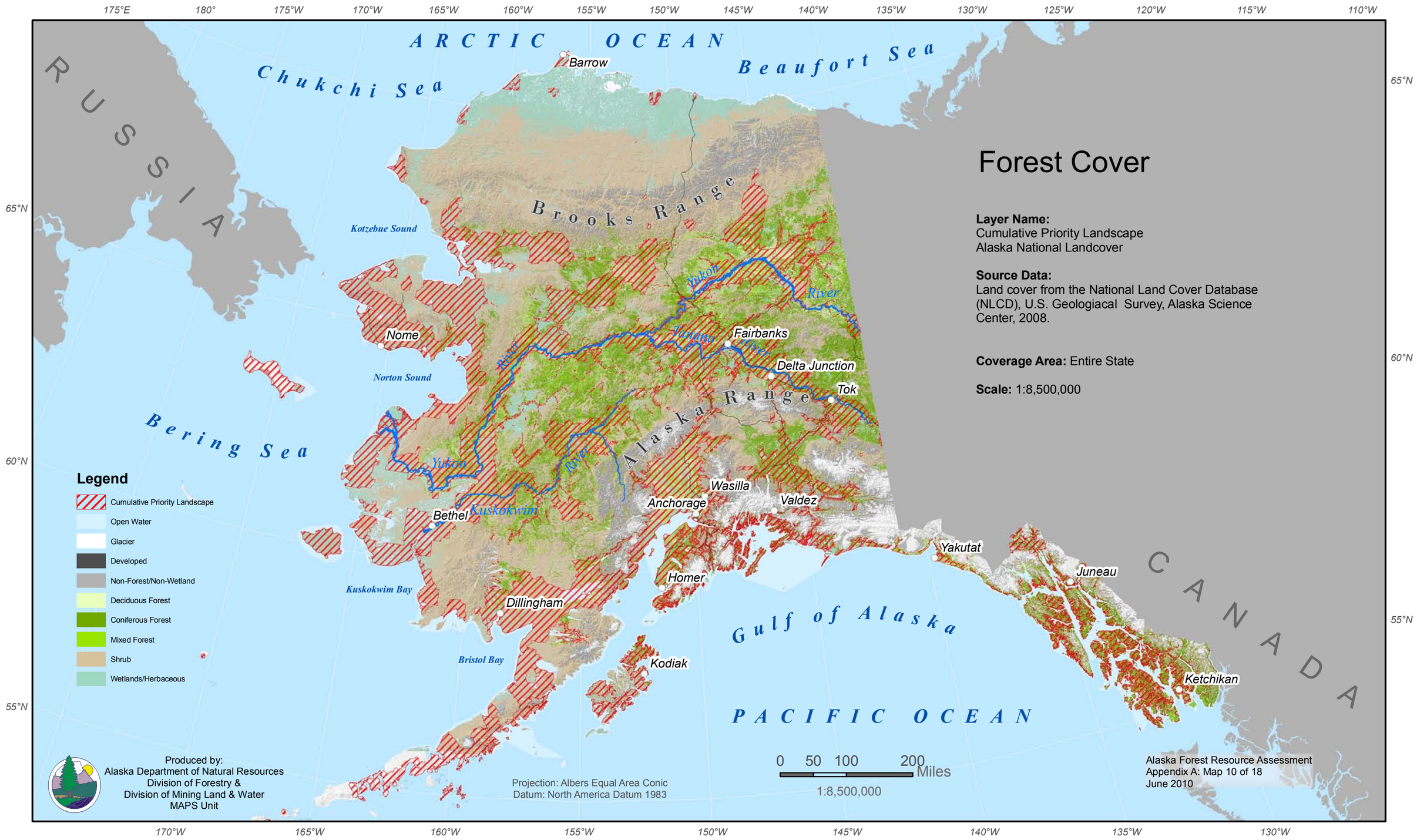
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Barrow
Kotzebue Sound
Nome
Norton Sound
Brooks Range
Alaska Range
Yukon River
Yukon River
Tanana River
Kuskokwim River
Fairbanks
Delta Junction
Tok
Wasilla
Anchorage
Valdez
Bethel
Kuskokwim Bay
Dillingham
Bristol Bay
Kodiak
Yakutat
Juneau
Homer
Ketchikan
Forest Cover
Layer Name:
Cumulative Priority Landscape
Alaska National Landcover
Source Data:
Land cover from the National Land Cover Database (NLCD), U.S. Geologiacal Survey, Alaska Science Center, 2008.
Coverage Area: Entire State
Scale: 1:8,500,000
Legend
Cumulative Priority Landscape
Open Water
Glacier
Developed
Non-Forest/Non-Wetland
Deciduous Forest
Coniferous Forest
Mixed Forest
Shrub
Wetlands/Herbaceous
Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit
Projection: Albers Equal Area Conic
Datum: North America Datum 1983
0 50 100 200 Miles
1:8,500,000
Alaska Forest Resource Assessment
Appendix A: Map 10 of 18
June 2010

Alaska Forest Resources & Practices Regions

Layer Name:
Cumulative Priority Landscape
FRPA regions

Source Data:
Alaska's three major forest regions defined by Alaska Forest Resources and Practices Act

Coverage: Statewide

Scale: 1:8,500,000

Legend

- Cumulative Priority Landscape
- Forest Resource and Practices Region I
- Forest Resource and Practices Region II
- Forest Resource and Practices Region III

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 11 of 18
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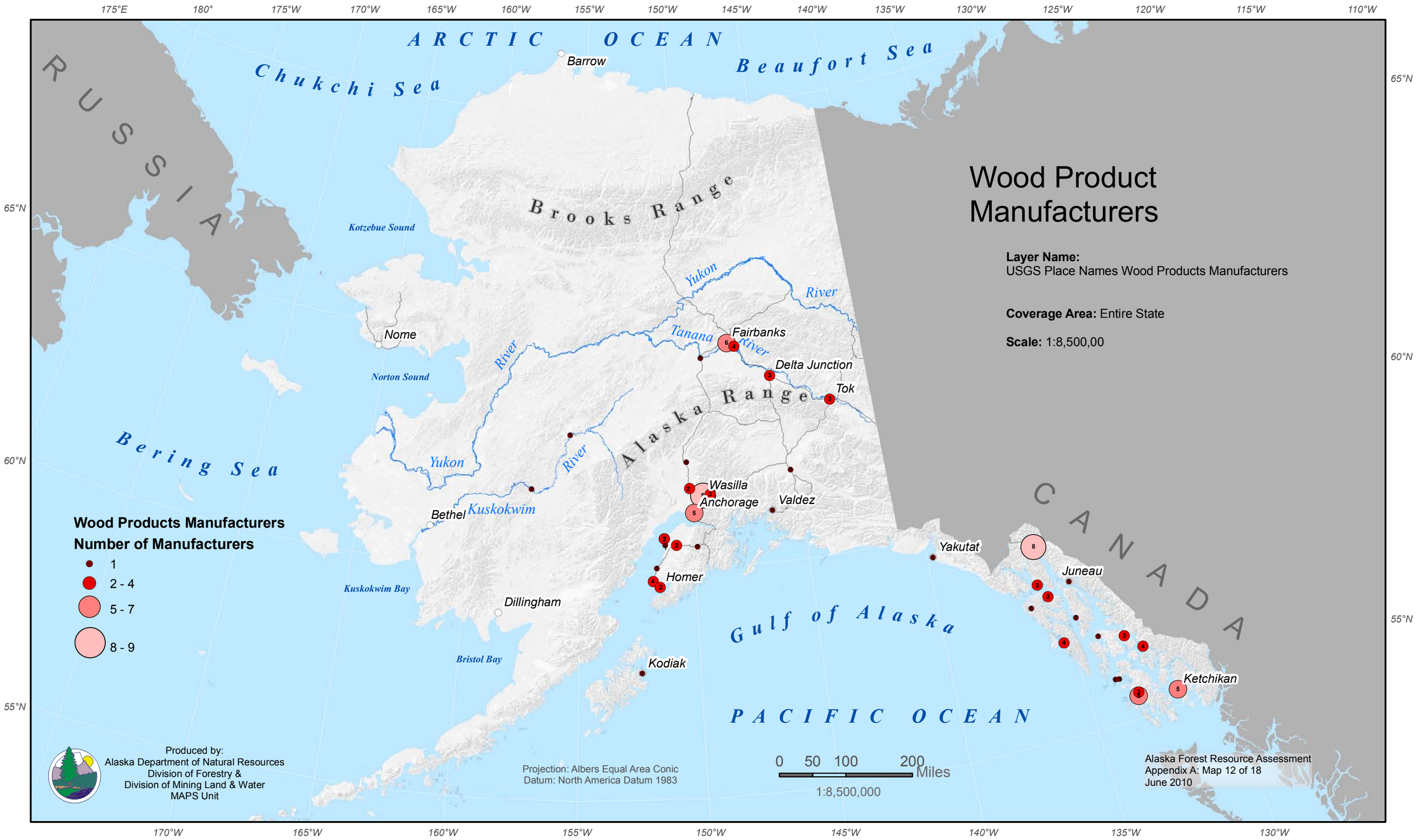
175°E 180° 175°W 170°W 165°W 160°W 155°W 150°W 145°W 140°W 135°W 130°W 125°W 120°W 115°W 110°W
65°N 60°N 55°N

Wood Product Manufacturers

Layer Name:
USGS Place Names Wood Products Manufacturers

Coverage Area: Entire State

Scale: 1:8,500,00



Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

Alaska Forest Resource Assessment
Appendix A: Map 12 of 18
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Transportation

Layer Name:
Transportation - Roads - Highway 63,360_LINE
Transportation - Roads - Secondary 63,360_LINE
Transportation - Rivers

Source Data:
Alaska Department of Natural Resources -
Land Records Information Section

This data depicts highway locations in Alaska as digitized primarily from 1:24,000, 1:63,360, and 1:250,000 USGS quadrangles.

Coverage Area: Entire State

Scale: 1:8,500,000

Supplemental Datasets:
Borough Roads
Kenai Peninsula
Fairbanks
Juneau
Anchorage
Mat-Su

Legend
- Railroads
- State Roadways
- Alaska Marine Highway
- Rivers with known barge travel

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 13 of 18
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2000 Census

Layer Name:
tl_2008_02_places00

Source Data:
U.S. Census Bureau, Geography Divsion
2000 Census TIGER/Line files

Coverage Area: Entire State

Scale: 1:8,500,000

Legend

Census Place Data

Total Population

- 500 - 1,000
- 1,001 - 4,000
- 4,001 - 10,000
- 10,001 - 30,000
- 30,001 - 260,000

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 14 of 18
June 2010

Permafrost

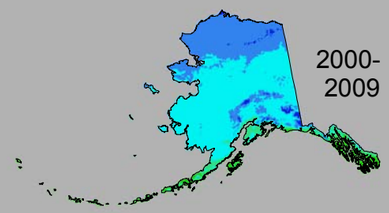
Layer Name:
Permafrost

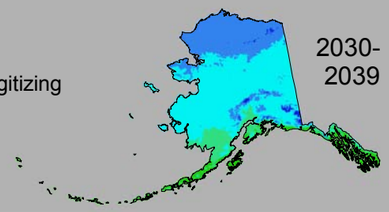
Source Data:
The linework was captured by hand digitizing the source map, Ferrians, O.J., 1965, Permafrost map of Alaska.

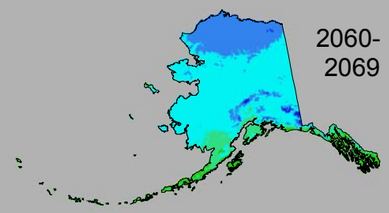
Coverage Area: Entire State

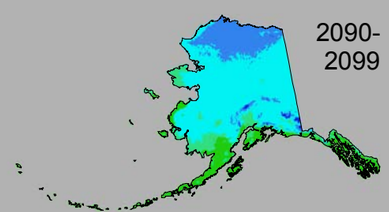
Scale: 1:8,500,000

Supplemental Datasets:
Growing Seasons
SNAP(Scenarios Network for Alaska Planning)
Climate Model: Canadian Centre for Climate Modeling and Analysis
Scenario: Scenario A1B









Growing Seasons: 2000 - 2099

Growing Days
- 0 - 100
- 101-150
- 151-200
- 201-250
- 251-365

Legend

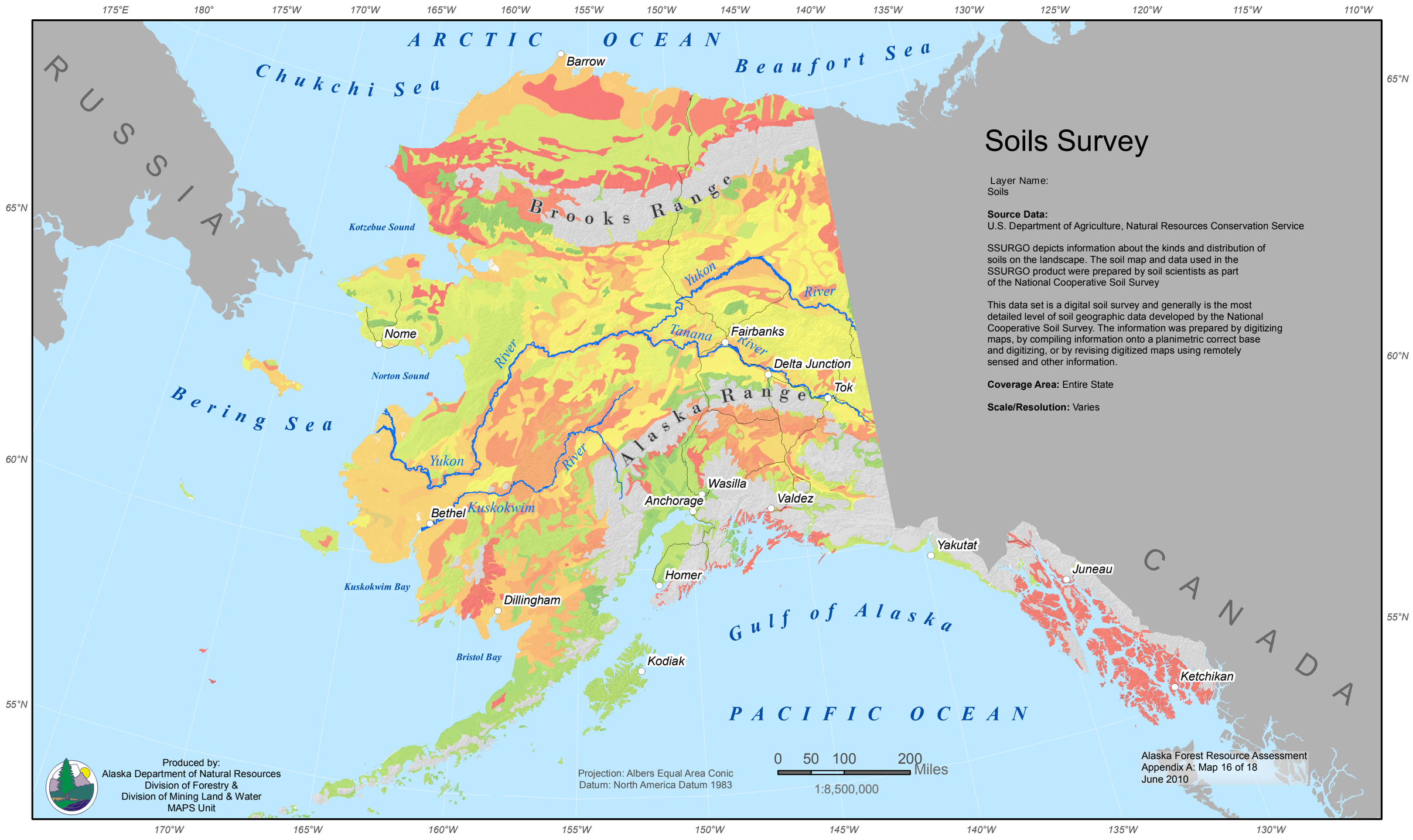
Permafrost
- Thick Permafrost
- Discontinuous Permafrost
- Thick and Thin Permafrost
- Isolated Permafrost
- Generally Free of Permafrost

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 15 of 18
June 2010



Soils Survey

Layer Name:
Soils

Source Data:
U.S. Department of Agriculture, Natural Resources Conservation Service

SSURGO depicts information about the kinds and distribution of soils on the landscape. The soil map and data used in the SSURGO product were prepared by soil scientists as part of the National Cooperative Soil Survey

This data set is a digital soil survey and generally is the most detailed level of soil geographic data developed by the National Cooperative Soil Survey. The information was prepared by digitizing maps, by compiling information onto a planimetric correct base and digitizing, or by revising digitized maps using remotely sensed and other information.

Coverage Area: Entire State

Scale/Resolution: Varies

Legend

- Dune land
- Fluvaquentic Cryofibrists-Andic Dystrocryepts
- Lithic Haplocryands-Andic Dystrocryepts
- Rough mountainous land
- Sphagnic Cryofibrists-Andic Haplocryods
- Sphagnic Cryofibrists-Andic Humicryods-Andic Haplocryods
- Typic Aquiturbels-Lava flows
- Typic Aquiturbels-Rough mountainous land-Humic Lithic Dystrocryepts-Andic Humicryods
- Typic Aquiturbels-Rough mountainous land-Lithic Cryorthents
- Typic Aquiturbels-Rough mountainous land-Lithic Haploturbels
- Typic Cryaquepts-Fluvaquentic Cryohemists-Andic Haplocryods-Andic Dystrocryepts
- Typic Cryofluvents-Typic Cryaquents-Fluvaquentic Cryohemists
- Typic Cryofluvents-Typic Cryaquents-Sphagnic Cryofibrists
- Typic Cryofolists-Typic Cryaquents-Terric Cryohemists-Rough mountainous land-Lithic Humicryods
- Typic Cryorthents
- Typic Cryorthents-Typic Aquiturbels
- Typic Dystrocryepts-Typic Cryopsamments-Aeric Cryaquepts
- Typic Dystrocryepts-Typic Cryorthents-Typic Aquiturbels
- Typic Eutrocryepts
- Typic Eutrocryepts-Typic Cryopsamments-Aeric Cryaquepts
- Typic Fibristels-Lithic Haplocryands-Andic Humicryods
- Typic Haplocryands
- Typic Haplocryands-Fluvaquentic Cryofibrists
- Typic Haplocryands-Rough mountainous land
- Typic Haplocryands-Rough mountainous land-Lithic Dystrocryepts
- Typic Haplocryands-Rough mountainous land-Lithic Haplocryands
- Typic Haplocryands-Rough mountainous land-Riverwash
- Typic Haplocryands-Typic Fibristels-Andic Humicryods
- Typic Haplocryods-Andic Humicryods-Andic Haplocryods
- Typic Haplocryods-Sphagnic Cryofibrists
- Typic Haplocryods-Sphagnic Cryofibrists-Andic Haplocryods
- Typic Haplocryods-Typic Aquiturbels-Lithic Cryorthents-Humic Dystrocryepts
- Typic Haplocryods-Typic Aquiturbels-Rough mountainous land-Lithic Cryorthents
- Typic Haplocryods-Typic Cryofluvents-Typic Cryaquents-Terric Cryofibrists
- Typic Haplocryods-Typic Cryofluvents-Typic Cryaquents-Terric Cryofibrists-Sphagnic Cryofibrists
- Typic Haplocryods-Typic Cryopsamments-Typic Aquiturbels
- Typic Haplocryods-Typic Cryorthents-Typic Cryohemists-Terric Cryosaprists
- Typic Haplocryolls-Typic Aquiturbels-Lithic Cryorthents
- Typic Haplocryolls-Typic Eutrocryepts-Typic Aquiturbels
- Typic Haploturbels-Typic Aquiturbels
- Typic Histoturbels
- Typic Histoturbels-Rough mountainous land-Humic Dystrocryepts
- Typic Histoturbels-Rough mountainous land-Humic Eutrocryepts
- Typic Histoturbels-Typic Aquiturbels
- Typic Histoturbels-Typic Aquiturbels-Humic Lithic Dystrocryepts-Humic Dystrocryepts
- Typic Histoturbels-Typic Aquiturbels-Humic Lithic Eutrocryepts-Humic Eutrocryepts
- Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels-Humic Dystrocryepts
- Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels-Humic Eutrocryepts
- Typic Histoturbels-Typic Cryofluvents
- Typic Histoturbels-Typic Cryorthents-Ruptic histic aquiturbels-Humic Dystrocryepts
- Typic Histoturbels-Typic Cryorthents-Typic Aquiturbels-Humic Eutrocryepts
- Typic Histoturbels-Typic Cryorthents-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Histoturbels-Typic Dystrocryepts
- Typic Histoturbels-Typic Dystrocryepts-Aeric Cryaquepts
- Typic Histoturbels-Typic Dystrocryepts-Aquic Cryorthents
- Typic Histoturbels-Typic Dystrocryepts-Lithic Dystrocryepts
- Typic Histoturbels-Typic Dystrocryepts-Rough mountainous land
- Typic Histoturbels-Typic Dystrocryepts-Typic Aquiturbels
- Typic Histoturbels-Typic Dystrocryepts-Typic Aquiturbels-Humic Lithic Dystrocryepts
- Typic Histoturbels-Typic Dystrocryepts-Typic Aquiturbels-Lithic Dystrocryepts
- Typic Histoturbels-Typic Dystrocryepts-Typic Cryopsamments
- Typic Histoturbels-Typic Dystrocryepts-Typic Cryorthents-Typic Aquiturbels
- Typic Histoturbels-Typic Eutrocryepts
- Typic Histoturbels-Typic Eutrocryepts-Aeric Cryaquepts
- Typic Histoturbels-Typic Eutrocryepts-Lithic Eutrocryepts
- Typic Histoturbels-Typic Eutrocryepts-Typic Aquiturbels
- Typic Histoturbels-Typic Eutrocryepts-Typic Aquiturbels-Humic Eutrocryepts
- Typic Histoturbels-Typic Eutrocryepts-Typic Aquiturbels-Lithic Eutrocryepts
- Typic Histoturbels-Typic Eutrocryepts-Typic Cryopsamments
- Typic Histoturbels-Typic Eutrocryepts-Typic Cryorthents
- Typic Histoturbels-Typic Eutrocryepts-Typic Cryorthents-Aeric Cryaquepts
- Typic Histoturbels-Typic Eutrocryepts-Typic Dystrocryepts-Aeric Cryaquepts
- Typic Histoturbels-Typic Fibristels
- Typic Histoturbels-Typic Fibristels-Andic Dystrocryepts
- Typic Histoturbels-Typic Fibristels-Andic Humicryods
- Typic Histoturbels-Typic Fibristels-Humic Dystrocryepts
- Typic Histoturbels-Typic Fibristels-Typic Aquiturbels
- Typic Histoturbels-Typic Fibristels-Typic Aquiturbels-Andic Dystrocryepts
- Typic Histoturbels-Typic Fibristels-Typic Cryaquents
- Typic Histoturbels-Typic Fibristels-Typic Cryofluvents-Typic Aquiturbels
- Typic Histoturbels-Typic Fibristels-Typic Cryorthents
- Typic Histoturbels-Typic Fibristels-Typic Dystrocryepts-Typic Cryorthents
- Typic Histoturbels-Typic Fibristels-Typic Eutrocryepts-Typic Cryorthents
- Typic Histoturbels-Typic Haplocryands-Fluvaquentic Cryofibrists
- Typic Histoturbels-Typic Haplocryands-Fluvaquentic Fibristels
- Typic Histoturbels-Typic Haplocryands-Lithic Haplocryands
- Typic Histoturbels-Typic Haplocryands-Typic Fibristels
- Typic Histoturbels-Typic Haplocryods
- Typic Histoturbels-Typic Haplocryods-Aeric Cryaquepts
- Typic Histoturbels-Typic Haplocryods-Humic Eutrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryods-Typic Aquiturbels-Humic Lithic Dystrocryepts-Humic Dystrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Cryorthents
- Typic Histoturbels-Typic Haplocryods-Typic Cryorthents-Rough mountainous land-Humic Dystrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Cryorthents-Rough mountainous land-Humic Eutrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Cryorthents-Typic Cryopsamments
- Typic Histoturbels-Typic Haplocryods-Typic Dystrocryepts-Humic Dystrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Dystrocryepts-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryods-Typic Eutrocryepts-Humic Eutrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Eutrocryepts-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryods-Typic Fibristels-Humic Dystrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Fibristels-Humic Eutrocryepts
- Typic Histoturbels-Typic Haplocryods-Typic Fibristels-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryods-Typic Fibristels-Typic Cryofluvents
- Typic Histoturbels-Typic Haplocryolls (s9309); Typic Histoturbels-Typic Haplocryolls
- Typic Histoturbels-Typic Haplocryolls-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryolls-Typic Cryorthents-Typic Aquiturbels
- Typic Histoturbels-Typic Haplocryolls-Typic Eutrocryepts-Humic Eutrocryepts
- Typic Histoturbels-Typic Haploturbels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Histoturbels-Typic Haploturbels-Typic Eutrocryepts
- Typic Histoturbels-Typic Haploturbels-Typic Fibristels
- Typic Histoturbels-Typic Haploturbels-Typic Fibristels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Histoturbels-Typic Haploturbels-Typic Fibristels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Humicryods-Lithic Cryohemists-Humic Placocryods-Andic Humicryods
- Typic Humicryods-Typic Aquiturbels-Rough mountainous land-Humic Lithic Dystrocryepts
- Typic Humicryods-Typic Aquiturbels-Rough mountainous land-Lithic Dystrocryepts
- Typic Humicryods-Typic Cryaquods-Terric Cryosaprists-Terric Cryohemists
- Typic Humicryods-Typic Cryohemists-Terric Cryosaprists-Lithic Humicryods-Lithic Cryofolists-Andic Haplocryods
- Typic Humicryods-Typic Cryohemists-Terric Cryosaprists-Lithic Humicryods-Lithic Cryofolists-Andic Haplocryods
- Typic Humicryods-Typic Haplocryods
- Typic Humicryods-Typic Haplocryods-Typic Cryaquepts-Rough mountainous land-Humic Lithic Dystrocryepts-Humic Dystrocryepts
- Typic Humicryods-Typic Haplocryods-Typic Cryofluvents-Typic Cryaquents-Terric Cryohemists
- Typic Humicryods-Typic Histoturbels-Lithic Haplocryods-Andic Dystrocryepts
- Typic Molliturbels-Typic Aquiturbels-Lithic Haploturbels
- Typic Molliturbels-Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Molliturbels-Typic Histoturbels-Typic Haploturbels-Typic Aquiturbels
- Typic Mollorthels-Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Psammoturbels-Typic Histoturbels-Typic Aquiturbels
- Typic Umbriturbels-Typic Histoturbels-Typic Aquiturbels-Lithic Umbriturbels
- Typic Umbriturbels-Typic Histoturbels-Typic Aquiturbels-Ruptic histic aquiturbels
- Typic Umbriturbels-Typic Histoturbels-Typic Haploturbels-Typic Aquiturbels
- Typic Vitricryands-Rough mountainous land-Lithic Haplocryands
- Vitric Haplocryands-Cinder land

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Alaska Forest Resource Assessment
Appendix A: Map 16a
June 2010

USFWS National Wetlands Mapping Status

Layer Name:
AK wet poly

Source Data:
U.S. Fish and Wildlife Service

This data set represents the extent, approximate location and type of wetlands and deepwater habitats in the Alaska, United States. These data delineate the areal extent of wetlands and surface waters as defined by Cowardin et al. (1979).

Coverage Area: Entire State

Scale: 1:8,500,000

Legend

Wetlands Mapping Status

- Digital
- Non-Digital
- No - Data

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 17 of 18
June 2010

Digital Imagery Available in Alaska

Layer Name:
SDMI Best Data layer

Source Data:
Geographic Information Netowrk of Alaska (GINA)
Statewide Digital Mapping Inititive (SDMI)

"The Alaska Statewide Digital Mapping Initiative seeks to make ongoing improvements to the maps for our State. Alaska is the only State in the Nation lacking current, accurate, high-resolution maps. The fact Alaska does not have a state-wide digital map is a deterrent to economic growth and a risk to public safety.

Resource management requires a strong mapping foundation; emergency preparedness and readiness for disaster recovery depends upon accurate location information."

Source: http://www.alaskamapped.org/

Coverage Area: Entire State

Scale: 1:8,500,00

Legend

SDMI Best Data Layer Inventory

Resolution of Available Imagery (Meters)

- <=1m
- >1m and <=2.5m
- 10 - 19m
- 20-30m

Produced by:
Alaska Department of Natural Resources
Division of Forestry &
Division of Mining Land & Water
MAPS Unit

Projection: Albers Equal Area Conic
Datum: North America Datum 1983

0 50 100 200 Miles
1:8,500,000

Alaska Forest Resource Assessment
Appendix A: Map 18 of 18
June 2010

ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
RUSSIA
Barrow
Brooks Range
Kotzebue Sound
Nome
Norton Sound
Bering Sea
Yukon River
Tanana River
Fairbanks
Delta Junction
Tok
Alaska Range
Wasilla
Anchorage
Valdez
Bethel
Kuskokwim River
Kuskokwim Bay
Dillingham
Homer
Yakutat
Juneau
Bristol Bay
Kodiak
Gulf of Alaska
Ketchikan
CANADA
PACIFIC OCEAN

175°E 180° 175°W 170°W 165°W 160°W 155°W 150°W 145°W 140°W 135°W 130°W 125°W 120°W 115°W 110°W
65°N
60°N
55°N

Appendix B ~ Stakeholder Process Summary

Issues were vetted with diverse groups through several means including a stakeholder interview conducted by Northern Economics, and outreach with key advisory committees including the Forest Stewardship Committee, Alaska Community Forest Council, NRCS State Technical Committee, via Gene Schock, State Resource Conservationist, and the Alaska Board of Forestry.

Northern Economics Interviews

To obtain unbiased and independent input from stakeholders, a private consultant company, Northern Economics, performed one-on-one stakeholder interviews during the summer of 2009. Stakeholders were selected to include a variety of interests, from land owners and managers to agency staff and researchers and regional and municipal governments. The initial list of potential contacts was well over 100 but it was narrowed to approximately 30 names, especially those with a statewide perspective and organization managers who could speak for members. The response rate was 91 percent.

Stakeholders usually know their local or land-specific issues, but may or may not be aware of statewide issues such as overall fire control, statewide forest practices, and forest management outside of the immediate area. Northern Economics solicited names and contacts at the contract kickoff meeting. Stakeholders are listed below. Northern Economics team members contacted stakeholders using a variety of methods: interviews, phone calls, emails, and web searches. Respondents provided their opinions about forest-related issues in several ways, from interviews to emails and to detailed suggestions about additions and especially focus and emphasis. Respondents provided names and sources for GIS data, some of which the team knew and others that were new.

The issues identified through these interviews were organized in a manner to facilitate geospatial representation and were used in developing the final issues as outlined in this assessment. Issues that reoccurred in several contexts and were not linked to specific landscapes were characterized as cross cutting issues and while not used to develop priority landscape, will assist in the development of statewide Forest Resource strategy.
A detailed summary of the Northern Economics work is available on file at Division of Forestry.

Stakeholder List

Local Government

- Debby Broneske, Resource Specialist, Matanuska-Susitna Borough
- Mike Fastabend, Spruce Bark Beetle Coordinator, Kenai Peninsula Borough
- Paul Costello, Director Land Management, Fairbanks North Star Borough
- Jeff Hermanns, Area Forester, Division of Forestry for community of Tok
- Sue Rodman, Forester, Anchorage Fire Department, Municipality of Anchorage,
- Ryan Stencel, Anchorage Soil and Water District
- Scott Stringer, Municipal Forester, Municipality of Anchorage

State Government

- Arlene Weber-Sword, Fire Staff Office, Division of Forestry
- Roger Burnside, Entomologist, Division of Forestry (referenced p.57)
- Patricia Joyner, Community Forestry Program Coordinator, Division of Forestry (referenced p.57)
- Jeff Graham, Forest Stewardship Coordinator, Division of Forestry (referenced p.57, p.58)
- Jim Durst, Habitat Biologist, Alaska Department of Fish and Game
- James King, Director, Division of Parks and Outdoor Recreation
- Chris Degernes, Chief of Field Operations, Division of Parks and Outdoor Recreation

- Dick Mylius, Director, Division of Mining, Land and Water
- Carol Fries, Project Manager, DNR-Commissioners Office
- Rick Jandreau, Acting Resources Program Manager, Division of Forestry
- Doug Schrage, President, state of Alaska Fire Chiefs Association

Federal Government

- Ron Knowles, Group leader, Fire and Fuels, State & Private Forestry, U.S. Forest Service
- Steve Patterson, Asst Director for Forest Health, State & Private Forestry, U.S. Forest Service
- Paul Brewster, Deputy Regional Forester, Resources, U.S. Forest Service, Region 10
- Mitch Michaud, Forester for state, Natural Resource Conservation Service
- Matthew Anderson, Lead Forester, Bureau of Land Management
- Sue Masica, AK Regional Director, National Park Service
- Suzy Wooliver, National Park Service
- Steve Heppner, Fire Management Officer, Bureau of Indian Affairs
- Debbie Steen, Fire Staff, U.S. Fish & Wildlife Service
- Brad Reed, U.S. Fish & Wildlife Service

Native Alaskans and Private Landowners

- Rick Rogers, Vice President, Chugach Alaska Corporation
- Charles Parker, president, Alaska Villages Initiatives
- Brad Garness, Executive Director, Alaska Inter-Tribal Council
- Will Putman, Forestry Director, Tanana Chiefs Conference
- Clare Doig, Consulting Forester ANCSA Corporations Kavilco, Klawock, Huna Totem, Cape Fox
- Ron Wolfe, Corporate Forester, Sealaska Native Corporation

Forest Stewardship Committee

The Forest Stewardship Committee is comprised of 14 diverse stakeholders knowledgeable and experienced about Alaska's private forest lands. The committee make-up is derived from Forest Service national guidelines. Jeff Graham, DOF Forest Stewardship Coordinator and Roger Burnside, DOF Forest Entomologist provided an overview of the Statewide Assessment on March 31, 2010. Twelve of fourteen members were present. Most committee members were supportive of the assessment overall. Comments included: the potential for biomass utilization from wildland urban interface zones, elaboration on definition of pests, concerns about bird habitats, expanding subsistence use to personnel and non-timber uses, consideration of agricultural lands, expanding priority landscape to high-medium-low designation. Many suggestions were addressed in the final assessment.

Alaska Community Forest Council

The Alaska Community Forest Council's 15 members received drafts of the Statewide Assessment and Community Forestry Program Five-Year Strategy and were asked for comments. The council is composed of members representing most of the population centers of the state and serves an advisory role to the state forester and the Community Forestry Program. Community Forestry Program Coordinator Patricia Joyner presented the assessment and strategy at the March 12, 2010 council meeting and asked for discussion and comments.

The council discussed the selected communities list, based on which have possibility of developing or managing CF programs. They discussed how to address communities like Chitina and Tok, which can not meet four standards set by the Forest Service because there is no local government, but forest management is important to the community. There was general agreement that the document was interesting and a good compilation of information that had not been in one document previously. Members thought it would useful for providing an overview of forestry in Alaska and for building support for State Cooperative Programs.

Natural Resource Conservation Service State Technical Committee

The Natural Resource Conservation Service (NRCS) State Technical Committee provides advice on a number of issues within a variety of NRCS conservation programs. Although the State Technical Committee has no implementation or enforcement authority, USDA gives strong consideration to the Committee's recommendations. The Statewide Assessment and Strategy was presented at the committee meeting on May 26, 2010 by Jeff Graham. At the meeting, 20 were present representing Alaska Native landowners, the Alaska Federation of Natives, the Alaska Department of Fish and Game, Alaska Division of Agriculture, and NRCS. The primary comment inquired if Alaska will receive additional Federal funding due to extra need and large acreage.

US Forest Service Alaska Region Leadership Team

A presentation on the Statewide Assessment and Strategy was given to the R10 leadership team on May 7, 2010 by Jeff Graham, Chris Maisch, Alaska State Forester and Rick Rogers, DOF Chief of Forest Resources. The leadership team had 11 members in attendance via video conference. Comments included discussion of transition to second growth management, emerging markets for forest products, transportation as a major challenge for small operators on Tongass National Forest, interaction of forest and salmon habitat, important in restoration investments. Note was made of the amount of priority landscape that was non-forested. A suggestion was made to reference the National Forest Management Plans.

Bureau of Land Management Alaska Leadership Team

The Bureau of Land Management (BLM) leadership was given a presentation on the Statewide Assessment and Strategy by Jeff Graham, Chris Maisch, and Rick Rogers on June 3, 2010. Ten members of the leadership team were present. Comments were made noting wildfire protection coverage, spruce beetle occurrence, and cross boundary management possibilities. Request was made for final Assessment and Strategy and documents will be made available to the Alaska BLM.

The Alaska Board of Forestry

The nine-member Alaska Board of Forestry is an advisory board established by the Alaska Forest Resources and Practices Act. Eight members are appointed to three year terms by the Governor, with the ninth seat filled by the State Forester serving as ex officio and board chair. This board represents a broad range of interest groups with board seats representing: a commercial fishermen's organization; an Alaska Native corporation; an environmental organization; a forest industry trade association; a professional fish or wildlife biologist; a professional forester; a mining organization; and a recreational organization.

Jeff Graham presented the Statewide Assessment and draft strategy to the Alaska Board of Forestry at their spring meeting in Juneau Alaska on March 18, 2010. Comments included: emphasis of fish resources in regard to communities, addressing climate change and carbon sequestration, adequate coverage of southeast Alaska, and similarities with other states such as the Texas model. Many suggestions were addressed in the final assessment.

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