WILDLAND FIRE IN ALASKA:

A History of Organized Fire Suppression and Management in the Last Frontier

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Wildland fire.
Photo courtesy of the Alaska Fire Service.

Definitions in this study

Fire control (as well as ***fire suppression***) refers to all work associated with extinguishing fires, including prevention, detection, control, restriction, suppression, and extinction).

Fire management refers to all activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives. It includes all the activities associated with fire control, as well as the planning, conduct, monitoring, and review of all aspects of fire protection and use of prescribed fire and prescribed natural fire in land and natural resource management.

Fuel is any combustible vegetative material.

Prescribed fire (and ***prescribed burning***) is the planned application of fire under selected weather and fuel conditions so that the fire is confined to a predetermined area and burns with the intensity and rate of spread necessary to achieve the objectives of management.

Wildfire is any unplanned fire. This term is rarely used by fire suppression agencies because it connotes a fire that is completely out of control.

Wildland fire refers to fires in non-urban areas.

A comprehensive glossary of fire management terms can be found at the New Zealand National Rural Fire Authority's website at http://www.fire.org.nz/rural/publications/glossary/index.html.

List of Abbreviations

ADF&G: Alaska Department of Fish and Game

AFCS: Alaskan Fire Control Service

AFS: Alaska Fire Service

AICC: Alaska Interagency Coordination Center

AIFMC: Alaska Interagency Fire Management Council

AIWFMP: Alaska Interagency Wildland Fire Management Plan

ANCSA: Alaska Native Claims Settlement Act

ANILCA: Alaska National Interest Lands Conservation Act

ARC: Alaska Road Commission

AWFCG: Alaska Wildland Fire Coordinating Group (a subcommittee of the AIFCMC)

BIA: Bureau of Indian Affairs

BIFC: Boise Interagency Fire Center

BLM: Bureau of Land Management

CCC: Civilian Conservation Corps

DNR: State of Alaska, Dept. of Natural Resources

DOF: Division of Forestry (Bureau of Land Management and later, State of Alaska, DNR)

ECW: Emergency Conservation Work programs

EFF: Emergency firefighters or emergency firefighting funds

EFP: Emergency fire protection funds

FDO: Fairbanks District Office

FPWG: Fire Planning Working Group

GLO: General Land Office

NIFC: National Interagency Fire Center

NPS: National Park Service

RPT: Resource Planning Team

USFS: United States Forest Service

USFWS: United States Fish and Wildlife Service

USGS: United States Geological Survey

…the whole fire question in the United States is one of bad habits and loose morals. There is no other reason or necessity for these frequent and recurring conflagrations.
— Bernard Fernow, Chief of the Division of Forestry, 1890

Fire may be left only on wildlands and parks…
Like the grizzly bear, I think fire will retreat to those landscapes.
—Stephen Pyne, 1996

1. Introduction

When the federal government used the military to fight fires in Yellowstone National Park in 1886, it marked the beginning of wildland fire suppression in the United States (Pyne 1982). Organized fire suppression in the Territory of Alaska began almost 60 years after the emergence of this first federal effort in the contiguous states. The state's first fire control agency, the Alaska Fire Control Service, was established in 1939. It faced a vast, remote, and largely unknown territory where wildfires burned millions of acres every year.

This is the story of that agency and its successors. It recounts the struggle these agencies faced in trying to prevent and suppress fires in the far north, as well as their efforts to understand the causes of fire and its unique role in the boreal forest ecosystem. It discusses their resourcefulness in the face of enormous challenges and the technological and organizational innovations they made that were subsequently adopted in other areas.

Their story also reflects changes in public attitudes toward fire, as well as changes in our scientific understanding of its ecological role. In the quotation cited above, noted fire historian Stephen Pyne likens fire to a grizzly that must retreat to remote habitats. Indeed, there are many similarities between fire and large predators. During the past century, we reacted to wildland fire in much the same way we reacted to predators. At the beginning of the century, we saw fires—and predators—as something to eliminate. We were remarkably successful at doing so; we eradicated predators from most of their range in the Lower 48 States and, for a time, we almost eliminated fire.

But by midcentury, many scientists realized that both fire and predators play important roles in ecosystems and that their elimination had unexpected consequences. Where predators were eradicated, prey species such as deer became overabundant and died slow deaths from starvation. Similarly, when fire was eliminated from areas where it had once been frequent, fuels in the form of underbrush and dead and downed wood became overabundant, increasing the potential for a catastrophic fire.

There are also important differences between predators and fire. First, we have been quite successful at eliminating predators from large areas. They did not so much "retreat" to wilderness areas as they were driven out of settled areas.

Fire is virtually impossible to confine to remote regions; if the fuels and conditions are right, it can and will occur anywhere. Also, when predators are eliminated, predation does not get worse. But the opposite has been the case with fire; attempts to eliminate it simply made it worse. Light, frequent fires had been clearing forests of excess fuels for centuries. Without such fires, underbrush and dead and down wood piled up, creating ideal conditions for virtually unstoppable firestorms.

Today, we are trying to reintroduce both predators and fire to many ecosystems in the contiguous states. Wolves have been successfully reintroduced to some areas and allowed to recolonize others on their own. But reintroducing fire into an area now choked with fuel is like introducing a spark to a powder keg. The question for managers is, how can fire be reintroduced without serious risk to human life and property?

For the most part, Alaska did not follow the same path as the Lower 48—although we tried to do so. Alaska's immense size, rugged terrain, difficult climate and lack of roads made it largely immune to our attempts to eliminate either fire or predators. As a result, Alaska was still blessed with healthy predator populations and large areas where fire could burn when the rest of the US was trying to reintroduce both. When the Alaska National Interest Lands Act was passed in 1980, 104.1 million acres were set aside in federal conservation areas, 57 million of which are designated wilderness areas. These and several state conservation units provide extensive habitat where wolves, grizzlies—and fire—can still run free.

But Alaska's population is increasing and with it, the risk of fires where urban areas meet the forest. In addition to the risk that fires will burn homes in outlying subdivisions, there is the problem of dense smoke, even if the fire is many miles away. Smoke poses a serious health threat and disrupts transportation, making it more difficult to allow fires to burn even in remote areas. Problems like these ensure that fire management in the Last Frontier will continue to be a challenging task.

A note on sources:

Little information exists for the years prior to 1939 beyond explorers' accounts of fire use and wildfires, along with some correspondence from federal agency personnel and published articles. Most of the information for the period 1939 to 1970 was found in archival fire records, letters, reports, and other unpublished materials. Most of these documents are housed at the Bureau of Land Management (BLM), Alaska Fire Service office in Fairbanks. Around 1970, a considerable amount of statistical, organizational, and fire planning materials began to emerge. These documents provided information on Alaska's most recent fire management history.

Table 1. Chronology of organized wildland fire control

In the Contiguous U.S.	In Alaska
1800s – Euro-American settlers learned burning from the Indians, but a cultural reaction against fire, starting in Europe in the 1800s, was soon reflected in US in controversy over fire.	
1880s – Timber owners and ranchers in California argue for use of "light burning" to reduce fuels, maintain pastures, and decrease likelihood of large fires (Pyne 1982, 101).	
1886 – Federal government uses military troops to fight fires in Yellowstone National Park, marking the beginning of wildland fire suppression in the US.	
1902 – Editorial in San Francisco paper attacks fire control as worse than ineffective because it allowed fuel hazards to accumulate (Pyne 1982, 102).	
1907 – Yale's H.H. Chapman studies use of fire by southern timber growers to prepare seedbeds for longleaf pine and to prevent pine from being overtaken by hardwoods and brush. He becomes a champion of prescribed burning.	1907 – The USFS began suppression of fires within Chugach and Tongass National forests, though it was rarely needed due to high rainfall.
1910 – 5 million acres of natural forests burn, 3 million in the "Big Blowup" in Idaho and Montana; 78 fatalities reported.	1915 – Severe drought results in 67 fires in the Chugach National Forest alone.
1916 – US National Park Service is established and adopts a policy of total fire suppression.	
1924 – Herbert Stoddard begins research on decrease in quail populations in Georgia and Florida. Published in 1931, his results "gave scientific credibility" to the concept that wildlife habitat could be improved through burning (Pyne 1982, 154).	
1931 – S.W. Greene publishes the broadside, "The Forest that Fire Made," which argues that fire is essential to maintenance of longleaf pine forests and livestock pastures in the south.	
1935 – US Forest Service (USFS) implements the 10 AM Policy, where all wildfires were to be contained by 10 AM the day after a control effort began.	

1942 – Disney's movie *Bambi* is released. Film's depiction of Bambi and his friends barely escaping a wildfire convinces audiences that fire is disastrous for wildlife, although studies show that fire benefits most wildlife.

1943 – Forest Service Chief Lyle Watts encourages the experimental use of prescribed burning.

1945 – USFS launches "Smokey Bear" ad campaign, one of the most effective public relations campaigns in history. The campaign's purpose is to prevent human-caused fires, although its effect was to make all fires seem disastrous.

1949 – US Congress allowed the use of Emergency Firefighting funds for fire suppression

1949 – During 1949–51, Prof. Harold Biswell of the University of California researches the use of prescribed burning in rangelands and forests.

1951 – Ed Komarek of the private Tall Timbers Research Station in Florida advocates prescribed fire worldwide.

1962 – The first of 15 annual Tall Timbers Fire Ecology conferences, chaired by E.V. Komarek, held in Tallahassee, Florida. These conferences resumed in 1991 and are now held biannually. They serve as a major forum for research on the role of fire in the ecosystem and on fire management worldwide.

1962 – A.L. Schiff's book, *Fire and Water; Scientific Heresy In The Forest Service*, examines how the agency repressed scientific evidence that challenged its 100% suppression policy.

1963 – A. Starker Leopold (1963) reports on wildlife management in National Parks; advocates restoring ecological processes, including fire, to the park system.

1965 – Great Basin Fire Center established in Boise, Idaho under the leadership of Roger R. Robinson, long time director of Alaska's fire program.

1967 – Studies by Hartesveldt and Harvey (1967) and Biswell (1967) show that fire must be restored if the giant sequoia ecosystem, which depends on fire to kill the seedlings of competing species, is to be maintained.

1968 – National Park Service publishes new policies adopting Leopold's 1963 recommendations and recognizing fire as a natural phenomenon.

1939 – First fire control agency in Alaska, the Alaskan Fire Control Service (AFCS), is established July 1 under the General Land Office (GLO).

1939 – First aircraft fire detection flight occurred July 28, 1939.

1942 – AFCS reorganized into six districts (Anchorage, Fairbanks, Fort Yukon, Ruby, McGrath, and Holy Cross).

1942 – Military constructed the Alcan International Highway between the contiguous states and Alaska.

1943 – AFCS first acknowledged that lightning occurred and caused fires in Alaska.

1946 – Bureau of Land Management (BLM) established by merging the GLO and the Grazing Service.

1947 – AFCS abolished, its duties transferred to the Division of Forestry under the Branch of Timber and Resource Management in the BLM.

1947 – Kenai National Moose Range fire burned 300,000 acres.

1949 – BLM Division of Forestry acquired its first plane, a Cessna 170.

1950 – 2-million-acre fire threatened the village of Fort Yukon and over 2,000 firefighters were on the line in Alaska at one time.

1957 – BLM Division of Forestry established two operations districts (Anchorage and Fairbanks) and delineated administrative areas within each.

1957 – Second most severe fire season recorded in Alaska with over 5 million acres burned in 500 fires.

1958 – Alaska's chemical retardant program began.

1959 – Alaska became a state.

1959 – First BLM smokejumper force established in Alaska

1960 – Aircraft force of the BLM in Alaska included 4 Cessna 180s, 3 Grumman Goose aircraft, a DC3C, and an F-51 along with contracted fixed wings and helicopters.

1960 – BLM established a contract with the state to provide fire protection on state lands.

1969 – In an agency bulletin, “Protecting the Forests from Fire,” the USFS admits that fire is beneficial.

1969 – USFS joined the Boise Interagency Fire Center, formerly the GBFC.

1988 – One-third of Yellowstone’s 2.2 million acres are scorched by 248 wildfires that are at first allowed to burn.

1989 – Report of the US Fire Policy Review Committee concludes that the public did not understand fire terminology or policy and advises that prescribed and natural fires be used more often to reduce hazardous fuel buildup.

1994 – In July a wildfire, kindled by lightning, overran a fire crew on Storm King Mountain in Colorado, killing 15 crewmembers.

1996 – Paper in *Science* reports that the suppression of wildfires led to the loss of a third of the native plant species in Wisconsin prairies over the past 50 years (Leach and Givnish, 1996).

2000 – the National Park Service loses control of two prescribed fires, the Outlet Fire on the North Rim of the Grand Canyon in Arizona and the Cerro Grande Fire, near Los Alamos, New Mexico.

2000 – Burned area reaches 50-year high. It was the most costly wildfire season ever—the federal government alone spent a record $1.6 billion fighting wildfires.

1969 – Cloud seeding project began in Alaska as an experimental fire suppression tool.

1969 – Over 4 million acres burned in Alaska, primarily on two fires in Kenai area.

1970 – BLM Division of Forestry became the Division of Fire Control.

1971 – Alaska Native Claims Settlement Act passed to settle Native claims in Alaska, beginning major land management changes.

1971 – Symposium on Fire in the Northern Environment held in Fairbanks. Ed Komarek of the Tall Timbers Research Station gives keynote address (Slaughter, 1971).

1971 – First all-female firefighting crew in US established in Alaska.

1973 – State Division of Land and Water assumed fire protection responsibility for southeast area.

1975 – BLM lightning detection and radar programs began.

1976 – Federal Land Policy and Management Act provided BLM with its first mission statement.

1976 – State Division of Forestry took over fire management responsibility for Kenai and Anchorage areas.

1977 – BLM Division of Fire Control renamed the Division of Fire Management.

1977 – First hotshot crew in Alaska created by the BLM.

1979 – Fortymile Interim Fire Management Plan completed in August 1979.

1980 – Alaska Interagency Fire Management Council and the Alaska Fire Planning Working Group established.

1980 – Alaska National Interest Lands Conservation Act passes, dramatically changing land ownership and management boundaries.

1981 – State government assumes fire protection for Matanuska-Susitna Valley, Copper River, Delta, and Fairbanks areas.

1982 – Alaska Fire Service established with four management zones (Galena, McGrath, Tanana, and Circle Hot Springs).

1982 – Tanana-Minchumina Fire Management Plan completed and fire management options defined.

1988 – Fire plans completed for all of Alaska.

1996 – Miller’s Reach Fire in Matanuska-Susitna Valley north of Anchorage destroys over 300 structures.

1998 – In October, the 13 area fire management plans were consolidated into one statewide plan, the Alaska Interagency Wildland Fire Management Plan, which is in use today.

2004 – Most severe fire year ever recorded in Alaska: 6.5 million acres burned and smoke overwhelmed much of the Interior for several weeks.

2. The Early Years: 1867-1939

2.1 Early accounts of fires in Alaska

The writings of early explorers and surveyors, which contain numerous references to forest and tundra fires, are the primary source of information on the fire history of Alaska before organized fire suppression. These scattered references to the uses of fire and observation of wildfires indicate that fires were common throughout Alaska. "It is probable that there have been fires in the northern forests ever since there were forests to burn," said Harold J. Lutz (1959), who is often referred to as the father of Alaska fire ecology.

Soon after the United States purchased Alaska from Russia in 1867, it launched several expeditions to map the newly acquired land. The US Army, and later the US Geological Survey (USGS), were the primary leaders of the exploration efforts. These expeditions reported frequent fires and intense smoke during their travels throughout Interior Alaska.

In 1885, Lieutenant Henry T. Allen of the US Army headed an expedition to the Yukon, Tanana, and Koyukuk River regions of interior Alaska. (Allen 1985). In his history of nineteenth-century Alaska exploration, Morgan B. Sherwood (1992) described Allen's journey as "the most spectacular individual achievement in the history of Alaskan inland exploration." In his own report of this expedition, Lieutenant Allen noted numerous signal fires warning others of the exploration party's presence in the area. He also reported large wildfires: "Heavy smoke caused by the extensive timber fires obscured the sun the entire day, so that an observation was impossible" (Allen 1985).

Fires increased with the gold rush and the accompanying influx of white miners and settlers in the 1890s. Between 1890 and 1900, the population of Alaska nearly doubled from 32,052 to 63,592 (Naske and Slotnick 1994). Not surprisingly, this rapid population escalation coincided with a jump in the number of fires reported. Whether the gold seekers actually started or simply reported more fires is unknown, but likely the rise in reported fires was a combination of the two.

During an army expedition to the Copper River basin in 1898, Frank Schrader, a civilian geologist, described the party's encounter with a forest fire (Schrader 1900 and Sherwood 1992). "West of the head of the lake the obstruction from this cause—burning timber—became serious" (Schrader 1900). In 1903, Robert Dunn led an expedition to Mt. McKinley that failed to summit (Dunn 1907). While in the Kuskokwim valley, Dunn and his party encountered a forest fire. "We struggled among the ponds, crossed a river, and toiled through burned forest, where smoldering fire gnawed the moss, and black bark scaled from the spruces as if by disease" (Dunn 1907).

Ten years later, Henry Eakin (1916), working for the USGS, headed a surveying and mapping expedition in the Yukon-Koyukuk region. Eakin and his party reported many hardships because of the forest fires in the Yukon-Koyukuk region:

> Smoke of forest and tundra fires obscured the landscape for weeks together, and much of the time it was impossible to discern objects more than half a mile distant. A few fires were actually encountered, necessitating hurried travel in some places and delay in others. The absence of horse feed in the burned-over forest areas made long forced marches necessary in places, when the energies of the entire party were required to get the outfit through. About 40 miles of trail in all had to be chopped out, work which was especially arduous in the heavy growth on the lowlands where fallen timber, killed by previous fires, blocked the way (Eakin 1916, p. 13).

Eakin estimated that half of the land between the Yukon and Koyukuk rivers burned in the summer of 1913. Such recurrent reports of human-caused fires and those of unknown origin indicates that timber and tundra fires were commonplace in Alaska during the late 1800s and first decades of the 1900s.

2.2 Who was setting the fires?

White settlers wanted to know who was to blame for igniting the fires. At the time, they did not recognize that lightning was a major source of ignition. This could be because in Alaska, thunderstorms often result in little or no precipitation. Now known as "dry lightning," these rainless clouds seemed an unlikely source of ignition. Consequently, until the 1940s, government agencies and others put the blame on humans.

A person's opinion on whether whites or Natives were responsible for more fires in the territory seemed to depend on whether they resided in the contiguous states or Alaska. In an article he wrote for *American Forests*, Henry S. Graves, Chief Forester of the US Forest Service (USFS), identified the migration of white settlers into Alaska since 1898 as the most significant source of forest fires (1916). Graves was convinced that "the first measure necessary for the successful practice of forestry is protection from fire" (Pyne 1982). John Guthrie (1922), in an article in the Journal of Forestry, stated that "forest fires [in Alaska] probably came in with the white man, and it is estimated that roughly 25,000,000 acres of these forests have been burned over."

But federal workers in Alaska had a different perception. Leo A. Parks (1919), Chief of the Field Division of the General Land Office (GLO) in Alaska, stated that forest fires were "mostly due to the carelessness of the tribes of nomadic Natives who travel through the country and stop at least every two hours to make tea."

Everyone agreed, however, that the new modes of transportation—namely trains and aviation—brought both additional ignition sources and better reporting of fires. The use of fires to clear the rights-of-way for the Alaska Railroad between 1915 and 1923 caused many wildfires (Parks 1919). But even after its construction, the railroad remained a source of fires because the engines frequently produced sparks. Although few fires were actually started by aircraft, the advent of aviation in the 1920s created a new awareness of both the number and size of fires burning in remote areas (McDonald 1939). Aircraft also increased the number of people in remote areas, which in turn increased the likelihood of human-caused fires in these areas.

2.3 Fire suppression considered impractical in Alaska

Understandably, prevention and suppression of Alaska's wildfires occurred on a very limited basis due to the General Land Office's (GLO) view that Alaska was just too large to make any real attempt at suppression. One of the first documented events in forest fire prevention was the arrest of two Natives in 1926 for allegedly igniting a wildfire that burned a swath at least 15 miles long near the village of Napamute (Kuskokwim Fire Patrol 1941). An Alaska district court judge in Bethel sentenced the two men to 90 days' jail time (Kuskokwim Fire Patrol 1941). It was not clear whether they set the fire intentionally or not. This was likely the first prosecution of individuals for causing a forest fire in Alaska.

Alaska firefighter during the 2004 fire season.
Photo courtesy of the Alaska Fire Service.

On public lands, the USFS and GLO provided very little fire suppression in Alaska at this time. The Tongass National Forest in southeast Alaska, the largest national forest in the nation, was established by a series of proclamations between 1902 and 1909. The Chugach National Forest, located in southcentral Alaska and the second largest forest in the system, was established in 1907. In 1910, Congress passed an act allowing for deficit spending to pay for forest fire suppression (Rakestraw 1981 and Pyne 1982). However, the damp climate of these coastal forests made fires a rare occurrence. For example, between 1914 and 1924, the two national forests together averaged just 26 fires annually (Rakestraw 1924). An exception was the very dry summer of 1915 in the Chugach National Forest, when forest officers spent three months trying to control 67 fires (Graves 1916, Rakestraw 1981). To this day, the USFS maintains responsibility for fire suppression in its two national forests in Alaska.

The first designated "fire patrolman" in Alaska was jointly employed by the USFS and the GLO in Haines (Parks 1919). Later, a GLO seasonal patrolman was stationed in Anchorage. An agent of the GLO, stationed in Fairbanks, was expected to handle fire prevention duties in that area. Parks (1919) described the fire duties of these patrolmen as predominantly education rather than suppression for several reasons:

> The country [Alaska] is so large and the areas where good stands of timber are found are so widely separated; the population so small and the settlements so isolated that it would be out of the question to attempt to establish and maintain an adequate patrol, except at an expense that would be out of proportion to the value of the protection afforded.

Believing fire suppression was not worth the effort, Parks (1919) felt the GLO's $3,000 annual appropriation was adequate. In the case of a large fire, he suggested that funds could be requested from Washington, DC. This no-action policy stands in sharp contrast to the burgeoning fire suppression organization developing at same time in the contiguous US.

In the Lower 48: The 'Big Blowup' of 1910 changes attitudes

Following its official establishment in 1905, the USFS dedicated much of its manpower to surveys and timber inventories. The service as a whole saw fire as the enemy of forestry, and foresters were expected to fight fires as part of their jobs. They felt they were doing an excellent job suppressing fires, so much so that in 1907, Gifford Pinchot proudly pronounced "measures…for detecting and extinguishing fires on the national forests are efficient" (Pyne 1982, 242). But the fires the service had faced were relatively small and of low intensity. At the time, the backcountry had no lookouts, little communication, and few trails.

Then came the spring of 1910. The western states experienced a fierce drought. Crops failed. Fires broke out frequently on the desiccated landscape. At first, the fires were close to roads and train tracks where they were relatively easy to control. By July 15, 3,000 men were employed as firefighters in Idaho and Montana (Pyne 1982, 243). A severe lightning storm on July 23 ignited fires in the backcountry. Then on August 20, a wind with the "roar of a thousand freight trains" hit the Northern Rockies and "exploded into conflagrations" (Pyne 1982, 243). The fires did not subside until late September.

When it was over, three million acres had burned in Idaho and Montana and 78 people had been killed. Another two million acres burned in other western states. This was a major turning point. Organized fire suppression began in earnest after the 1910 fire season, as policymakers were unwilling to allow the 1910 season to repeat itself; they thought they could and should eradicate fire. USFS policy became 100 percent suppression of all fires on its lands.

The USFS assumed leadership of forest fire control in the contiguous states because it had jurisdiction over much of the timber that needed protection (Pyne 1982). In contrast, the GLO held responsibility for the majority of the more fire-prone public lands in Alaska. Although the USFS worked to suppress fires when they did occur in the Tongass and Chugach Forests, it never assumed a leadership role in fire suppression in Alaska as a whole.

Before 1930, the desire to protect the commodity value of natural resources dictated USFS fire policy in the contiguous states. To determine whether to fight a given fire, foresters were expected to analyze whether the dollar value of the resource as a commodity exceeded the cost of suppressing a fire that could destroy it (Pyne 1982). In Alaska, the GLO was directed to use the same "net value" approach. However, with what Parks considered "virtually worthless" resources, any fire suppression efforts were too costly to pursue unless man-made structures and materials were threatened.

But in the 1930s, the benefit/cost approach to fire control decisions was abandoned in favor of an aggressive fire suppression policy. This was facilitated by the New Deal era. Conservation during the New Deal focused on protecting potential commodities from destruction by disturbances such as floods and wildfires. The programs, personnel, and funding associated with the New Deal programs, particularly the Civilian Conservation Corps (CCC), largely removed the requirement for economic justification of fire control (Pyne 1982). In fact, the Forest Service often found itself in the unusual situation of having more money and firefighters than it needed.

The CCC and Emergency Conservation Work (ECW) programs also moved fire control into more remote regions with the construction of roads, trails, lookout towers, and fire breaks (Pyne 1982). The USFS first used CCC employees as firefighters during the 1933 Tillamook Fires in Oregon (Pyne 1982).

In 1935, the USFS implemented the 10 AM Policy, an idea made possible by the resources of the New Deal programs. This policy directed suppression forces to control wildfires by 10 AM the day after efforts began. If firefighters did not reach this goal, then the new one would be 10 AM the next day and so on (Pyne 1982). In practice, this directive called for aggressive attack of all fires as soon as they were detected, regardless of their location, using all the necessary or available resources to control them as quickly as possible.

Policy developers likely chose 10 AM because increased fire activity could be expected during the heat of the day, shortly after noon. Also implicit in this choice of time was limiting a fire to a single burning period. Cost of this effort was not an issue—a noticeable change from the economic rationale used previously.

With the CCC firefighters and emergency funds for fire control, suppression in the contiguous states was able to expand to include backcountry lands considered less valuable from a traditional timber harvesting perspective (Pyne, 1982). The end of the New Deal programs severely affected the fire control efforts of the USFS, and forced the agency to take new approaches to fire suppression in the contiguous states (Pyne 1982).

3. The 1940s: Organized Fire Control Begins in Alaska

3.1 Alaskan Fire Control Service is formed

Late in the 1930s, W.J. McDonald, USFS supervisor of the Chugach National Forest, called for the suppression of forest fires in Alaska. He believed that lightning was rare in Alaska and that almost all fires were human-caused. Thus, he thought successful suppression efforts could focus on the few populated areas of the state. In an article for *American Forests*, McDonald (1939) argued for protection of Alaska's natural resources:

> A well-planned, far-flung protection organization of crusading trained men, with good facilities and equipment, will preserve the natural beauty and wildlife of this last extensive wilderness on United States soil, and protect the natural vegetative resources for present and future economic use.

Harold Ickes, Secretary of the Department of Interior, considered McDonald's request for an Alaska fire control agency when he visited the state in 1938 (Robinson 1989 and Rakestraw 1981). The Fairbanks and Anchorage Chambers of Commerce voiced their fears to Ickes that wildland fires might destroy their communities (Robinson 1989). In the mid-1930s, the citizens of Anchorage created a firebreak—600 feet wide and 3 miles long—between themselves and the community of farmers to the north of the city (Robinson 1988 and 1989). Anchorage residents also hoped this fuel break would protect them from the frequent fires that occurred along the Alaska Railroad. The concerns of the citizens apparently impressed Ickes. When the Secretary returned to Washington, DC, he included the establishment of a separate fire-fighting agency in Alaska in his budget request for the next year (Robinson 1989 and Rakestraw 1981).

In response, Congress established the Alaskan Fire Control Service (AFCS) on July 1, 1939, with an annual operating budget of $37,500. The GLO appointed McDonald as chief of the new agency and he remained head of the AFCS until the mid 1940s when his assistant, Roger R. Robinson, took over (McDonald 1940, Robinson 1947). The GLO supervised the AFCS because it operated on the territory's public domain, an area totaling 336 million acres. The AFCS estimated that 225 million acres of public domain were not glaciated and therefore required its fire protection (McDonald 1940). The task was immense for this bare-bones organization consisting of six permanent and about a dozen seasonal employees (McDonald 1940).

AFCS began its duty of fire control by attempting to station personnel throughout the frontier. To improve its ability to control, suppress, and prevent fires along transportation routes and provide fire protection to more remote areas, the AFCS created six districts on July 1, 1942 (Robinson 1942). Previously, the senior forester's office in Anchorage and the fire warden's office in Fairbanks were the only bases of operation. Anchorage and Fairbanks remained, but the GLO supplemented them with district ranger stations in Fort Yukon, Ruby, McGrath, and Holy Cross (Robinson 1942). Seasonal fireguards and an assistant aided the district ranger in areas where annual fire activity was high (Robinson 1942).

However, the AFCS had trouble staffing the outlying districts because the pay was poor and more lucrative employment opportunities abounded. The Alaska Railroad and construction of military facilities in Alaska provided the majority of high paying jobs (McDonald 1940 and 1941). Seasonal AFCS employees often left during the middle of the season when they found better jobs. As a result, few employees returned from season to season, which forced the agency to hire inexperienced firefighters (McDonald 1941). During the first few years, the only training the AFCS provided new firefighters was on the job.

The AFCS hoped to reduce delays in communication and transportation by having personnel stationed in more remote locations and by decentralizing decision-making (Robinson 1942). This allowed the district rangers to take immediate action on fires while they were still small, thus reducing costs (Robinson 1942).

3.2 Fire suppression in the boreal forest presents unique challenges

One of the world's three primary forest ecosystems, the boreal forest or "taiga" ecosystem is found at the higher latitudes of the northern hemisphere and covers much of interior Alaska, Canada, and Russia (Figure 2). The climate of this subarctic forest is characterized by low precipitation, long, cold winters, and short, warm summers. Large patches of black spruce grow on poorly drained and permafrost soils, whereas the riverbanks and south-facing slopes are patchworks of birch, quaking aspen, balsam poplar, and white spruce. Another characteristic of the boreal forest is lightning-caused fires that find excellent fuel in stands of black and white spruce. In the sequoia, ponderosa pine, and other fire-dependent forests of the Lower 48, light surface fires burn the understory vegetation, but leave the large trees relatively unscathed. In contrast, fires in the spruce stands of the boreal forest tend to be stand-replacing fires that completely burn huge patches of the forest—large trees and all. Blackened, burned trees may remain standing for several years, but most of them are killed by the fire.

Such stand-replacing fires "reset the ecological clock" and replace the spruce with fast-growing herbaceous plants, willows, aspen and birch. In addition to stand-replacing fires and permafrost, the AFCS soon recognized another unique problem of fighting fires in the boreal forest. A fireguard in the Palmer area reported that fires sometimes smoldered for

Figure 1. Map of Alaska showing the location of communities, national forests, and rivers mentioned in the text.
Map by Susan Todd.

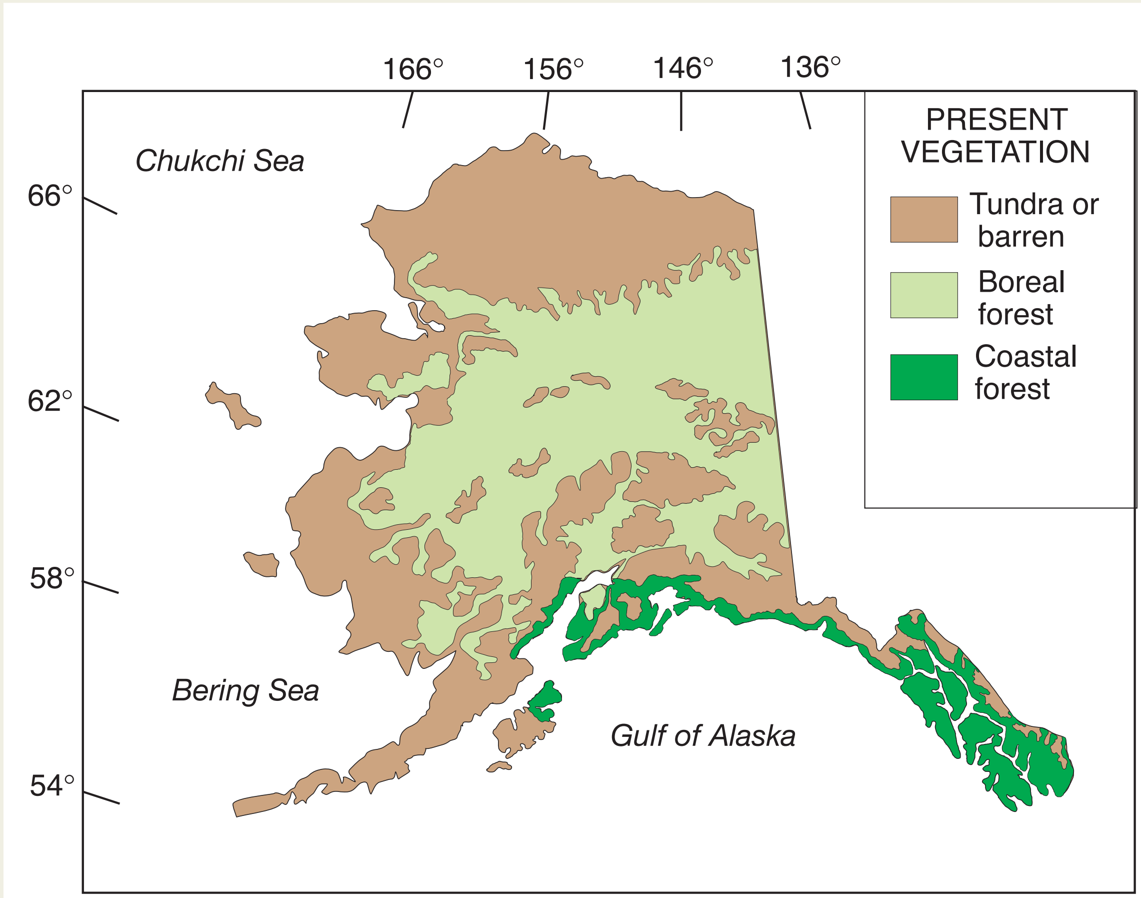


Figure 2. Major vegetation types in Alaska. Map courtesy of the U.S. Geological Survey.

weeks or even months in the deep moss beneath the surface before reemerging during dry weather (Demming 1947). This amazed control personnel who thought they had thoroughly extinguished the fire. To deal with this, the AFCS began using bulldozers to build fire lines around such areas. The bulldozers would strip the vegetation down to mineral soil. If a fire reemerged, the fire line would stop it. These became an effective and common method of creating fire lines (Gates 1948). However, in some areas of Alaska, the underlying permafrost melted after bulldozers removed the vegetation. This, in combination with slow revegetation rates due to the short growing season, caused severe erosion. As a result, the AFCS limited the use of bulldozers to situations where fires threatened human settlements.

3.2.1 *Aircraft are essential*

While controlling fires in the fire-prone boreal forest was a challenge in accessible areas of the state, it was nearly impossible in the vast roadless areas. The roads, firebreaks, lookout towers, and rural ranger stations that provided local access to most areas in the contiguous states were noticeably absent in Alaska. The AFCS needed unique tactics to deal with Alaska wildland fires. It found part of the solution in aircraft (McDonald 1941).

In the contiguous US, the USFS first employed the Army to perform detection flights following World War I (Pyne 1982). This army program ended in 1922, and several years later the USFS replaced it with private contracts (Pyne 1982).

But from its inception, the AFCS program depended on aircraft. Less than one month after the agency was established by Congress, the first AFCS patrol flight on July 28, 1939, spotted a fire near Tonsina Lake located east of Anchorage near the town of Glenallen (Smith 1939). Just two years later, a fire patrol along the Kuskokwim River indicated that planes had already become essential: "it is only through the use of planes that we can hope to make any appreciable gains against the ravages of fires that are rapidly making a truly barren ground of interior Alaska" (Kuskokwim Fire Patrol 1941). From the beginning, the AFCS depended on planes for transport of personnel and equipment, presuppression and detection patrols, and forest surveys.

Despite the obvious need for its own plane, ten years passed before the AFCS was granted adequate funding to purchase one in 1949 (Robinson 1989). Until then, the AFCS had to charter with private pilots, including its own employees who owned planes, for fire suppression duties (McDonald 1943).

Both Alaska and stateside fire control evolved with a strong link to aviation. The difference was that Alaska had no other choice; planes, and later helicopters, were the only efficient means of transportation to the remote locations where the vast majority of large fires occurred. Fire control in Alaska would not have been feasible without aircraft.

3.3 AFCS skeptical of the role of fire

Prior to 1943, the AFCS officially listed all wildfires as human-caused. Reports by fire patrolmen displayed dedication to this view. Leo Rhodes (1939), one of the first fire patrolmen for the AFCS, reported that fires destroyed the aesthetic and commercial values of timber in the territory. "Such destruction can be stopped by throttling our forests' greatest foe—man-made fires" (Rhodes 1939).

The AFCS believed that clearing land for army bases, agriculture, roads and other infrastructure was a major fire hazard (McDonald 1940 and 1941). It also named trappers, miners, and Natives as particularly incendiary groups (McDonald 1940 and 1941). Trappers used fires in hunting furbearers, and also used smudge fires to ward off mosquitoes. Placer miners used fire to clear the vegetation from their claims.

The Kuskokwim Fire Patrol (1941) even suggested photographing trappers in the field to discourage carelessness with fires. If a patrol discovered a fire in an area where a trapper had been photographed a few days earlier, then the photographs could be used to identify the likely culprit (Kuskokwim Fire Patrol 1941). Although residents claimed that lightning started many fires, the agency refused to believe them (Kuskokwim Fire Patrol 1941). The patrolmen thought residents were attempting to cover their own carelessness by blaming wildfires on lightning (Kuskokwim Fire Patrol 1941).

However, other field personnel began to report first-hand accounts of lightning storms. By 1942, some AFCS personnel began to believe that lightning was starting many of the fires in Alaska, but they had a difficult time convincing others (McDonald 1943). It was not until 1943 that McDonald himself acknowledged that lightning ignited fires in Alaska and that Natives and others had sometimes been wrongfully blamed. The AFCS still believed that lightning caused fewer than 25 percent of fires, but this represented a milestone in its understanding of the causes of fire in Alaska.

The recognition that something as uncontrollable as lightning was causing many of the fires had profound implications. The agency had based its entire fire suppression strategy on educating the public about the evils of fire. But if humans were not starting all of the fires, the agency faced a far more onerous task than previously thought.

3.4 AFCS sees values worth protecting

At the turn of the century, foresters in the contiguous states were concerned about a potential timber famine, a concern that increased their desire to control wildfires. During the early 1940s, a similar concern was expressed by Alaska residents. Consequently, the AFCS noted the issue in its annual reports (McDonald 1941; Kuskokwim Fire Patrol 1941).

In a report submitted in 1941, the Kuskokwim Fire Patrol indicated that while some residents seemed indifferent to the occurrence of fires, others voluntarily suppressed them. The fire patrol believed that these divergent attitudes could often be explained by how long the resident had been in Alaska. Long-term residents appeared largely indifferent, while those who voluntarily suppressed fires likely "came to Alaska after the doctrine of conservation had been thoroughly established in the [lower 48] states, and so they learned all the intricate economic and aesthetic aspects of fire prevention before they came here" (Kuskokwim Fire Patrol 1941).

AFCS employees cited what they believed were impacts of wildland fires, including a reduction in furbearers, loss of fuelwood, irregularity in stream flows, and lack of visibility due to smoke (Rhodes 1939, McDonald 1940 and 1941). In an annual report to Washington, DC, McDonald (1941) compared the destruction of natural resources by fire in Alaska to the losses suffered in the west with the end of the frontier. AFCS employees also linked declines in caribou populations to wildfires that burned their winter food sources (Kuskokwim Fire Patrol 1941).

Along with the conservation ethic came recognition of the economic value of the territory's natural resource assets (Rhodes 1939). A very different attitude had developed since 1919 when Parks wrote that the timber in Alaska was not worth the cost required to reduce its destruction by fire. In the 1945 AFCS annual report, McDonald wrote that "present funds will have to be greatly increased if this Service is to keep the annual fire losses at a level which the Territory can afford to lose without depreciating its growing stock of natural resources below the net income-producing level" (McDonald 1945).

Despite the limited capabilities of the AFCS at the time, McDonald (1945) believed that his agency had saved millions of dollars in timber along with "incalculable" aesthetic, recreational, and ecological values. Residents and AFCS employees countered the historical view that the diminutive timber in the territory was worthless and the remaining tundra a wasteland. Wallace Landford, a fire patrolman based in Fairbanks, defended the value of the territory's natural resources, saying, "If the territory is to be developed, it must be from the natural resources" (Landford 1939).

3.5 World War II changes fire suppression

When World War II began, many feared that the enemy would destroy natural resources via incendiary bombs (Robinson 1942). To prevent this, Congress established Emergency Fire Protection (EFP) Funds (Robinson 1942). Congress also appropriated funds for the USFS to study the control of fires near human settlements (Chandler 1963).

EFP funds were the first of many changes World War II brought to the territory. The federal government invested over $1 billion dollars in Alaska during the war years (Naske and Slotnick 1994). Much of this went to infrastructure. In just over nine months in 1942, the US Army built the International Highway through Canada—more commonly known as the Alcan—providing a thoroughfare for military supply transport to Alaska (Naske and Slotnick 1994). Within the state, the Alaska Road Commission constructed another 400 miles of roads (Robinson 1942).

Between 1940 and 1950, the military population in Alaska rose from 500 to over 20,000 people (Naske and Slotnick 1994). The total territorial population stood at over 72,000 by 1940 and rose to almost 128,643 by 1950 (US Bureau of the Census 1941 and Naske and Slotnick 1994). This population growth continued at an average annual growth rate of 9.6 percent between the end of World War II and 1952—when the Korean War began (Naske and Slotnick 1994).

World War II influenced fire suppression in Alaska the way the New Deal influenced fire suppression in the contiguous states. Alaska's frontier atmosphere remained, but the state's key role in the war effort assured that it was no longer a forgotten territory.

3.6 AFCS employs cooperative agreements to its advantage

Both during and after the war, the Alaskan Fire Control Service made cooperative agreements with other agencies and organizations. In an annual report, McDonald (1940) explained the importance of such agreements: "[the level of cooperation] is excellent and it is only through them that this Service has been able to affect the sharp reduction of fire losses since 1940." Not surprisingly, the most significant cooperator with AFCS during this time was the military. Its supply of personnel, aircraft, and equipment were invaluable assets to fire control (McDonald 1943 and Robinson 1989). With bases scattered across the territory, soldiers served as a local source of firefighters. The military provided supplies and food to its troops even when they were under the direction of the AFCS (McDonald 1943). This legacy of military cooperation is still evident today with the Alaska Fire Service headquarters located at Ft. Wainwright, an army base on the outskirts of Fairbanks.

The AFCS identified the Alaska Railroad as both a causative and cooperative organization in fire control. Underpowered engines and low-grade coal necessitated running the engines with forced draft, increasing the chance of sparks and fires (McDonald 1940). Also, this type of engine could not be outfitted with front-end spark arresters that reduced the occurrence of fires (McDonald 1940). The AFCS assigned patrolmen to the railroad to deal with these fires, but on July 1, 1941, the Alaska Railroad assumed responsibility for fire suppression along its route, allowing the AFCS to assign personnel to other areas (McDonald 1941).

The AFCS also entered into cooperative agreements with numerous other federal, territorial, and local agencies to aid in suppression efforts. Alaska Game Commission personnel aided in detection of fires spotted during fieldwork (McDonald 1940 and 1941). Relations with the Alaska Road Commission (ARC) were crucial since the agency often used fire to clear rights-of-way for new highways (McDonald 1940). The Civil Aeronautics Board and private airplane companies provided additional detection capabilities by reporting fires spotted during their normal flights throughout the territory (McDonald 1941). Bus and trucking companies assisted with the transportation of personnel and equipment to fires and between districts (McDonald 1943). The US Weather Bureau was invaluable in providing weather information that helped predict high fire danger and occurrence, as well as fire behavior of existing burns (McDonald 1940 and 1943).

The dependence of the AFCS on other agencies highlighted not only the Service's limitations, but also its resourcefulness. Although the USFS had cooperative and mutual aid agreements with other federal agencies and intermittently with the military, it was not as dependent on these organizations. Cooperation with the military during both world wars provided training for pilots and allowed use of surplus equipment (Pyne 1982). Cooperation with state fire protection agencies was a way to influence state forestry and fire programs with federal forestry practices (Pyne 1982).

A changing of the guard occurred in Alaska fire suppression during this period. W.J. McDonald died in the mid-1940s and Roger R. Robinson became the head the AFCS.

3.7 The Bureau of Land Management assumes control

In 1946, Congressional Reorganization Plan No. 3 merged the GLO and the US Grazing Service into a new federal agency, the Bureau of Land Management (BLM) (Muhn and Stuart 1988). This resulted from a conflict between the Grazing Service and Congress. The Grazing Service wanted to raise grazing fees on public lands, but western senators opposed any increase (Muhn and Stuart 1988). The political debate continued for years and Secretary of the Interior Harold Ickes recommended the merger between the GLO and Grazing Service, hoping to reduce conflict and provide better management of public lands (Muhn and Stuart 1988).

The following year, Administrative Order No. 2, dated February 19, 1947, abolished the AFCS (Johnson 1947 and Robinson 1947). This order called for the duties of the AFCS to be given to a new Division of Forestry under the BLM's Branch of Timber and Resource Management in Alaska. In a letter to the head of the newly established BLM, Robinson (1947) said that he disagreed with the name change. He argued that territorial residents had come to recognize and identify with the AFCS, particularly because the title included "Alaskan." He explained that even though timber management was not explicit in the title, the residents associated the agency with forestry (Robinson 1947). But his arguments did not prevail, and in 1948, the Alaskan Fire Control Service became the Division of Forestry with Robinson as director (Robinson 1949).

Robinson soon realized the loss of the name Alaskan Fire Control Service was the least of his worries. Along with incorporating the AFCS into the BLM, Congress cut its budget by almost 84 percent, from $170,000 to $28,000 (Gates 1948). With such a small budget, Robinson could no longer pay seasonal fireguards. The organization's staff of thirty-one quickly shrank to the mere skeleton unit it had been at the start (Gates 1948).

Also in 1947, a large and much publicized 300,000-acre fire broke out on what was then the Kenai National Moose Range (now the Kenai National Wildlife Refuge). With so few staff, Robinson's Division of Forestry could do little more than coordinate firefighters from the Alaska Road Commission, USFWS, volunteers, and the army (Gates 1948). Popular articles written during this time severely criticized the congressional decision to cut Alaska's fire control budget (Gates 1948).

The last annual report of the AFCS reflected on its seven-year history. The same problems the service had faced since its inception were still present, including difficulty hiring and keeping employees, inadequate funding, and an unfilled need for aircraft. Robinson (1947a) told the director of the BLM that the new forestry division and the BLM "should be leading, planning and assisting the development of Alaska's natural resources; we, at present, are having difficulty in even following the development." He stressed that "until these basic problems have been removed or neutralized, the Service will have no latent reserve, no resiliency, to meet the rapidly increasing external problems."

The "increasing external problems" Robinson referred to included the rapid development of Alaska following World War II. Between 1949 and 1954, the Department of Defense spent approximately $250 million on infrastructure in Alaska. Wages as well as the cost of living skyrocketed as the influx of military money drove the growth of the Alaska economy. In Fairbanks, cabins without running water or electricity rented for $150 per month and union workers throughout the territory made over $3 per hour. Workers from the lower 48 states moved north for these higher wages and employment. From 1940 to 1950, the population of the territory increased 77 percent from 72,524 to 128,643. Between April 1, 1950 and December 31, 1951—a period of just over eighteen months—the population of Anchorage increased a startling 52 percent (Naske and Slotnick 1994).

Far more vehicles were also entering the territory. In July 1946, 376 vehicles passed through the customs station in Tok, but five years later, in July 1951, the vehicle tally had increased twelvefold to 4,467 (Zumwalt 1954). Total road miles almost doubled from less than 2,000 in 1921 to almost 4,000 miles in 1959 (Naske and Slotnick 1994).

In 1950, the demand for homesteads prompted the BLM to provide additional small tracts for this purpose. By 1952, over 1300 tracts became available in the Fairbanks and Anchorage areas (Jorgenson 1952). In 1954, this number was up to 4,321 (Gustafson 1954). The new homesteaders were required to clear their land and, because this involved burning brush, fires were likely to be a problem. The program also added settlements in more remote locations where fires were more difficult to control (Zumwalt 1954).

Someone must have heard Robinson's plea for additional support; in 1949, Congress not only increased the appropriation for the Division of Forestry to $140,000, but also provided emergency firefighting funds (EFF). This allowed the Division to hire additional employees (Robinson 1949). Because the EFF came from a separate account, they did not affect the division's appropriation. In effect, this allowed the division to spend money that was not in its own budget and that had few strings attached.

Also in 1949, amendments to the Territorial Fire Control Act gave the division additional power to prevent and suppress fires (Robinson 1949). The revisions delegated authority to the regional forester of the Division of Forestry to close forest areas to public use during drought and high fire danger conditions (Robinson 1949). Other changes allowed the control of fires on private land when the division or others considered the property owner negligent or incompetent in dealing with fires (Robinson 1949). Such fires could be designated as public nuisances, allowing the Division of Forestry or neighbors to fight them (Robinson 1949). The amendments also shortened the official fire season by moving the beginning date from April 15 to April 30.

Fires northeast of Fairbanks, summer 2004.
Photo courtesy of Alaska Fire Service.

In the Lower 48: The USFS wages 'War on Fire'

Photo courtesy of the Bureau of Land Management.

The analogy between firefighting and combat has a long history that began in the active 1910 fire season that launched the USFS role in organized fire control. Pyne (1982) described the USFS fire suppression organization in the contiguous states during this time as "a paramilitary service of national defense." Now that World War II was over, an all-out war on fire began.

In his book, *Fireline: Summer Battles of the West*, Michael Theole (1995) describes the commonalties between the USFS firefighting forces and the military:

Though its [USFS] leaders never sported collar bars or shoulder stripes, and its troops were never required to salute, it found much to imitate in the military model: bivouacking in remote camps, studying maps and reviewing intelligence from the field, planning flanking attack, taking and holding ground, puzzling out logistical problems, lacing together field communication systems.

Theole's (1995) chapter titles emphasize this analogy to warfare: "The Two-Faced Enemy," "The Armies of Summer," "The Moral Equivalent of War," and "The Fire Generals." In an article in *Wildfire*, Seal and others (1997) list another set of elements common to both war and wildland firefighting, including a hostile enemy, uncertainty, disorder, the human dimension (fear, exhaustion, privation), and danger.

However, this analogy fails in one important point: during war, some casualties are expected in the course of securing the objective. But in wildland firefighting, safety is the primary objective. No burning forest, range, or home is worth the loss of a firefighter's life.

3.8 The number and size of fires in the 1940s

The AFCS fire control policy was to suppress and prevent as many fires as possible using the resources available. Prevention, education, and suppression efforts focused on the major transportation routes between Anchorage, Tok, and Fairbanks (McDonald 1940). Although the AFCS limited fire control efforts to travel corridors, it was still a daunting task for an agency of less than twenty-five people to protect an estimated 2000 miles of roads and trails and 357 miles of railroad (McDonald 1940).

Table 2 and Figure 3 show the estimated number of fires, acreage burned, and number of fires fought during this period. It must be kept in mind that these statistics are estimates based on the AFCS' limited observations. Many additional fires may have burned without its knowledge, and the acreage estimates may have been derived from distant observations of burned vegetation and smoke plumes. These statistics do not include fires on the Chugach and Tongass national forests, which were not under AFCS jurisdiction.

The wide fluctuation in annual acreage burned continues to this day. Although the average area burned during this period was 1.2 million acres per year, in both 1944 and 1945, just over 100,000 acres burned; in 1949 less than 18,000 acres burned. However, the division estimated that both 1940 and 1941 saw in excess of 3 million acres scorched annually. Although the AFCS attempted to take credit for the reduction in acreage burned in the mid-1940s, it was likely a result of the normal fire cycle. A few years of low acreage burned was often preceded and followed by catastrophic fire seasons.

The number of lightning-caused fires reported in Gabriel and Tande (1983) and included in Table 2 for the years 1943-1946 were not included in the division's annual reports. The division did not begin reporting the number of lightning-caused fires in their annual reports until 1947—eight years after the agency's inception. In that year, the annual report estimated that lightning caused 32, or just 20 percent, of the 159 fires. However, this relatively small number of lightning-caused fires accounted for 61 percent of the estimated acreage burned.

Figure 3 indicates that there is no obvious correlation between

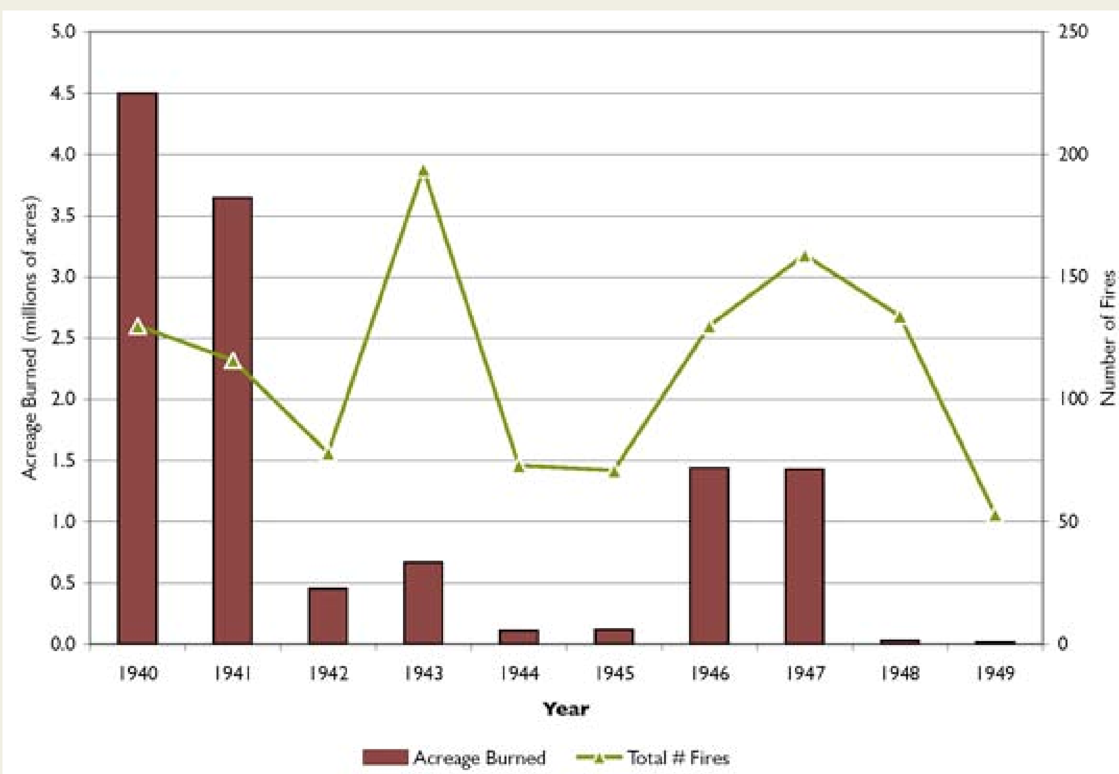
Table 2. Number of fires and acreage burned, 1940-1949

Year	LIGHTNING-CAUSED FIRES		HUMAN-CAUSED FIRES		ALL FIRES	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Number of Human-Caused Fires That Year	Estimated % of All Fires That Year	Total Number of Fires	TOTAL ACRES BURNED
1940*	*	*	130	*	130	4,500,000
1941*	*	*	116	*	116	3,645,774
1942*	*	*	78	*	78	452,510
1943	40	21%	154	79%	194	666,773
1944	18	25%	55	75%	73	110,604
1945	30	42%	41	58%	71	117,313
1946	52	40%	78	60%	130	1,436,597
1947	32	20%	127	80%	159	1,429,896
1948	21	16%	113	84%	134	33,676
1949	7	13%	46	87%	53	17,933
TOTAL	**200**		**938**		**1138**	**12,411,076**
AVERAGE	**29**	**25%**	**94**	**75%**	**114**	**1,241,108**

*For the first three years, lightning was discounted as a cause of fires and none were reported.
Acreages burned by lightning-caused fires were not reported until 1950.
Source: Gabriel and Tande, 1983

the number of fires and the acreage burned. Although human-caused fires were more numerous, human-caused fires burned far less acreage. In hindsight, this is not surprising, since human-caused fires tended to be in accessible areas where they were detected earlier and suppressed more successfully. The division pointed out that lightning-caused fires would continue to be a problem in remote areas because they often went undetected until they were so large that suppression was difficult, expensive, and often futile (Division of Forestry 1949).

Figure 3. Number of fires and acreage burned, 1940-1949



The territorial legislature officially recognized fire control in Alaska on March 26, 1943, with the passage of the AFCS-sponsored 1943 Territorial Fire Control Act, the first fire legislation in Alaska (McDonald 1943). This legislation defined:

> •An official Alaska fire season from April 15 to September 30.
>
> •Misdemeanor fire offenses as leaving a fire before extinguished, allowing a fire on one's land to escape, and failing to assist fire control authorities in suppression when asked to do so.
>
> •Felony fire offenses as "any person who maliciously or wantonly sets on fire any timber, brush, grain, grass, or other inflammable material being or growing on lands not owned, possessed, or controlled by him."
>
> (Alaska Territorial Legislature 1943)

During debate on the bill, lawmakers amended it several times. McDonald (1943) conveyed his unhappiness with the changes in a report to the GLO in Washington, DC, "The deletions were made by persons ignorant of fire control language and activities and who therefore unwittingly and unintentionally removed two or three of the most essential portions of the proposed Act." One deletion was the loss of the word "range." Because range or tundra fires described many fires the AFCS fought, the removal of this specific reference was critical. The territorial legislature also deleted a section of the bill that assumed the accused incendiary party was guilty unless the person proved otherwise (McDonald 1943). The policing power of the AFCS personnel would have been greatly enlarged with the inclusion of this section. McDonald hoped amendments to include these changes would be passed during the next legislative session.

Because of its distance from Washington, DC, and the GLO administrators, the AFCS made numerous requests for greater control over local hiring and fire control actions (McDonald 1941 and Robinson 1989). In letters to the Department of the Interior historian, James Muhn, and to Tom Owen of the Alaska Fire Service in 1989, Robinson (1989 and 1989a) reflected on the difficulty of communicating with the Washington office of the GLO. He stated that the Washington, DC office insisted on making all operational decisions and wanted AFCS personnel to send telegrams asking for permission to hire equipment and even take action on fires. In Robinson's opinion, headquarters did not understand the operational and logistical problems of suppressing fires and obtaining equipment in Alaska. Conveying the realities of fire control in the territory to decisionmakers in Washington, DC was a difficult task that the AFCS often simply ignored during the busy fire season.

The AFCS believed autonomy was essential to its duty to suppress fires in the territory and took as much initiative as it could. McDonald, Robinson, and other AFCS employees essentially created their own agency and operating procedures, constrained only by the funding Congress allotted. Robinson (1989a) described how their unconventional approaches still met basic audit requirements: "it was 1947 when the GAO [Government Accounting Office] made its first audit and was shocked at our free wheeling…[but] they found only one travel voucher mistake of 4 hours which I gladly paid to clear the record."

4. The 1950s

4.1 Changing attitudes toward fire in Alaska

4.1.1 BLM recognizes lightning's role

As discussed in the conclusion of this report, data over the past fifty-four years indicate that lightning has been responsible for 86 percent of the acreage burned in Alaska. But during most of the 1950s, the BLM continued to be skeptical of the role lightning might play in igniting fires in Alaska. The Division of Forestry's 1951 annual report continued to blame humans and, more specifically, Natives for most of the fires: "the Alaskan Native has proven himself to be the most dangerous fire bug that is loose in the Alaska bush today." The division also reported that hunters and trappers, regardless of race, used fire. For example, muskrat hunters lit fires around ponds to drive the animals to open water where they became easy targets. Hunters also burned thick brush to facilitate travel and make it easier to spot game (Zumwalt 1955). The division worried that the increase in tourism during this postwar period would increase the number of campfires and cigarettes that would ignite wildfires along travel routes and tourist destinations (Zumwalt 1955 and Robinson 1949).

Harold J. Lutz, a pioneer of Alaska fire ecology in the 1950s, discussed what he saw as the role of both Natives and whites in starting forest fires in the boreal forest. In a Yale School of Forestry publication, he stated that both groups built fires to ward off insects and to serve as signals, and in some cases they set incendiary fires for enjoyment (Lutz 1959). He observed that both groups used fires to clear land, to facilitate hunting, and to dry fuelwood, and that whites used fires to clear land for placer mining and agriculture (Lutz 1959).

Although the division still focused on human-caused fires, by the mid-1950s the agency recognized lightning's role in starting a significant number of fires. The agency also recognized that, although the number of human-caused fires was often higher than that of lightning-caused fires, the acreage burned by the latter was much greater. In 1959, the division estimated that lightning started 62 percent of the fires, but these were responsible for 97 percent of the acreage burned (Woozley 1960).

Richard Barney, the fire control scientist at the Institute of Northern Forestry at the University of Alaska Fairbanks, completed a study of forest fires in interior Alaska between 1956 and 1965. He found that human-caused fires averaged 165 acres in size, while lightning fires averaged 7,645 acres (Barney 1969). He attributed this to the fact that many of these were in remote areas where they often went undetected until they were too large to fight (Woozley 1960).

Most human-caused fires were caused by homesteaders burning debris (LaDoaquet 1961). Robinson (1960) also reported that tourism rose 30 percent annually after statehood. This, along with the increased use Alaskans made of wilderness areas for recreation, resulted in more discarded cigarettes and unattended campfires (LaDoaquet 1961). As a result, the BLM Division of Forestry expanded its education program in 1961 to include "Smokey Bear" displays and a fire danger meter at the Tanana Valley Fair in Fairbanks (LaDoaquet 1961).

4.1.2 Biologists debate ecological benefits of Kenai Moose Range Fire

Concern about the destruction of valuable timber continued to intensify during this time. In the first work on fire ecology in Alaska, Lutz (1956) stated that "Interior Alaska simply does not have timber to burn," meaning that the Interior could not afford to lose any of its timber. He based this statement on the short growing season, what he saw as the negative effects of fire on game species, and the smoke that hampered tourism and flight operations (Lutz 1956). In the division's 1951 annual report, Robinson described fires as the most destructive force to Alaska's resources, surpassing insect damage and removal for human use.

However, this view was being questioned by an increasing number of biologists, who were beginning to understand the ecological benefits of fire. Although many biologists thought the 1947 fire on the Kenai Moose Range had "decimated" the area's value for moose, subsequent studies caused them to question this assumption. These studies indicated that large areas of burned spruce were coming back in willow and aspen, which moose prefer as a food source (Gates 1948). In 1953, a report by the BLM and USFWS on ways to improve moose habitat concluded that prescribed fire was "the most economical means of providing this vegetation" (Scott et al. 1953).

However, Lutz (1956) countered this claim with his own observations after the 1947 fire. He stated that fires did not always create the desired result. He thought fires always affected wildlife adversely, and he believed that more spruce than willow was returning after the 1947 burn (Lutz 1956). Although research would later prove him to be largely incorrect on both points, Lutz concluded "neither the forester nor the wildlife specialist in Alaska today has the requisite knowledge to enable him to use prescribed burning on anything more than a purely experimental basis" (Lutz 1956).

4.2 Tactical innovations in the 1950s

4.2.1 BLM's fire policy includes more remote areas

Like its predecessor, the AFCS, the fire policy of the BLM Division of Forestry remained similar in that it focused along roads and the railroad. Virgil T. Heath (1951), acting regional forester for Alaska, told the Chief of the Division of Forestry in Washington, DC, that the transportation corridors and adjacent lands in the Anchorage and Fairbanks districts received adequate fire control efforts. In 1951, the Anchorage District considered its entire area as accessible, allowing the division to suppress all fires in the district for the first time (Heath 1951).

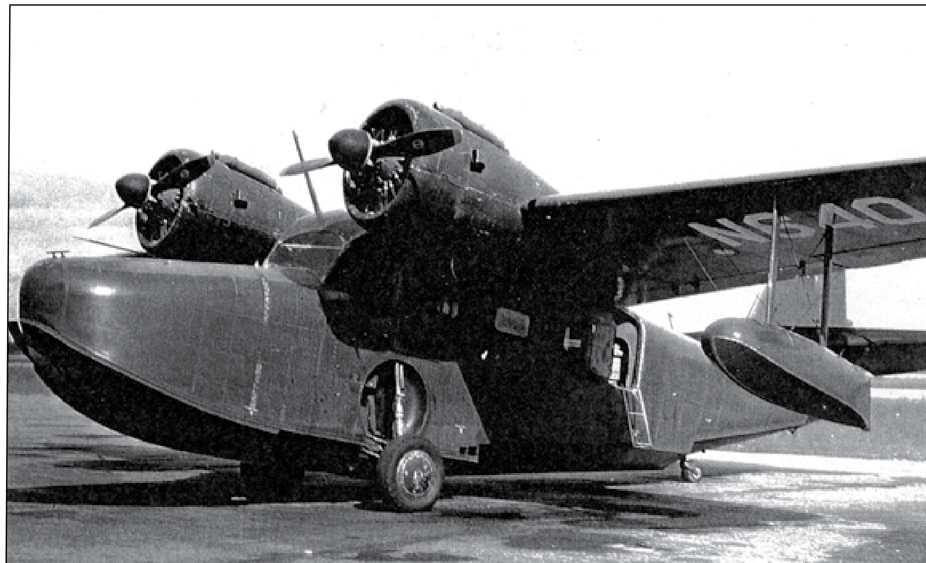
Floatplanes allowed the division to consider lands and settlements in the vicinity of rivers and lakes accessible for fire control (Heath 1951). Firefighters also used riverboats for transportation into more remote areas (Heath 1951). Use of local residents in fighting remote districts became more common in the 1950s. The division employed Cliff Carroll, a Native of Fort Yukon, to detect and report fires (Barr 1953). Carroll also organized emergency firefighting (EFF) crews from the area (Barr 1953). Eight-person crews became the standard composition in Alaska. In more remote areas, crews sometimes spent a month on a fire due to its extent or depth of burning in the moss layer. When supplies ran out, the crews often had to hunt and fish for sustenance (Barr 1953).

Designating fires as unreachable for suppression included economic considerations. When detection occurred after the fire reached considerable size in a remote area, the division did not always allocate resources to control it (Zumwalt 1955). Even though the division could utilize EFF funds, it often deemed the potential costs to be greater than the value of the resources burned (Zumwalt 1955).

4.2.2 Alaska's aviation program develops

The BLM Division of Forestry continued the resourcefulness of the AFCS while concurrently developing its own programs and acquiring necessary equipment. In 1949, the Division of Forestry acquired its first plane, a Cessna 170 (Robinson 1989). It added two more Cessnas the following year, allowing planes to be based in Anchorage, Fairbanks, and McGrath (Robinson 1951). Pilots transported men and supplies, served as fire detectors following lightning storms and as communicators between field personnel and the district (Robinson 1951).

A major addition to the AFCS aircraft fleet came in 1953 when the division bought three Grumman Goose amphibious planes from the Coast Guard (Zumwalt 1955). Because these aircraft could land on water or ground, this purchase made more remote areas accessible for fire control.



Grumman Goose.
Photo courtesy of the Alaska Fire Service

Another significant aviation development was the use of helicopters. The division first used a helicopter on a fire in the McGrath area (Heath 1951). This trial was successful and encouraged the fire control organization. The division expected to employ helicopters in the future to reduce the number of fires that were inaccessible (Heath 1951).

The increasing acquisition and use of aircraft also facilitated a more versatile organization by allowing the establishment of remote camps and rotating staff between districts. In 1951, the Fairbanks District used fire camps equipped with essential supplies (Division of Forestry 1951). Such camps facilitated access to areas with numerous small or large fires. The division also posted fireguards to different parts of the territory as the scale and number of fires dictated (Zumwalt 1955).

Cooperative agreements decreased as the division acquired more equipment and funding to accomplish its fire control duties. The division hoped to attain greater self-sufficiency so that the time and cost of suppression would be minimized (Robinson 1951 and Zumwalt 1955). In particular, the Division of Forestry's reliance on the military diminished (Robinson 1951).

Stateside, the USFS also developed an aviation program that expanded greatly in the 1950s with the addition of military surplus planes (Pyne 1982). However, the USFS was not as dependent on aviation as Alaska, since more roads and firebreaks were available. Most of Alaska was roadless, and any concerted effort to control fires would have to include airplanes.

In the late 1950s, the BLM in Alaska chartered over 100 aircraft per fire season for hauling supplies and personnel to fires (Robinson 1960). These statistics also included helicopters that efficiently transported ground crews and removed smokejumpers from fires. The military's large helicopters had long been employed in Alaska suppression efforts. However, they required frequent refueling, so their range was limited. This was an important factor, because settlements where pilots could refuel were often greater than fifty miles from a fire.

Private and commercial pilots aided in detection efforts by reporting fires on their flights throughout the state (Robinson 1960). Other federal agencies with aircraft also served as mobile fire lookouts. With the highest per capita aircraft ownership in the world, Alaska was a natural setting for an extensive aviation program that incorporated agency, military, and private aircraft (Robinson 1960).

In 1959, the division delineated administrative areas within the Fairbanks and Anchorage districts (Robinson 1960). The Fairbanks District assumed responsibility for fire control north of the Alaska Range; the Anchorage District covered the area south of the range, with the exception of the Chugach and Tongass National Forests, where fire control was carried out by the USFS (Robinson 1960). The BLM also established remote posts at Delta, Central, Chicken, Eagle, Fort Yukon, Galena, Glenallen, Homer, Lake Louise, Manley Hot Springs, McGrath, Northway, Palmer, Skilak Lake, and Tanacross (Woozley 1960).

4.2.3 Smokejumpers arrive on the scene

Smokejumper forces originated with the USFS in the contiguous states in 1940 when it established the first bases in Winthrop, Washington, and Missoula, Montana (Pyne 1982). Pyne notes that these elite firefighters not only made the work more efficient—they also made it more glamorous. The Kuskokwim Area Patrol had first mentioned the possible use of parachutists to control remote fires in Alaska in 1941 (Kuskokwim Fire Patrol 1941), but it was not until 1959 that the BLM Division of Forestry established the first smokejumper force in the new state (Woozley 1960).

In Alaska, smokejumpers significantly affected remote fire suppression. There were sixteen smokejumpers in the 1959 force, and in their first season they fought 34 fires and traveled an average distance of 210 miles to reach these fires (Woozley 1960). The division deemed the experiment successful in addressing remote fires and therefore planned to expand this unit to meet the demands of the peak fire season (Woozley 1960 and Johnson 1960). By 1969, the smokejumper force had nearly fifty employees. Although based in Fairbanks, these highly trained individuals traveled to other administrative areas during periods of high fire danger (Johnson 1960).

The establishment of the smokejumper base in Fairbanks improved the division's fire-suppression capabilities because smokejumpers could quickly reach formerly inaccessible areas. Remote lightning fires could be fought efficiently by smokejumpers if discovered while small. As soon as the division learned of a fire, it dispatched smokejumpers to control it.

The success of the smokejumpers depended on the aviation program of the Division of Forestry for both early detection of and transportation to fires. Unlike the rest of the country, Alaska continues to have virtually no other modes of transportation to remote fires. The state has a limited road system, few logging roads, and very few of the firebreaks commonly found in the backcountry in the contiguous states.

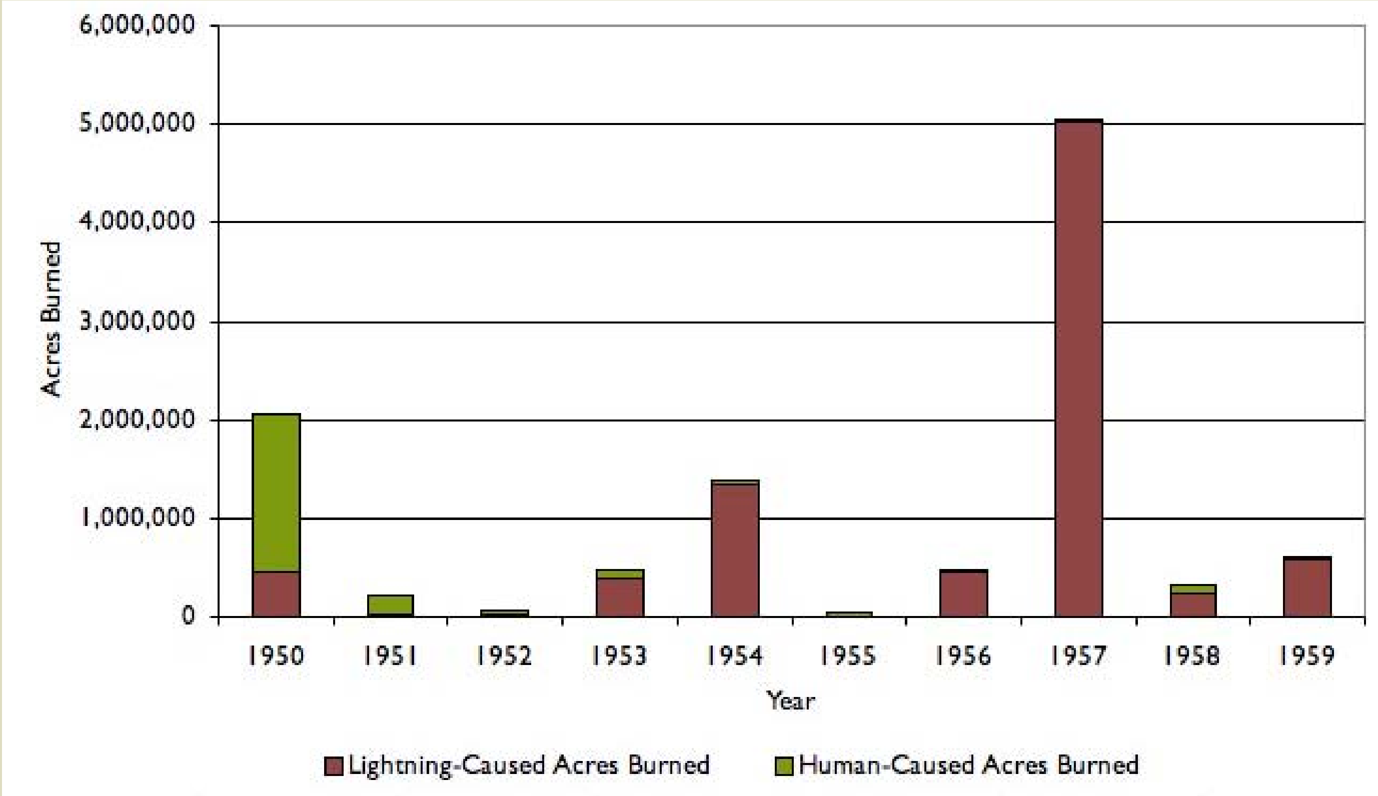
Despite Robinson's frequent disagreements with headquarters, his superiors respected his knowledge and resourcefulness. Robinson expanded the duties of the new Division of Forestry and he became the regional director of the BLM in Alaska in 1954 (Robinson 1989).

Eugene V. Zumwalt (1955), who took over as head of the BLM Division of Forestry when Robinson became chief of the Alaska BLM, wrote in an annual fire report that it was not until 1951 that McGrath had a few employees. Due to the increase in population in the cities, it was not difficult for the Division of Forestry to find seasonal workers in the Fairbanks and Anchorage districts (Bennett 1949 and Zumwalt 1955). However, the other four districts had difficulty hiring personnel, even with adequate funds, because the populations of these areas were small, and people from elsewhere were unwilling to move to these remote locations. (Zumwalt 1955). In 1953, the division provided the Ruby, McGrath, and Holy Cross districts each with a staff of three: a district forester, fire guard, and part-time pilot (Zumwalt 1955).

The Division of Forestry reorganized again in 1957. It dismantled the six-district organization that had existed since 1942 and designated just two operations districts, or field headquarters, in Anchorage and Fairbanks (Robinson 1960). Although it did not explain why it designated Anchorage and Fairbanks as operations districts, the experiences of the Division of Forestry and AFCS give some clues. Since the beginning of organized fire control in Alaska in 1939, Anchorage and Fairbanks had been the only districts consistently staffed. Inadequate funding, transportation, and personnel severely limited the agency's ability to maintain remote stations. The division stored the bulk of its equipment at the military bases near these growing cities.

Smokejumpers land near interior Alaska fire, June 2004.
Photo courtesy of the Bureau of Land Management.

Figure 4. *Estimated acreage burned by cause, 1950-1959*



The duties of the Division of Forestry also included forestry and maintenance of roadside campgrounds (Robinson 1949). Timber management was especially difficult since the division had to develop tree volume tables for the northern forest. Employees spent several years creating these tables that were vital for further forest inventory work. Personnel limitations confined forestry duties to the same areas as fire suppression. Therefore, the concentration of timber sales and management occurred in the vicinity of Fairbanks and Anchorage (Robinson 1949). Robinson notes that unauthorized timber harvesting also occurred in remote areas where no one was available to enforce regulations.

Maintaining the roadside campground system occupied the seasonal fire staff during slow periods (Robinson 1949). The employees built picnic tables, fire rings, and wastewater facilities. The division hoped fire rings would reduce wildfires resulting from campfires (Robinson 1949). The BLM turned many of these campgrounds over to state management in the 1970s.

4.3 Alaska becomes the 49th state

When Alaska became a state in 1959, the BLM assumed a unique fire suppression role compared to that in other states. Other federal agencies and the BLM in the rest of the US had mutual aid agreements with other land managers, but the Alaska BLM served as sole wildfire suppression agency for the entire state, except for USFS lands (Alaska Department of Education 1977). The State of Alaska reimbursed the BLM for its fire control efforts on state lands. It was not until the 1970s that the State Division of Lands and Water began to develop its own fire control capabilities (Alaska Department of Education 1977).

4.4 Number and size of fires by cause

Table 3 presents the fire statistics for the 1950s. Again, the average area burned annually exceeded one million acres, with considerable variation around the mean. Low acreages were still largely a function of favorable weather rather than successful suppression. Ten-year moving averages indicate a gradual increase in the number of fires reportedly due to lightning. It is not clear whether lightning actually ignited a higher proportion of the fires, or if it simply became more acceptable to report lightning (rather than humans) as the probable cause.

The 1950 fire season highlighted the consequences of the forestry division's limited personnel and funding. Only half of the normal precipitation fell that year, creating the worst Alaska drought recorded up to that time (Robinson 1951). Nearly two million acres, an area almost three times the size of Rhode Island, burned in numerous fires around the village of Fort Yukon, home of approximately 500 Athapaskan Indians (*Jessen's Weekly* 1950). The village was considered in danger for several days (*Alaska Weekly* 1950; *Jessen's Weekly* 1950). The smoke made flying dangerous and poor visibility caused at least one plane crash (Gillette 1950). When the

Table 3. Number of fires and acreage burned, 1950-1959

Year	Lightning-Caused Fires				Human-Caused Fires				Totals	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
1950	27	12%	445,595	22%	197	88%	1,612,222	78%	224	2,057,817
1951	27	10%	17,484	8%	244	90%	202,210	92%	271	219,694
1952	11	8%	14,556	20%	125	92%	59,245	80%	136	73,801
1953	75	26%	381,143	82%	210	74%	85,605	18%	285	466,748
1954	63	24%	1,347,990	97%	199	76%	41,930	3%	262	1,389,920
1955	26	14%	10,467	28%	164	86%	26,765	72%	190	37,232
1956	64	28%	446,746	94%	162	72%	29,857	6%	226	476,593
1957	160	41%	5,029,081	99%	231	59%	20,915	1%	391	5,049,661
1958	92	33%	228,648	72%	186	67%	88,567	28%	278	317,215
1959	200	62%	580,830	97%	120	38%	15,744	3%	320	596,574
TOTAL	**745**		**8,502,540**		**1838**		**2,183,060**		**2583**	**10,685,255**
AVERAGE	**75**	**26%**	**850,254**	**62%**	**184**	**74%**	**218,306**	**38%**	**258**	**1,068,526**
Standard Deviation	62		1,520,712		41		492,872		70	1,534,953
Max	200		5,029,081		244		1,612,222		91	5,049,661
Min	11		10,467		120		15,744		36	37,232

Source: Gabriel and Tande, 1983
Note that some of the fire records are known to be missing from the data for 1953 and 1957 (Kasischke et al. 2002).

fires created extremely dangerous conditions, the inability to fly prevented additional Division of Forestry personnel from reaching the area (Gillette 1950). The village survived, but the division reiterated the need to have personnel stationed at the 69-million-acre Fort Yukon forest district (Heath 1951). It believed that if it took action when fires were small, such large uncontrollable fires could be avoided or at least minimized.

The 1950 season also saw an expansion of the fire suppression organization and manpower in Alaska. At one time during that fire season, over 2,000 firefighters were on the fire line throughout the territory (Robinson 1951). This assortment of Division of Forestry, other agency employees, and volunteers represented the largest organized fire suppression effort ever made in Alaska (Robinson 1951). In 1951, reflecting on the past fire season and the improvements made in the past decade, Robinson described forestry division and AFCS achievements as "strides in developing a closer-knit harder hitting fire suppression organization."

4.5 1957 season sets a record

In 1957, a severe fire season again tested the BLM with over 400 fires that burned more than five million acres (Woozley 1960). Stephen Pyne (1982) considered this fire season as important to Alaska fire control as the 1910 fires were to the USFS. However, if any single fire year was responsible for the expansion of the division, it was 1947. Responding to a question regarding the influence of the 1957 season on fire suppression in Alaska, Roger R. Robinson (1989) replied: "Yes, 1957 was a bad fire year... But truly 1947 was the most traumatic."

The EFF fund provided over $1.3 million for firefighting in 1957. With a regular appropriation of only $105,000 per year, reliance on the emergency fund continued after 1957 (Woozley 1960). Annual withdrawals from the EFF fund were consistently over $1 million per year in the coming years.

Herb Stoddard, pioneer in fire ecology.
Photo courtesy of Lenz, Inc. Decatur, Georgia.

"At one time I was classed by many as an enemy of these forests because of my written and spoken insistence that the pine forests not only could be burned over frequently enough to maintain their natural vegetation and associated wildlife but indeed should be burned, for the safety and the healthy development of the forests themselves. I did my part in bringing about 'controlled burning,' or 'prescribed burning,' as a routine practice in large acreages of pineland."

from *Memoirs of a Naturalist*
(Stoddard, 1969)

The new science of fire ecology questions fire policy

Fire Ecology:

The study of the relationships between fire, the physical environment, and living organisms.

Aldo Leopold, known widely as the Father of Wildlife Ecology, began his career thinking that fires were as bad for forests as predators were for game—and that both destructive agents should be eradicated. But Leopold had a remarkable ability to read the land with his own eyes. His observations provided a radical new view of the role of both fire and predators. In 1924, he summarized his emerging view of the "natural" role of fire in an article in the *Journal of Forestry*:

[The Forest Service has] "administered the Arizona Forests on the assumption that while overgrazing was bad for erosion, fire was worse...[but] in making this assumption, we have accepted the traditional theory as to the place of fire and forests in erosion, and rejected the plain story written on the face of Nature. He who runs may read that it was not until fires ceased and grazing began that abnormal erosion occurred (Leopold 1924)).

At about this time, Herb Stoddard, a friend and colleague of Leopold's, began detailed studies of quail habitat in Georgia. He discovered that the exclusion of fire from the pine forests of the coastal plain had resulted not only in poor quail habitat, but also in decreased pine reproduction and an increased risk of large fires. In the 1930s, he experimented with controlled burning, with good results for quail, pines, and wildlife. Leopold was conducting similar experiments with controlled burning at the University of Wisconsin Arboretum, with similar results (Meine 1988, 399).

Leopold and Stoddard were pioneers in understanding fire as a powerful natural factor that could be a major determinant of ecosystem character. Researchers who followed, including Leopold's son, Starker, realized that some ecosystems were adapted to a certain frequency and intensity of fire; these ecosystems would remain in their natural state only if this pattern of fire was maintained.

In such ecosystems, natural periodic fires reduced fuel loads. But excluding fire from such fire-adapted ecosystems allowed fuels to accumulate, creating "dog-hair thickets of conifers" that carried fire so well that catastrophic fires were a definite possibility (Leopold et al. 1963). Department of Interior Secretary Stewart Udall commissioned Starker Leopold and other ecologists to report on wildlife management in the national parks. Their study, known as "The Leopold Report," underscored the importance of restoring ecological processes, including fire. In response to that report, National Park Service policy on fire—as well as other natural disturbances—changed dramatically. Naturally ignited fires were recognized as "natural phenomena" and the use of prescribed fire was accepted as a means of achieving resource and fuel reduction objectives in the national parks.

Beginning in 1962 and continuing until 1975, Tall Timbers Research Station, a private laboratory in Florida, organized a series of highly influential fire ecology conferences. These conferences stimulated and published new research on the beneficial roles of fire along with the potential use of prescribed fire.

In the contiguous states, agencies began to assume suppression responsibility for their own lands. The Wilderness Act of 1964 and the National Environmental Policy Act of 1969 influenced the decisions of federal agencies regarding all actions that adversely affected the environment, particularly wilderness (Pyne 1982). Fire monitoring (also known as "let burn") policies emerged, particularly in wilderness areas, in hopes of creating and maintaining more natural ecosystems. Agencies also aimed at fuel reduction using prescribed fire. Consequently, the focus on suppression diminished as agencies began to understand fire's ecological roles and beneficial uses (Pyne 1982).

But it had taken decades to build a massive fire control organization capable of suppressing fires even in the worst fire years. It would not be easy for such a behemoth to change course.

5. The 1960s

5.1 Tactical innovations in the 1960s

From 1959, when Alaska became a state, to 1969, when the state government began taking an active role in fire control, the BLM Division of Forestry greatly improved its ability to fight remote fires. With the technological improvements that occurred in the 1950s and 1960s, the BLM could fight a remote lightning-caused fire with smokejumpers and retardant before it became too large to handle. The organization also became larger and more dispersed, capable of fighting fires in remote areas devoid of roads and waterways. Suppression innovations, including smokejumpers and chemical fire retardant, were key to enhancing the division's effectiveness.

In the early 1960s, BLM's aviation fleet consisted of four Cessna 180s, three Grumman Goose amphibious aircraft, a DC3, and a F-51 World War II fighter aircraft dubbed "the Pink Lady" because of its unusual color (Robinson 1960). The division used the Cessnas for routine fire detection patrols. Smokejumpers employed the DC3 for transport to fires. The F-51 *Pink Lady* was used for fire detection, providing rapid and extensive coverage following lightning storms.

5.1.1 Chemical retardants and cloud seeding

Over time, weather modification experiments and the use of chemical retardant to control fires developed. In 1958, the BLM initiated chemical fire retardant drops on fires in Alaska, while the USFS introduced them in Oregon. In the first year in Alaska, the BLM "successfully" treated 17 of the 24 fires chosen for this experimental program. A case was reported successful if it slowed the fire's advance to the point where it was safe for firefighters to get on the ground to try to contain the fire (Woozley 1960). Success of this program for the following two years is summarized in Table 4.

Borate, which is a compound of boron and inorganic salts, was the chemical of choice for this retardant. Boron is an essential micronutrient for plants, vital to plant fertilization, seeding, and fruiting. Although it was known that too much of any nutrient can be toxic, borate was considered preferable to its alternatives at that time. Firefighters no longer use borate on wildfires.

One of the primary benefits of chemical retardant was that it could be dropped at a great distance from the Anchorage and Fairbanks Operations Districts. The division used the *Pink Lady* as the lead plane to direct drops, which were made using vintage bombers from World War II (Robinson 1960).

Although the use of borate retardant was a valuable tool, on the ground firefighters were still necessary because chemicals alone usually did not put out a fire (Woozley 1960). With efficient detection through aircraft surveillance and quick dispatch of smokejumpers and retardant, the division now possessed the capability of containing at least some of the remote fires in Alaska (Woozley 1960 and Johnson 1960).

Table 4. Early use of borate retardant in Alaska, 1959-1962

Year	1959	1960	1961
Number of Fires Where Retardant Was Used	n.a.	27	24
Total Number Retardant Loads Dropped	n.a.	176	31
Number of "Successful" Uses	17	25	8
Gallons Used	157,000	162,600	29,800
Average Distance to Fire (miles)	116	186	117
Source of estimates: Woozley 1960, Johnson 1960, LaDoaquet 1961			

Once a fire was contained, emergency firefighter crews could be dispatched to ensure the fire was out.

The BLM cloud-seeding project was also a new approach to wildland fire suppression in Alaska. Research on weather modification began after World War II as part of the research aimed at controlling fires that might be set by enemy incendiary devices. The US fire control organizations, particularly the USFS in the contiguous states, received considerable funding for this experiment (Pyne 1982). At first, the Alaska BLM seeded clouds over fires to induce rainfall, but later it seeded clouds to reduce lightning strikes in storms (Cooper and Heikes 1973). The program began in 1969 and continued for five years, but was costly and ended without conclusive evidence of its effectiveness (Cooper and Heikes 1973).

5.1.2 EFF crews provide a vital manpower

For larger fires, the BLM needed additional, temporary fire crews. Since the 1950s, emergency firefighter (EFF) crews have served this purpose. The EFFs are only paid when they fight fires. Generally, the BLM and other agencies do not use these crews for initial attacks, which are more dangerous, but for tasks such as "mop-up." The objective of mop-up is to extinguish all remaining embers and sparks to keep them from crossing the fire line.

In the 1950s and 1960s, EFF crews were particularly useful for fires in the vicinity of their villages and generally received excellent reviews of their work (Johnson 1960). Firefighting also provided an increasingly important source of income for village residents who had difficulty obtaining employment in their communities. Theole (1995) stated that "in some Alaska villages, the economic benefits of firefighting are so profound that a standard of one crew member per family is imposed."

The BLM Division of Forestry also hired emergency fire-fighter (EFF) crews in the population centers of Anchorage and Fairbanks (LaDoaquet 1961). The Glenallen area used crews varying from three to eight people to suppress roadside fires with the aid of a wildland fire engine containing water (Rungee 1967). The division formed crews of over twenty firefighters to fight more remote and larger fires (Rungee 1968). The BLM also used prison inmate crews on at least one fire in 1965, an idea that developed in California during World War II (McCoy 1965 and Pyne 1982). However, the division did not need prison crews as often as other states, since there were many village EFF crews willing to work.

While village crews were praised, evaluations of urban EFF crews were not always favorable. Harold Sutton (1965) of the Anchorage area Division of Forestry reported "as usual with the Anchorage EFF, they were a problem…two walked off the first night and out of the other ten, none had fire experience to speak of and only about four were willing workers." The division also investigated reports that locals who volunteered as emergency firefighters may have set fires. Because of the wages firefighting provided, incendiary fires may have been common. In Gulkana, the division refused to hire local residents to suppress fires in the area because of such concerns (Rungee 1968). Presumably, residents would not want to start a fire for some EFF crew from another village to put out.

The USFS and state agencies had long used EFF crews in the contiguous states. Pyne (1982) described the dissatisfaction with EFF crewmen prior to the formation of the CCC in the 1930s:

> He offered little more than a warm body—untrained in hand tool use; ignorant of fire behavior strategy and tactics; ill equipped in clothing and footwear; insubordinate by nature and generally unknown to those who worked beside him; of dubious health and not infrequently seized by *delirium tremens* after a morning on the line.

But following the CCC days, agencies recruited a new era of EFF crews predominantly from Indian tribes and the Hispanic community (Thoele 1995). As in Alaska, fighting fires provided an intermittent and valuable source of income. Thoele (1995) stated that "almost uniformly, EFF crews from rural communities of low-income Americans of color" continued to provide a reliable source of manpower for large fires throughout the nation.

5.2 Cooperative agreements continue

Cooperative agreements continued, but Alaska statehood and the division's aircraft program altered the extent and reason for them. In 1959, when Alaska became a state, the Division of Forestry began work on a fire protection agreement with the State Department of Natural Resources (DNR), Division of Lands (Robinson 1960). This agreement delineated the role the BLM Division of Forestry would play in providing fire protection to state lands (Robinson 1960).

Their agreement, the Cooperative Fire Protection Agreement of 1960, specified that the BLM would serve as the fire suppression agency for all public domain, state, and private lands (Alaska Department of Education 1977). The division's role was unique in the US because it had sole responsibility for fire suppression for the entire state, excluding the Tongass and Chugach national forests (Pyne 1982). The rest of the states had a variety of federal, state**,** and local agencies involved in fire protection.

Cooperation with the military continued, but as the military switched to jet aircraft, which are ineffective for most fire work, the division relied on its own aircraft (Robinson 1960). The military still provided large helicopters used to transport crews efficiently to fires (Robinson 1960). The USFS relationship in the contiguous states with the Department of Defense also slowly dissolved as the threat of the Cold War waned (Pyne 1982).

In another cooperative arrangement, the US Weather Bureau provided information on lightning storms or high fire-danger conditions throughout the state. This data allowed the division to focus detection patrols in these areas (Robinson 1960). Cooperative agreements, both written and verbal, remained crucial to the activities of the division to provide fire protection to the state of Alaska.

A plane drops retardant on a wildfire in Alaska.
Photo courtesy of the Alaska Fire Service

5.3 Number and size of fires by cause

As shown in Table 5, the total acreage burned during the 1960s varied from less than 4,000 acres in 1964 to more than 4 million acres in 1969. Although the innovations witnessed during this decade may have reduced the acreage burned during wetter years, they had little effect in dry years or years with severe lightning storms. For example, in the 1969 fire season—the fourth worst fire year on record in terms of acreage burned—over four million acres burned despite the new suppression technology. Lightning-caused fires remained a major challenge. Between 1956 and 1965 the division took action on 69 percent of lightning fires compared to 88 percent of human-caused fires (Barney 1969).

In 1960, Robinson felt that the BLM was capable of suppressing 75 percent of the fires in Alaska (Robinson 1960). The division's goal was to have an annual loss of no more than 100,000 acres. Robinson believed the only hindrance to reaching this goal was limited presuppression efforts. Such efforts would place personnel and equipment in areas of high fire danger before an actual fire, but it was difficult to obtain funding for such efforts.

Burn scar over hills north of Fairbanks.
Photo courtesy of the Alaska Dept. of Fish and Game.

Moose in recently burned area.
Photo courtesy of Alaska Department of Fish and Game.

Figure 5. Estimated acreage burned by cause, 1960-1969

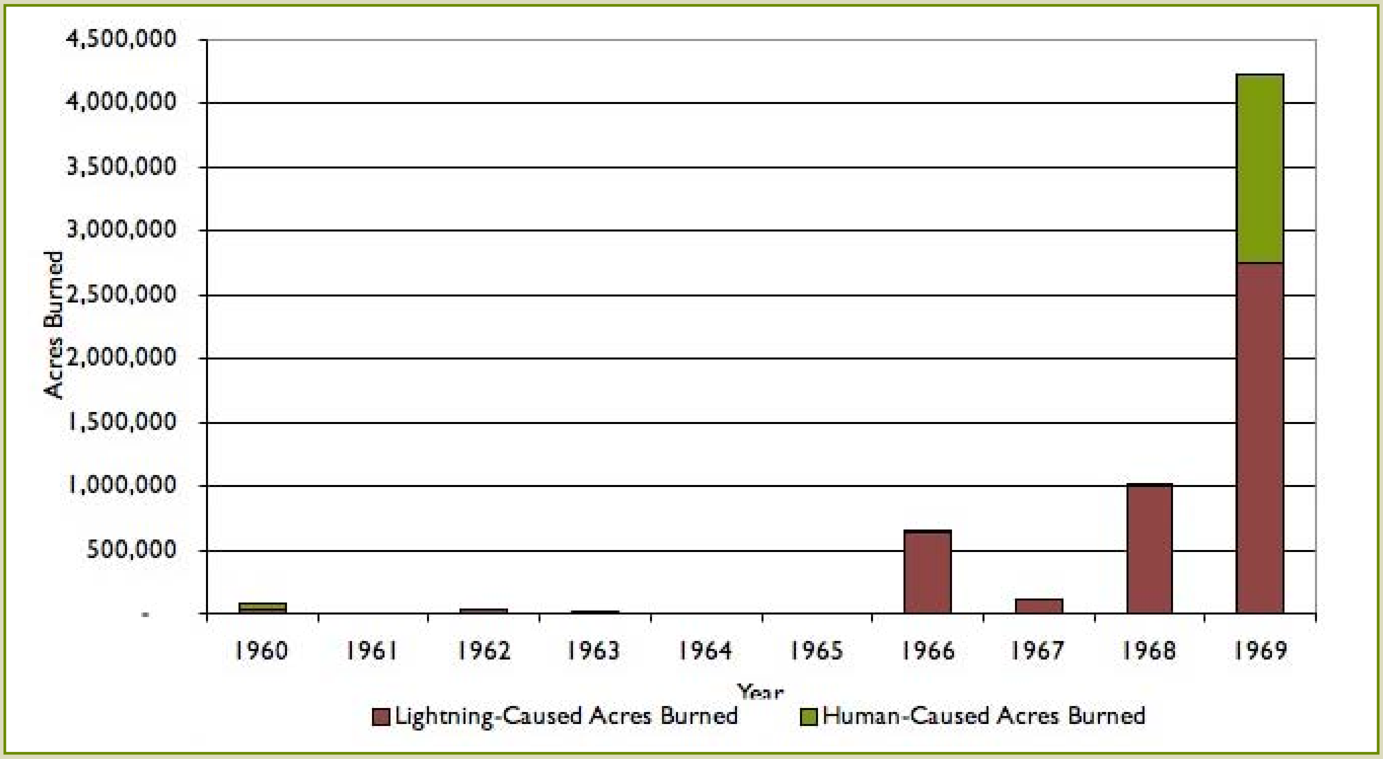


Table 5. Number of fires and acreage burned, 1960-1969

Year	Lightning-Caused Fires				Human-Caused Fires				Totals	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
1960	62	26%	32,657	37%	176	74%	54,523	63%	238	87,180
1961	31	26%	1,283	25%	86	74%	3,817	75%	117	5,100
1962	53	52%	37,828	97%	49	48%	1,147	3%	102	38,975
1963	79	41%	13,859	85%	115	59%	2,431	13%	194	16,290
1964	63	38%	2,430	71%	101	62%	1,000	29%	164	3,430
1965	30	20%	2,918	41%	118	80%	4,175	59%	148	7,093
1966	73	22%	643,205	98%	251	77%	11,234	2%	324	645,439
1967	76	35%	104,162	96%	139	65%	4,843	4%	215	109,005
1968	265	59%	1,008,911	99%	180	40%	4,310	1%	445	1,013,301
1969	126	24%	2,756,279	65%	389	76%	1,475,541	35%	515	4,231,826
TOTAL	858		4,603,532		1604		1,563,021		2462	6,157,639
AVERAGE	86	34%	460,353	71%	160	65%	156,302	28%	246	615,764
Standard Deviation	69		877,053		98		463,813		140	1,315,777
Max	265		2,756,279		389		1,475,541		515	4,231,826
Min	30		1,283		49		1,000		102	3,430

Source: Gabriel and Tande, 1983

Note that some of the fire records are known to be missing from the data for 1967 and 1969 (Kasischke et al. 2002). However, this does not explain the record low fire years of 1961, 1964, and 1965.

Ecological benefits of fire in the boreal forest

Although fire has many "benefits," it is important to point out that fire itself is neither good nor bad. It is simply a natural occurrence in the boreal forest. Also, regardless of the pros and cons of fire, the question is not if a boreal spruce forest will burn, but when. A given stand of spruce in the boreal forest will burn every 50 to 150 years, and some areas burn even more frequently. This is inevitable in a fire-driven ecosystem.

Benefits to wildlife

- Although there is little, if any, food and cover for most wildlife immediately after a fire, vigorous new vegetation begins growing within a few weeks after most fires. The pioneer species that grow following a fire tend to be both more productive and more nutritious than the mature coniferous forests they replace.
- The most important effect of fire on wildlife in the boreal forest is that it creates and maintains a natural mosaic of forest ages and types. Fires can be patchy, burning one area and skipping the next, resulting in a mix of different habitat types ideal for wildlife.
- Contrary to popular belief, few large mammals are killed in fires; most leave the area as soon as they sense a fire. Also, many wildlife populations benefit in the long run from the more productive habitat, even if some individual animals do not escape the fire.
- For birds of prey, recent burn areas are good hunting areas.
- The shrub stage after a burn provides abundant cover for small mammals such as voles and hares, which are food for larger animals such as owls and foxes.
- Trapping and hunting for many species is generally better in recently burned areas (within five to ten years after a fire).
- Fires leave substantial debris that provides structure. Dead and downed trees, cavity trees and debris on the ground provide habitat for small mammals, songbirds, and furbearers.
- Some species prefer mature forests and are therefore harmed by fire, but most species benefit from the effects of fire. Species that benefit from fire include (but are not limited to) moose, bears, lynx, voles, beaver, snowshoe hares, sharp-tailed grouse, ruffed grouse, rough-legged hawks, red-tailed hawks, American kestrels, black-backed woodpeckers, three-toed woodpeckers, hairy woodpeckers, northern flickers, swallows, robins, yellow warblers, orange-crowned warblers, Wilson's warblers, white-crowned, golden-crowned, Lincoln's, and Savannah sparrows, and dark-eyed juncos.

For further information on how fire affects different species of wildlife, go to http://www.wildlife.alaska.gov/education/community_ed/fire6.cfm and click on "Effects of Fire on Wildlife Populations" (pdf file).

Benefits to the forest

- Fire reduces fuel continuity and sets succession back to an early stage. Plant diversity and productivity are greatest in the decades after a fire. In contrast, a climax black spruce forest is not as diverse or as productive as earlier stages of succession.

Aspen regeneration just two months after a prescribed burn in early spring.
Photo courtesy of Tom Paragi, Alaska Department of Fish and Game.

• Fires perpetuate the natural mosaic of forest types. Large expanses of any one forest type lend themselves to rapid spread of pathogens and insect infestations, especially if the plants are old or otherwise stressed.

• Old trees are more susceptible to fire, so the forest that develops after a fire is younger and of different composition than the surrounding forest. Young, vigorous trees are less susceptible.

• The black spruce forests of interior Alaska are different from the "park-like" forests of Ponderosa pine or sequoias in the Lower 48. Although each of these species evolved with fire, natural Ponderosa pine and sequoia forests have frequent, low-intensity surface fires that remove the underbrush with little effect on the fire-resistant mature trees. This leaves an open, park-like understory. But fires in black spruce stands tend to be so intense they kill almost all the vegetation—trees included—resulting in complete stand replacement.

• Black spruce forests are an ideal fuel for spreading fire. They have resinous needles, considerable pitch in their wood, and dense branches that go all the way to the ground. These branches serve as "ladder fuels" that allow fires to climb to the tops, or crowns, of the trees. Fires in black spruce can quickly become "crown fires" that reach the tops of the trees. Once in the crown, the fire intensifies and spreads rapidly. In contrast, deciduous trees such as birch and aspen do not have resinous needles or dense branches near the ground and are therefore not as prone to intense fires as black spruce. Even fires in white spruce often do not crown, because white spruce trees, unlike black spruce, often do not have many branches near the ground and the resin content in the needles is lower than in black spruce.

• A mature black spruce forest has a shaded understory, with moss and lichen on the ground surface above a relatively deep organic layer, and a shallow active layer (where permafrost is often near the surface). The resulting cold, wet soils slow nutrient cycling. When fire removes the overstory vegetation, sunlight warms the ground and speeds up plant growth and nutrient cycling.

• Fire does not "destroy" the forest; it changes the forest temporarily, but a new forest grows back. Paving and urban development, on the other hand, do destroy forests.

• Fire returns some nutrients to the soil (although others, particularly nitrogen, are volatized).

• Depending on its severity, fire consumes some of the thick organic layer in a spruce forest, exposing the mineral soil essential for spruce (as well as many other seeds) to germinate. Fire also provides fertilizer in the form of ash.

• Black spruce are partially dependent on fire to reproduce. Although they dispense some seeds without a fire, their cones open fully after being scorched by a crown fire.

• Morels, highly prized gourmet mushrooms, are often plentiful after wildland fire.

• Fire helps prevent many pathogen and insect attacks because it encourages plant diversity in an area (although fires can also attract other insects and pathogens that depend on recently burned forests).

• Allowing some fires to burn restores a more natural disturbance regime, which is conducive to greater biological diversity.

• By replacing patches of highly flammable black spruce with less fire-prone deciduous trees and shrubs, fire forms a discontinuous fuel source. These breaks in the climax vegetation provide a measure of protection from the unmanageable, costly, and dangerous fires that can occur in continuous black spruce forests.

Dense branches that go all the way to the ground serve as "ladder fuels" that allow fires to climb to the tops of black spruce trees.
Photo courtesy of Alaska Fire Service.

6. The 1970s

In the 1970s, the passage of two major land laws and the emergence of a state fire control organization were major influences on fire policy in Alaska. The state, as well as the nation as a whole, took steps toward making fire management, rather than fire control, the focus of their efforts.

6.1 Fire control vs. fire management

In 1971, a conference entitled "Fire in the Northern Environment" was held in Fairbanks, Alaska. This meeting was the first effort in Alaska to bring together resource managers, fire control specialists, scientists, and private citizens to explore some of the ramifications of wildland fire, its control and its role in the boreal forest ecosystem.

In his keynote address to the conference, Ed Komarek (1971), made a clear distinction between fire management and fire control. This is the first mention of such a distinction in the Alaska fire literature, although the term fire management must have been in use prior to this.

Komarek pointed out that fire control consists primarily of fire suppression techniques, but fire management is "much more than fire control…. It includes fire prevention as well as an understanding of fire ecology" (Komarek 1971).

Although we do not know when this term first appeared, Stephen Pyne pointed out that by 1974 *fire management* had entered official vocabulary, rapidly replacing *fire control* and *fire protection* (Pyne, personal communication, May 2, 2004).

Fire control refers to the prevention, detection, control, suppression, and extinction of fire. Fire management, on the other hand, includes the activities associated with fire control—and much more. It refers to "all activities associated with the management of fire-prone land, including everything from fire suppression to the use of fire to meet land management goals and objectives" (New Zealand Rural Fire Authority 2004). The objectives of fire management include:

1) produce defensible space: reduce fuels near human habitation, private property, timber stands, etc. to make fire suppression easier where it is desired;

2) maintain forest health and regenerate forests (using timber harvests in settled areas and fire in remote areas that are not likely to be harvested during next rotation);

3) maintain wildlife habitat.

The change in terminology from fire *control* to fire *management* reflects a sea change in the way many agencies think about their task. Eradicating fire was not only undesirable, it was also unlikely to be successful. Many managers were coming to the conclusion that it was time to try to live with fire rather than strictly fight it.

But for those who had spent their lives waging war on every conflagration, the simplicity of fire control had much more appeal than fire management. Fire *control* did not equivocate; it offered a clear goal against a clear enemy, it defined good guys and bad guys, right and wrong. Fire *management*, in comparison, was as ambiguous as fire control was clear. Dealing with fire had lost both its innocence and its simplicity.

This new complexity was surely also a reflection of the times. From Vietnam to atomic energy, it was no longer so easy to know the "right" course of action. Action itself, a hallmark of American tradition, was brought into question. The world was changing.

6.2 Administrative changes

6.2.1 State of Alaska assumes a role in fire protection

In the 1970s, the State Division of Lands and Water began developing its own fire control capabilities. Statehood allowed Alaska to qualify for federal assistance to states for wildfire control (Alaska Department of Education 1977). The USFS was critical because it was the premier US fire control agency and Congress therefore designated it as the primary agency to implement suppression legislation. Without the presence of the USFS in Alaska, these benefits would have been more difficult for the state to acquire.

Two acts in particular provided a vital source of funding and technological assistance to state and local fire control agencies. The Clarke-McNary Act of 1924 provided for USFS cooperation with states and allowed federal funding of state fire control efforts. The Rural Development Act of 1972 empowered the USFS to provide financial, organizational, and educational assistance to rural fire agencies. This act applied to towns of less than 10,000 residents, which described the majority of settlements in Alaska (Alaska Department of Education 1977).

Although the financial assistance was important, it still took several years for the state to assume responsibility for fire suppression. The process began in 1973 when the state assumed responsibility for fire suppression in southeast Alaska (Alaska Department of Education 1977). Because of the wet climate and the fact that the majority of this area was under the management of the USFS, few fires occurred within the State's jurisdiction. In 1976, the state added the Kenai Peninsula and the Anchorage bowl to its jurisdiction, both of which had higher fire potential than southeast Alaska. By the 1977 fire season, the State Division of Lands and Water provided fire suppression for both state and private lands near population centers and along the road system south of the Alaska Range (Alaska Department of Education 1977 and Resource Planning Team no date [all subsequent references to this document appear as RPT n.d.]). In 1981, the Alaska Department of Natural Resources (DNR) Division of Forestry was formed. It assumed the fire protection duties when it split from the Division of Lands and Water.

6.2.2 Alaska managed by geographic, not land ownership, boundaries

When the state established its own fire suppression organization, it decreased the BLM's responsibility in Alaska. With the exception of the Tongass and Chugach national forests, the state essentially took over fire management duties for public lands south of the Alaska Range, while the BLM assumed responsibility for public lands north of the Range. Duplicate coverage by the state and BLM did not occur and there was also little overlap of available forces (Alaska Department of Education 1977). This reduction resembled the diminishing role of the USFS in fire control in the contiguous states as other agencies assumed protection for their own lands (Pyne 1982).

However, Alaska's geographical separation of responsibility without regard to ownership boundaries, was unique in US fire control. In the contiguous states, each agency maintained fire protection within its own jurisdiction. The size of Alaska likely played a role in developing this geographic division. In order to address the complex mosaic of land ownerships, both organizations would have needed much larger forces and expenditures.

The division between the state and the BLM in Alaska also allowed each agency to tailor its resources accordingly. As the State Division of Forestry assumed responsibility for the more populated and accessible areas, the use of BLM helitack and roadside crews decreased and the BLM eventually eliminated both programs. The BLM relied more on smokejumpers, while the state relied on roadside crews and helitack.

6.2.3 "Division of Forestry" becomes "Division of Fire Management"

The BLM fire suppression organization also experienced two significant name changes in the 1970s. First, the BLM Division of Forestry became the Division of Fire Control in 1970 (Fairbanks District Office, no date [All subsequent references to this document appear as FDO n.d.]). Because fire control duties occupied the majority of the Division of Forestry's time and resources, the name change simply reflected this focus.

The name changed again in 1977 when the Division of Fire Control became the Division of Fire Management (FDO n.d.). This title reflected the research in fire ecology demonstrating that fire was a natural phenomenon that was not "all bad" (FDO n.d.). In the 1980s, this new philosophy greatly influenced fire suppression policy throughout the nation.

The BLM fire suppression organization remained with operation districts in Fairbanks and Anchorage throughout the 1970s. However, subunit boundaries within these districts changed twice, in 1973 and 1978 (FDO n.d.). The division formed several areas out of each district to facilitate stationing of personnel and rapid fire control. The AFCS had attempted this dispersal of forces in 1942 with little success due to the funding and personnel constraints during that time.

The more remote areas of the state also received additional facilities and staging areas. Bettles, Central, Chicken, Dahl Creek, Delta, Eagle, Fort Yukon, Kotzebue, Nome, Northway, Tanacross, and Tanana served as intermittent bases or staging areas (FDO n.d.). These temporary facilities were critical during periods of high fire activity or frequent lightning to pre-position aircraft, smokejumpers, and other suppression forces. These field offices served to speed up the response to fires while they were small and tactically and economically controllable.

6.2.4 Tactical innovations 1970-1979

The Division reassessed its tactics after the very active 1969 fire season when over 4 million acres burned (RPT n.d.). It insisted that additional quick response firefighters were essential to contain fires while they were small. The BLM responded by giving the division additional specialized firefighters, expanding existing programs and new technology.

6.2.4.1 Helitack units created

In 1970, the US Congress allocated $500,000 to Alaska's BLM, which it used to organize helitack units composed of a helicopter, pilot, and firefighters (FDO n.d.). The advantage of helicopters was their instant readiness to respond to fires with a crew and gear (BLM 1970). The firefighters could size up the fire before landing and the helicopter could be equipped with a bucket to drop water on fires (BLM 1970).

The use of helicopters in fire control increased greatly in the Lower 48 during the 1970s (Pyne 1982). Because helicopters did not require a landing strip and could fly in higher winds, they could be used in a wider range of circumstances than fixed wing aircraft (Pyne 1982). The organization of these helitack crews of two to sixteen firefighters evolved from the organized crews that had existed for many years throughout Alaska (BLM 1970). The division assigned helicopters and crews to units throughout the state and easily moved them as fire occurrence and weather dictated.

However, the fuel constraints of helicopters restricted their use to within 100 miles of their base (FDO n.d.). This was not a drawback in the contiguous states, but it presented a problem in Alaska where many of the fires were more than 200 miles from the base. Smokejumpers were more efficient than helitack crews on these remote fires (FDO n.d.).

6.2.4.2 Smokejumper program expands in Alaska

In his book, *Fire in America,* Pyne (1982), questioned the value of smokejumpers in a more developed country where agencies were beginning to let fires burn in remote areas. Although jumpers had been useful in "romanticizing and publicizing fire control to the public," Pyne (1982) stated "the smokejumper concept may have exhausted itself." In Alaska, however, the smokejumper program continued to expand in the 1970s.

The Alaska Smokejumpers were the backbone of the Alaska BLM fire suppression organization through the 1970s. The Fairbanks District—the only smokejumper base in Alaska—hired 44 smokejumpers in 1970, and increased this to 95 by the end of the decade (FDO n.d. and Alaska Smokejumpers 1998). The BLM also experimented with new and faster aircraft for transport, thereby improving the efficiency of the smokejumper program (FDO n.d.).

In 1977, during a severe fire season, when over two million acres burned, they jumped 291 fires. As of the 2003, this record still stood as the most active fire season for smokejumpers. The BLM also experimented with new and faster aircraft for transport, thereby improving the efficiency of the smokejumper program (FDO n.d.).

6.2.4.3 Fire crews become more diverse

Although it had employed Native Alaskans for years as emergency firefighters, the division formally organized Native Alaskan crews beginning in 1970 (BLM 1970). These crews provided trained personnel in remote areas who could respond quickly. The contiguous states also frequently requested crews that BIFC filled in part with Alaska Native EFF crews.

Native EFF crews began in the contiguous states in 1948 when the Mescalero Red Hats, the first Native crew, started fighting fires (Theole 1995). The Southwest Forest Firefighters program, largely composed of Native Americans, developed in the 1950s and now trains over 1200 firefighters annually (Pyne 1982 and Theole 1995). This employment continues to be an important source of wages in remote villages in Alaska and throughout the states (BLM 1970).

Author Michael Theole (1995) in his *Fireline: Summer Battles of the West*, describes the commonly told story of the first female firefighter hired in the US, coincidentally in Alaska. Legend has it that this unknown woman was hired in 1971, but fired the first day when the crew boss realized "the awful truth of inferior gender" (Theole 1995). According to the story, the firing led to a public outcry—and the first all-woman fire crew. Although Theole was unable to verify this as the reason for its formation, he did confirm that the first all-female firefighting crew in the country started in Alaska in 1971 (Theole 1995).

Villages throughout Alaska provided hundreds of women firefighters in the 1970s. In 1972, the Division of Fire Management hired 270 female firefighters and the following year remote villages provided over 200 female firefighters (RPT n.d.). In the contiguous states fire agencies did not hire female firefighters until a year or two later (Theole 1995). By 1978, female firefighters moved beyond EFF crews to find spots on hotshot crews. Despite much dissent in the ranks of smokejumpers in the contiguous states and Alaska, the USFS in McCall, Idaho, hired the first female smokejumper in 1981 (Theole 1995). Today, female smokejumpers are not unusual.

Another development in the BLM Division of Fire Management was the establishment of the first Alaska hotshot crew in 1977 (FDO n.d.). Alaska's reliance on smokejumpers and EFF crews likely slowed the introduction of hotshot crews, which had been used in the Lower 48 since 1939. However, after the creation of this first crew in 1977, the hotshot program expanded to include three 20-person crews by 1998 (FDO n.d.).

Theole (1995) describes hotshot crews, also referred to as Type I crews, as the "shocktroops of wildland fire" and "chasers of conflagrations." The idea to employ them began in the contiguous states in 1939 with the organization of forty-person crews and culminated with the forest service interregional crews in 1961 (Pyne 1982). Hotshot crews are regimented groups of about 20 people employed during the fire season on a full-time basis. They generally work on the largest fires and their quality of work and high degree of discipline often separates them from the temporary EFF crews. Supervisory fire personnel assign them the more difficult and dangerous

A hotshot crew pauses from its work setting a backfire.
Photo courtesy of Alaska Fire Service.

tasks. While not on fires, they generally complete project work involving arduous outdoor labor, and they participate in a strenuous physical fitness program.

6.2.4.4 Division installs lightning detection units and experiments with aerial backfiring

The expansion of the BLM suppression program depended on the simultaneous advancement of aviation, a long-standing and vital part of fire control in Alaska. In 1973, the BLM formally organized the aerial fire detection program (FDO n.d.). By 1978, the BLM had dedicated twelve aircraft solely to fire detection. The six aircraft used by the smokejumper program assisted with this task (FDO n.d.).

Innovations in lightning locators and radar further improved the detection program. In 1975, BLM installed lightning detection systems in the Great Basin of Nevada, Utah, southern Idaho, and western Colorado. The same year, the Fairbanks District installed the first lightning detection system in Alaska (FDO n.d.). The success of the first season with lightning detection units led to the addition of four more the following year and a total of eight units by 1979 (FDO n.d.). This program allowed the division to identify clouds producing ground lightning strikes (FDO n.d.). The division's reconnaissance flights then focused on these specific areas, providing a much more efficient method of detection. Over fifty remote weather stations provided vital weather information around the state to the BLM for use in calculating fire danger and behavior (FDO n.d.).

Another change in strategy during this period was the aerial backfiring program that began in 1972 (FDO n.d.). This method involved dropping incendiary grenades from a helicopter or fixed-wing aircraft to create a fire line that would have been too time consuming or dangerous for ground personnel to construct (FDO n.d.). The division also experimented with explosives on the fire line in the late 1970s and early 1980s to create more extensive fire lines with minimal time and labor (FDO n.d.). The BLM discontinued most of these experimental techniques in the 1980s due to both their ineffectiveness and their safety risks. However, they used fire line explosives on the 1990 Tok Fire, but had problems with permafrost melting where the insulating mat was blown away (Dale Haggstrom, personal communication, June 2005).

6.2.4.5 Use of bulldozers criticized

Fire suppression and management techniques did not go unquestioned. Fire control techniques, particularly the use of bulldozers, have long been criticized in Alaska (Sykes 1971; DeLeonardis 1971). Bulldozed fire lines require years to revegetate; in alpine areas the damage can be permanent. Dozer lines create access routes for off-road vehicles and cause an increase in siltation of streams, adversely affecting fish spawning areas (DeLeonardis 1971). Also, once bulldozers remove the vegetation in permafrost areas, the ice melts, leading to significant erosion and large gullies that can exceed 20 feet in depth (RPT n.d., DeLeonardis 1971).

Fire suppression tactics attempt to use less intrusive methods when possible, including natural barriers such as large rivers (DeLeonardis 1971). When agencies deem bulldozer lines necessary, rehabilitation of the line, including seeding after control of the fire, is increasingly common, although some still feel that bulldozers are used more often than necessary and that revegetation efforts are inadequate.

6.3 Economic and environmental concerns influence fire policy

The BLM fire suppression policy remained essentially the same: attempt to suppress all fires. The primary exception was during severe lightning storms when the number of fires pushed the resources of the Division of Fire Management to its limits. To prioritize suppression efforts, the division assessed these fires according to 1) their proximity to towns and villages; 2) the tangible and intangible resource values affected; and 3) the number of personnel available to fight them (Richardson 1971).

The Alaska Fire Attack Policy and Fire Control Action Plan ostensibly allowed for varying degrees of suppression based on the values at risk (RPT n.d. and Richardson 1971). However, the division worried that if fires were allowed to burn on lower-value lands, they could easily cross into valuable areas. Thus, in practice, the division sought to fight fires immediately after detection even on lower-value lands (RPT n.d.; Richardson 1971). For the most part, fires were only allowed to burn when there were simply too many for the division to fight. For example, in July 1972, 387 lightning fires occurred during a one-week period (RPT n.d.).

6.4 Land laws influence fire policy

6.4.1 Alaska Native Claims Settlement Act of 1971 (ANCSA)

The 1970s saw significant and management changes throughout Alaska. The civil rights movement and the desire to construct a trans-Alaska pipeline through lands claimed by Native tribes made it necessary to settle the Alaska Native claims (Naske and Slotnick 1994). The Alaska Native Claims Settlement Act of 1971 (ANCSA) attempted to find a solution.

The ANCSA provisions included an end to Native claims in return for $1 billion and a 40-million-acre land grant given to twelve regional Native corporations. In addition to the land grants, this act affected the BLM because it also authorized the Secretary of the Interior to consider up to 80 million acres of federal public lands for additions to other national land management agencies (Naske and Slotnick 1994).

The passage of ANCSA and application of federal land management agencies for additional lands fueled an Alaska debate between conservation and development advocates that drew national attention (Naske and Slotnick 1994 and Coates 1991). The development interests favored management by agencies with multiple use mandates such as the USFS and the BLM. Conservationists countered with desires for management by the NPS and USFWS, agencies with more specific mandates. Conservationists also wanted significant acreage designated as wilderness under the Wilderness Act of 1964 (Naske and Slotnick 1994).

The BLM was not able to apply for any of the acreage because at the time, it was a land disposal rather than a land management agency (Naske and Slotnick 1994). The Federal Land Policy and Management Act of 1976 finally provided the BLM with a mission statement, giving it authority to manage its public lands according to multiple use and sustained yield principles (Muhn and Stuart 1988). However, this came at least five years too late for the BLM to submit timely proposals for lands to be maintained under its management (Naske and Slotnick 1994).

During this time, the issue also evolved into a debate over national versus state interests. The state wanted to be able to extract resources from its lands to bolster its natural resource-based economy, but there was national pressure for conservation and preservation (Naske and Slotnick 1994 and Coates 1991). The battle continued until 1978, the deadline for settling this land issue, and the US Congress reached an impasse. Because Congress failed to settle the issue, President Carter designated 56 million acres as national monuments and 40 million acres as wildlife refuges in an emergency measure in 1978 (Naske and Slotnick 1994).

6.4.2 The Alaska National Interest Lands Conservation Act of 1980 (ANILCA)

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) passed in the last hours of the Carter administration. It allocated 104.1 million acres to conservation systems (see Table 6). It also designated 57 million of these acres as wilderness under the Wilderness Act (Naske and Slotnick 1994). ANILCA also extended the time for the state to select its statehood lands (104.5 million acres) from 25 to 35 years (Naske and Slotnick 1994). The BLM assumed management for 61.4 million acres of these conservation lands (Naske and Slotnick 1994). The resulting mosaic stood in sharp contrast to the days when the General Land Office managed virtually all of Alaska. It took many years for the land conveyances to be made, a process that continues to this day. But much of the land was conveyed from the BLM to its new owners by 2000. To more closely reflect the final result of these land acts, Table 6 compares ownership in 1960, before the land acts, to that of 2000, after much of the conveyances were complete.

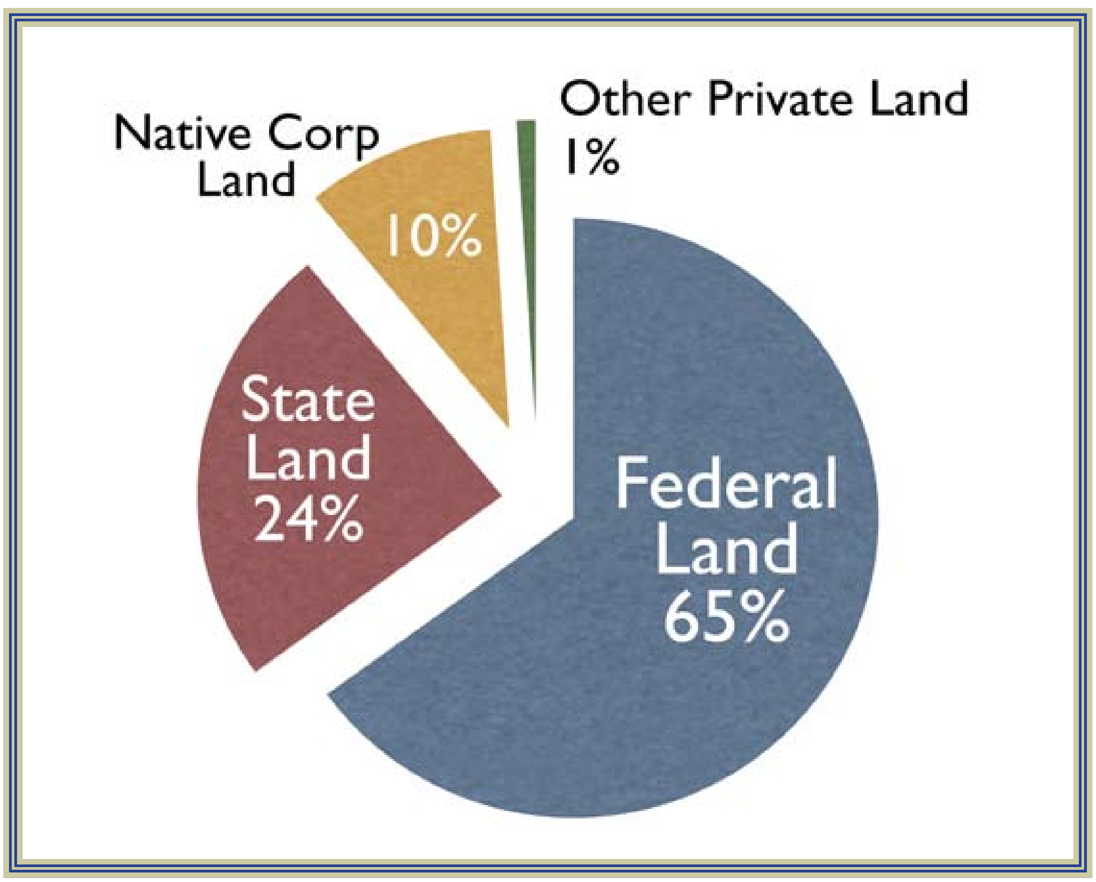


Figure 6. Alaska Land Ownership, year 2000.

Table 6. Changes in land ownership in Alaska, 1960 and 2000 (in millions of acres)

YEAR:	**1960**		**2000**	
	Ownership in 1960	**% of Alaska's Land Area**	**Ownership in 2000**	**% of Alaska's Land Area**
PUBLIC LAND				
FEDERAL LAND				
USFWS National Wildlife Refuges	18.70	5%	76.50	20%
BLM General Public Domain/Multiple Use Lands	290.30	77%	61.40	16%
NPS National Parks, Preserves, Monuments	7.50	2%	52.00	14%
BLM National Petroleum Reserve-Alaska	23.00	6%	23.00	6%
USFS National Forests and Monuments	20.70	6%	22.00	6%
Other Withdrawals	7.50	2%	2.60	1%
BLM National Conservation and Recreation Areas	0.00	0%	2.20	1%
Military Reserves	2.60	1%	1.80	0%
Native Reserves	4.10	1%	0.08	0%
Total Federal Lands	374.40	100%	241.58	65%
STATE LAND				
General State Lands	0.00	0%	77.90	21%
Parks	0.00	0%	3.30	1%
Game Refuges, Sanctuaries, CHAs	0.00	0%	3.20	1%
Other Special Categories	0.00	0%	2.60	1%
Forests	0.00	0%	2.20	1%
Mental Health Trust (MHT) land	0.00	0%	1.00	0%
Municipal Lands	0.15	0%	0.66	0%
University of Alaska Lands	1.00	0%	0.17	0%
Total State Lands	1.15	0%	91.03	24%
TOTAL PUBLIC LAND	375.15	100%	333.03	89%
PRIVATE LAND				
Alaska Native Corporation Lands	0.00	0%	37.40	10%
Other Private	0.50	0%	2.69	1%
Federal Land Sales (homesteads, etc)	0.50	0%	1.80	0%
State Land Sales (homesites, etc)	0.00	0%	0.75	0%
Municipal Land Sales	0.00	0%	0.14	0%
TOTAL PRIVATE LAND	0.50	0%	40.09	11%
TOTAL, ALL ALASKA LAND*	375.65	100%	373.12	99%

* Acreage figures differ slightly because some agencies count submerged lands and others do not. Thus, the amounts cited in individual categories do not total to exactly 375 million acres, the acreage most commonly cited for Alaska.

Source: Hull, T and L. Leask. 2000. Dividing Alaska, 1867-2000: Changing Land Ownership and Management. Institute of Social and Economic Research, University of Alaska Anchorage.
http://www.iser.uaa.alaska.edu/Landswebfiles/lands.pdf

Note that some of the fire records are known to be missing from the data for 1971, and 1974 (Kasischke et al. 2002).

6.5 Number and size of fires by cause, 1970s

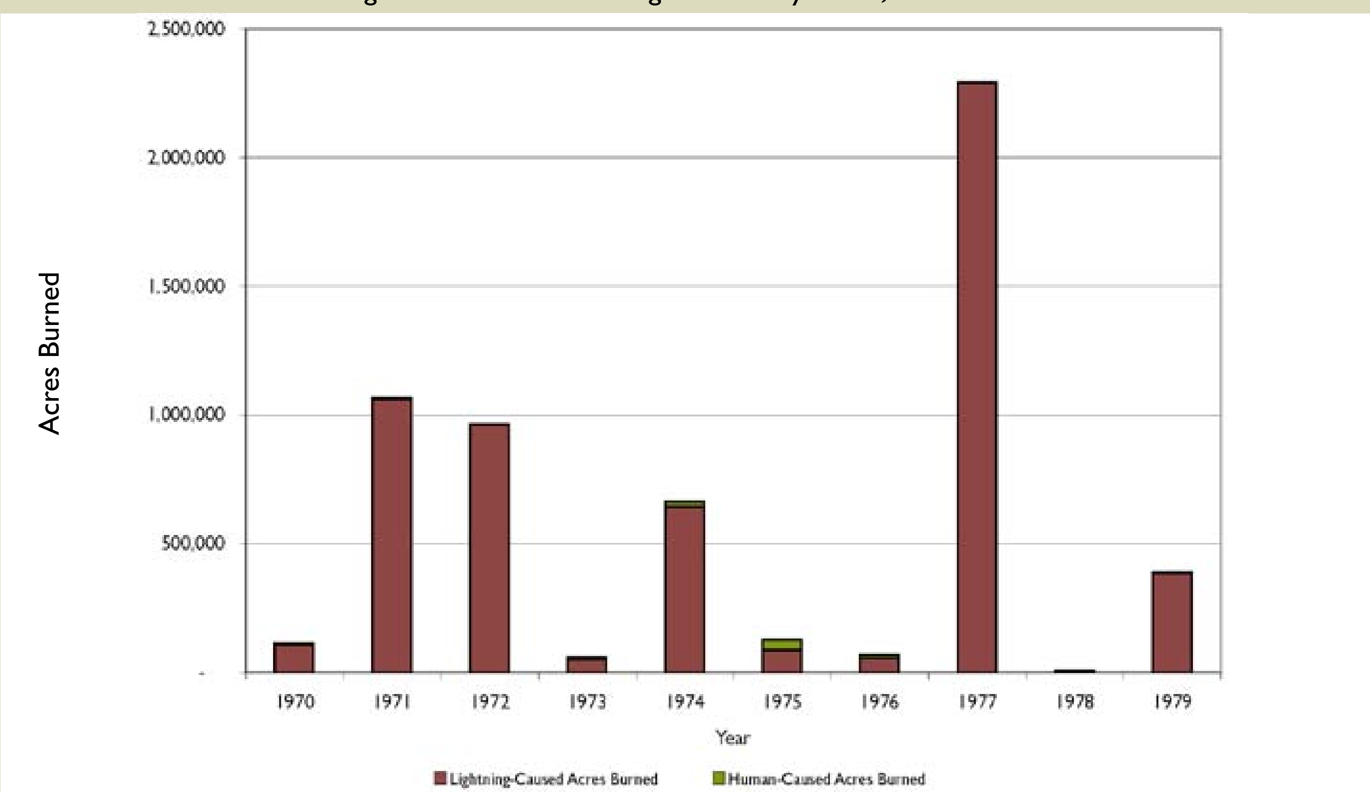
The estimated number of fires and acres burned are found in Table 7 and Figure 7 below.

Table 7. Number of Fires and Acreage Burned, 1970-1979

Year	Lightning-Caused Fires				Human-Caused Fires				Totals	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Total Number of Fires	TOTAL ACRES BURNED
1970	140	28%	107,108	94%	347	71%	6,378	6%	487	113,486
1971	240	51%	1,059,921	99%	232	49%	9,187	1%	472	1,069,108
1972	472	73%	963,999	99%	173	27%	2,248	1%	645	966,247
1973	123	37%	50,480	84%	213	63%	9,336	16%	336	59,816
1974	384	49%	645,192	97%	398	51%	17,768	3%	782	662,960
1975	134	39%	86,208	67%	210	61%	41,637	33%	344	127,845
1976	227	40%	54,885	79%	345	60%	14,234	21%	572	69,119
1977	401	64%	2,292,431	99%	222	36%	3,377	1%	623	2,295,808
1978	82	25%	5,809	75%	242	75%	1,948	25%	324	7,757
1979	188	67%	385,321	99%	92	33%	3,341	1%	280	388,662
TOTAL	2,391	49%	5,651,354	98%	2,474	51%	109,454	2%	4,865	5,760,808
AVERAGE	239		565,135		247		10,945		487	576,081
Standard Deviation	135		722,913		91		12,007		167	719,327
Max	472		2,292,431		398		41,637		782	2,295,808
Min	82		5,809		92		1,948		280	7,757

Source: Gabriel and Tande, 1983

Figure 7. Estimated acreage burned by cause, 1970-1979



7. The 1980s

In the 1980s, national attention focused on prescribed fires and fire ecologists began to examine a possible link between fire and global climate change. In Alaska, the BLM established the Alaska Fire Service (AFS) as its fire management agency and fire management plans were completed for the entire state.

7.1 Administrative changes

7.1.1 Alaska Fire Service formed

By the 1982 fire season, the Division of Fire Management restructured and became the Alaska Fire Service, still under the BLM (AFS 1982). Deprived of its land base as a result of the land reallocation in the 1970s, AFS became a service organization that provided fire protection to other landowners, including its parent agency, the BLM. In this capacity, the AFS was responsible for fire control on about 162 million acres (Roessler 1997). In its 1982 annual statistical report, AFS defined its mission as "moving from a time when we had a relatively simple mandate (suppress all fires), into an era when we must respond as a service organization to the complex demands and objectives of many new and old land managers."

Because AFS was responsible for fire suppression duties north of the Alaska Range, Fairbanks became the base for AFS operations (AFS 1988). By 1985, AFS divided its protection area into three zones, the Upper Yukon, Galena, and Tanana zones. The State of Alaska Division of Forestry (DOF) fire management program continued to grow in the 1980s and 1990s. Its area of protection responsibility expanded in 1984 and 1985 to include the McGrath and Tok areas, along with an extension of the pre-existing Delta and Fairbanks areas (DOF 1988). Its protection area now encompasses approximately 134 million acres (DOF 1988).

7.2 Changes in tactics

7.2.1 Coordination of Alaska's and national fire resources

AFS also continued to be actively involved with the transfer of personnel and equipment between the contiguous states and Alaska. BIFC, renamed the National Interagency Fire Center (NIFC) during this time, still coordinated the transfer of national firefighting resources. In 1982, it signed international agreements with Canada for mutual aid on large fires (BIFC 1983). Alaska played a large role in providing resources for fires in Canada as it is closer to Yukon Territory and parts of British Columbia than most of the contiguous states.

Also, the wildfire coordinating group, the AWFCG, adopted the Canadian Forest Fire Danger Rating System (CFFDRS) because it more accurately predicts conditions in Alaska than the indices developed in the contiguous states (AFS 1990). Alaska fire conditions and ecosystems more closely resemble Canada's boreal forests than the temperate forests of the contiguous states. A broadening sense of cooperation was apparent with international resource and information transfer.

Both state and federal fire resources in Alaska also had a coordination center. The Alaska Interagency Coordination Center (AICC) based in the AFS Fairbanks office facilitated coordination of Alaska fire suppression efforts (AFS 1989). The AICC also assisted during natural disasters when other agencies requested resources from AFS and the state. For example, the AICC sent fire personnel and equipment to help following the 1989 *Exxon Valdez* oil spill, the 1990 Florida hurricanes, the 1994 Koyukuk River flooding, and the 1998 hurricanes in the Caribbean (AFS 1989, 1990, 1994). It was clear that the management structure used in fire suppression was effective in dealing with other emergency situations.

7.2.2 Expansion of firefighting crews

The abilities of the Alaska Fire Service also improved with the addition of new and specialized personnel. Two hotshot crews, the Chena and Midnight Suns, performed fire suppression activities throughout the state and spent significant time in the western contiguous states during most seasons (AFS 1984).

AFS also created fire suppression specialist positions. These positions provided a valuable source of intermediate support for fire suppression, both on the fire line and with logistical tasks such as transport of resources and personnel (AFS 1984). Their duties included training Native crews in villages and mobilization into helitack units as needed. Together, the hotshot crews and fire suppression specialists provided additional support for larger fires that escaped initial suppression attempts.

7.2.3 The computer age comes to fire management

Several technological advancements facilitated detection, initial attack, and monitoring of fires during this time. The division continued to upgrade the automatic lightning detection system, allowing data to be sent directly to Fairbanks via phone lines from the systems scattered throughout the state (AFS 1983). The number of remote automatic weather stations (RAWS) increased as well, aiding in recognizing high fire danger conditions and anticipating fire behavior (AFS 1984).

Infrared (IR) equipment became more prominent, particularly units called Probeyes that detected hot spots on fires (AFS 1984). Probeyes can quickly survey a large fire, providing information on the fire's potential for continued spread. They indicate which part of the fire is hottest and likely to continue to burn given favorable weather conditions and fuel.

But today, more than twenty years later, most monitoring in Alaska is still done without the benefit of infrared imaging. IR is expensive, and often an aircraft with IR capability has to be requisitioned from the lower 48 states. IR units are particularly useful when smoke obscures the fire boundaries and there is no other way to determine where the fires are. The deciding factor that makes IR worthwhile is imminent threat to people and property, or an inability to see where the fires are with conventional means.

7.3 Fire management planning comes of age

During the 1980s, the AIFMC completed fire plans for the entire state. As stated earlier, the AIFMC included representatives of federal land management agencies (Bureau of Land Management, National Park Service, Bureau of Indian Affairs, and US Fish and Wildlife Service), state agencies (Alaska Department of Natural Resources and Alaska Department of Fish and Game), the USFS Institute of Northern Forestry, and Native Corporations (by statute, the DNR represents other private land owners).

Fire management plans were expected to include ecological considerations; they were to consider the benefits of fire and not focus solely on suppression. In order to reduce the suppression bias and broaden the message carried to the public, the AIWFMP made a purposeful decision *not* to designate protection areas or suppression levels. Instead, they would designate areas under one of four "Fire Management Options."

Fire Management Options Included in the Fire Management Plans

The fire plans place land in one of four management options:

- **Critical** – Areas where human life and settlements are at risk. These areas receive the highest priority and aggressive suppression efforts.
- **Full** – Areas that are uninhabited, but contain valuable resources. These areas receive suppression priority second only to critically designated areas.
- **Modified** – Fires are suppressed during the peak fire season, but later are converted to a limited management option.
- **Limited** – Areas where fires are generally allowed to burn and only monitored. However, adjacent lands are considered so that a fire does not burn into a higher priority option (AIFMC 1988)

Defining what areas would be eligible for the Limited option was very controversial. Although the AFS ostensibly supported the concept of limited management areas, they proposed the following narrow criteria for designating an area under the Limited option:

> [Limited areas should be restricted to areas that] have a historical record of low fire occurrence, an absence of conflagrations, or are self-contained by effective natural barriers (Roessler 1997).

Under this proposal, the only areas that would be designated as Limited would be those where fires were rare or small in size. Thus, the proposal would have allowed only areas where fire was *not* a natural part of the ecosystem.

But fire suppression agencies were no longer the decision makers when it came to fire planning; they were (and continue to be) nonvoting members of the AIFMC. The land management agencies that are voting members often rely on the expertise of fire management agency staff to ensure that provisions of the plan are feasible. Although the fire management agencies are involved in the drafting the plan, it is the land managers who approve the final content and any subsequent revisions.

In 1983, the AIFMC did not accept the AFS proposal. Instead, Limited designations would be considered wherever "the environmental impacts of suppression exceed the effects of fire or *where the exclusion of fire may be detrimental to the fire dependent ecosystem*" (Roessler 1997).

In 1982, the AIFMC completed the Tanana-Minchumina Plan, which covered 31 million acres of federal, state, Native corporation, and numerous private lands (AIFMC 1983). The plan served as a model for future fire management plans and updating the Fortymile Plan to conform to these standards. The Tanana-Minchumina Plan contained language that demonstrates that the planners were well aware of the benefits of fire:

> The boreal forest is a fire-dependent ecosystem, which has evolved in association with fire, and will lose its character, vigor, and faunal and floral diversity if fire is totally excluded. (AIFMC 1983).

The AIFMC completed the Kuskokwim-Illiamna and Copper River Basin Plans in 1983 and the Yukon-Togiak, Kenai, Upper Yukon-Tanana, Seward Koyukuk, and Kobuk fire management plans in 1984. The North Slope Fire Plan went into effect in 1985 and plans for the rest of the state were completed in 1988 (AIFMC 1998).

The amount of land designated under the Limited Option increased steadily as managers and suppression agencies became more comfortable with it. The first plans were conservative in their use of Limited designations, but the 1993 update designated 47 percent of Alaska's land as Limited, and the 1998 revision increased this to 66 percent (Roessler 1997; Haggstrom personal communication 2005).

The plan is revised and amended as needed by the Coordinating Group (the AWFCG). The selection of fire management options is the responsibility of the landowners represented on the group. The fire management agencies, such as AFS and ADNR-DOF, simply facilitate the annual review of the fire management option boundaries, but they do not actually write the plan.

The policies associated with each option provide guidance and flexibility to the fire suppression agencies. During drought or high fire danger periods, the AWFCG can alter the recommended fire response for an area (the designation is not changed, just the action that is taken on fires in that designation during that fire season). The decision criteria currently used to determine what action should be taken on a given fire are shown in Table 8.

Table 8. Criteria for deciding what action should be taken on a fire (AIFMC 1998, 53)

Fire Identification: Location, Fire Plan Options, and Land Ownership

Fire Number: ______________________ Fire Name: ______________________

Fire Plan Fire Management Option: ______________ Adjacent Fire Management Option(s) ______________

Land Manager/Owner: ______________ Adjoining Land Manager/Owner(s): ______________

Current Fire Size: ______________ Location (Legal Description): ______________

Map Quad:/Meridian: ______________ Lat/Long (if available): ______________

Assessment of Risk Factors

Public Safety at Risk	Yes	No
Firefighter Safety at Risk	Yes	No
Threatening Private Property	Yes	No
Improvements at Risk	Yes	No
Threat to Natural/Cultural Resources	Yes	No
Initial Attack Resources Not Available	Yes	No
Unacceptable Factor(s) to Land Manager/Owner(s)	Yes	No
Other Unacceptable Factors	Yes	No

Resistance to Control/Extinguishment:	
Topography/Natural Barriers:	
Fuels:	
Other Contributing Factors: (Fire Danger Ratings, Greenness, etc.):	

Weather:	Current	Past:	Predicted:

Fire Behavior	Current:	Past:	Predicted:

Fire Representative Summary Statement:

Objectives: ______________________

Strategy: ______________________

Estimate Duration of Actions: ______________________

Signature: ______________________ Date ______________

Fire Representative

Land Manager Summary Statement and Authorization:

Objectives: ______________________

Constraints: ______________________

Authorization: ______________________ Date ______________

Land Manager/Owner(s) Representatives

7.4 Number and size of fires by cause, 1980s

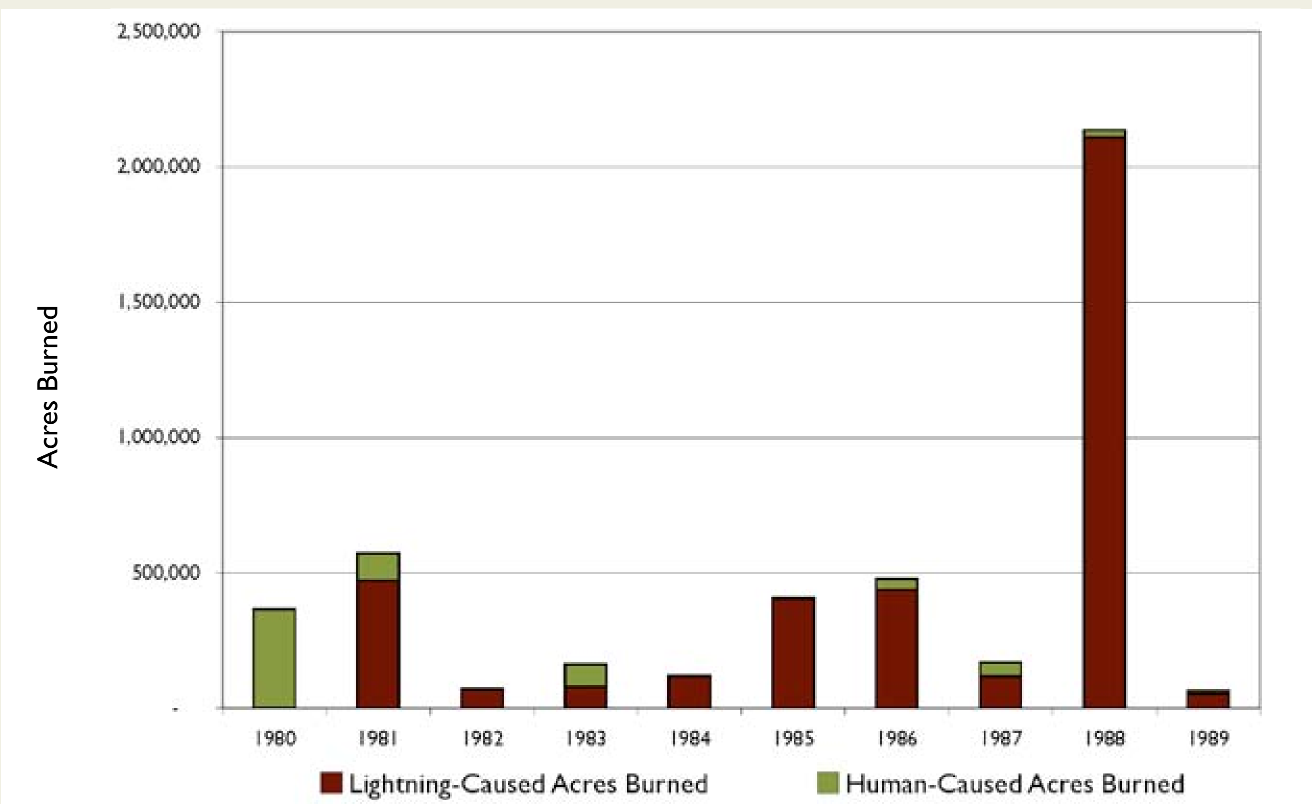
The number and size of fires that occurred in the 1980s are shown in Table 9 and Figure 8.

Table 9. Number of fires and acreage burned, 1980-1989

Year	Lightning-Caused Fires				Human-Caused Fires				Totals	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Total Number of Fires	TOTAL ACRES BURNED
1980	97	28%	2,600	1%	246	72%	362,339	99%	343	364,939
1981	233	46%	471,119	82%	271	54%	101,023	18%	504	572,142
1982	199	44%	70,121	98%	252	56%	1,735	2%	451	71,856
1983	360	50%	79,848	49%	357	50%	82,190	51%	717	162,038
1984	355	85%	116,108	96%	65	15%	4,398	4%	420	120,506
1985	208	37%	404,881	99%	356	63%	2,419	1%	564	407,300
1986	310	43%	436,567	91%	417	57%	40,888	9%	727	477,455
1987	175	27%	116,608	69%	483	73%	52,537	31%	658	169,145
1988	251	43%	2,109,974	99%	328	57%	24,565	1%	579	2,134,539
1989	45	10%	53,388	82%	396	90%	11,422	18%	441	64,810
TOTAL	2,233	41%	3,861,214	85%	3,171	59%	683,516	15%	5,404	4,544,730
AVERAGE	223		386,121		317		68,352		540	454,473
Standard Deviation	103		630,590		116		108,896		131	616,796
Max	360		2,109,974		483		362,339		727	2,134,539
Min	45		2,600		65		1,735		343	64,810

SOURCE: Alaska Interagency Fire Coordination Center, Alaska Fire Service, 2004. Unpublished data.

Figure 8. Estimated acreage burned by cause, 1980-1989



In the Lower 48: Yellowstone fires "go wild"

Yellowstone was the nation's first national park. Before it was created in 1871, fire was a natural part of its ecosystems. Early visitors complained of persistent, widespread smoke from frequent fires. However, as more and more people visited the park, and as full fire suppression became one of the top priorities, all accessible fires in the Yellowstone area were extinguished quickly. By the early 1970s, many parts of the park had not been touched by fire in a century.

Fire suppression increases the proportion of conifer forests on the landscape and therefore the continuity of late successional fuels, which in turn increases the flammability of the landscape.

The summer of 1988 witnessed one of the worst droughts in US history. In Yellowstone, the lack of moisture, coupled with high temperatures and high winds, created dangerous wildfire conditions, and nearly doubled the usual number of forest fires in the area.

The park's fire policy allowed lightning-caused fires to burn in many parts of the park as long as they remained under control (Pyne 1995). At one point, there were 28 fires being monitored in and around the park. But many of these turned into raging crown fires and coalesced into fire storms. Soon one of the largest fire suppression efforts in US history was mounted to stop them. But the fires proved irrepressible even with the best in modern fire suppression forces and technology.

Much of the US population was appalled at what they felt was a management disaster. After all, they had been bombarded since childhood with Smokey Bear's message that fire was bad.

The Yellowstone fires did not stop burning until the snow fell that fall. When the smoke cleared, some 793,000 acres, just under half the park's total area, were charred (Schullery 1997 and Pyne 1995). The firefighting in Yellowstone cost $130 million and more than 25,000 personnel had assisted in the cause (Pyne 1995).

Fire ecologists were not surprised at the intensity and extent of the fires. In these conifer-dominated stands, it was only a matter of time before lightning or sparks would ignite a disaster. Ecologists regarded the fires as a natural event that was bound to happen eventually—and one that would ultimately result in a more productive, healthier ecosystem. But the reaction by the public and policy makers was largely negative. Today the park is lush and green, the habitat is much improved, and wildlife is abundant, but this information does not capture the public's attention the way the wildfires did.

Following this "catastrophe," the federal government reassessed national fire policy and land managers reviewed virtually every fire plan in the nation (Pyne 1995). Although the federal government did not prohibit prescribed fire, managers were afraid the tactic would bring strong public opposition—and financial liability. No one wanted to be responsible for a prescribed fire gone wild, and there was always a chance something would go wrong, be it weather or human error.

But this reduction in the use of prescribed fire also came under criticism. In an article in *American Forests*, Secretary of the Interior Bruce Babbitt (1995) recognized the problems of liability as well as public opposition in applying prescribed fire, but also pointed to its benefits. He stated that prescribed fires could reduce the occurrence of severe crown fires by allowing managers to choose the timing of burning outside of the peak fire season.

But even if there were no problem with fires going wild, there would still be a problem with the smoke from prescribed fires. People detest smoke, it violates air quality standards, causes serious health problems, and hampers air travel.

Though prescribed fire is a useful tool to accomplish land management objectives, public opposition and agencies' fears of losing fires restricted its use for several years after the Yellowstone fires.

Ecologists had hoped that prescribed fire would be a way to restore a natural process to a natural ecosystem. But fire occurrence and frequency had been altered even in wilderness areas in the contiguous US.

Whether they allowed fires to burn or intentionally set them, agencies were not recreating a natural process in a completely natural system. They were using a natural process in a very unnatural system, with potentially dangerous impacts (Pyne 1995).

8. The 1990s

The 1990s and beginning of the new millennium brought both new challenges and continuance of old debates in fire management throughout the US, notably wildland-urban interface fires, global warming, and prescribed fire. These national issues also affected fire and natural resource managers in Alaska.

8.1 Planning and cooperative efforts

Although some complain that fire protection agencies are still not adequately dedicated to allowing areas to burn, Alaska's fire management plans are a step closer to fire management and a step away from all-out suppression.

The Alaska Interagency Wildland Fire Management Plan (AIWFMP) amended most recently in 1998, is now one basic reference document instead of thirteen or more separate ones. The plans for each area can be consulted when an agency requires more detailed information.

To assist with the frequent fires on military lands within its protection area, AFS in the 1990s delineated another zone, the Military Zone. This resulted in four zones, the other three being the Yukon, Galena, and Tanana zones established in 1985.

8.2 Wildland-urban interface fires increase

The 1990s and early years of the millennium brought fire management in the US a powerful new foe—wildland-urban interface fires. Such fires occur on the border between wildlands and human settlements. As population centers spread and people build their homes in more remote locations throughout the US, this problem increases. The implications for fire management are considerable because whenever human life and property are at risk, some fire suppression effort is likely to be needed. When homes burn, the media and politicians bring the issues of fire management to the headlines, front pages, and congressional chambers.

Wildland-urban interface fires require managers, wildland firefighters, rural and county fire departments, and urban fire departments to cooperate (Pyne 1995). But while cooperation improves, "turf wars" also result between wildland fire and structural fire agencies (Pyne 1995). Wildland fire agencies focus on suppressing fires in vegetation. Their role in protecting buildings is limited to the exterior through removal of wood and other fuels, back burning, and application of water and foam to the exterior of the building. Structural fire agencies, on the other hand, focus on saving lives and homes. These different philosophies sometimes clash.

Wildland-urban interface fires are now a more prevalent issue in Alaska. The 1996 fire season was a striking example of the emergence of such interface concerns in "the last frontier." The Miller's Reach fire, which originated in the town of Houston north of Anchorage, burned 37,366 acres and destroyed 344 structures (Murphy et al 1996). More than 1,500 firefighters fought the blaze for weeks and the fire was dubbed the "worst urban/wildland fire in Alaska's history" (DOF 1996).

At the same time, several other fires occurred near human settlements in other parts of the state, pushing firefighting capabilities to their limit. Critical and full suppression designations in Alaska are predominantly found in human settlement areas. Without aggressive fuel reduction programs such as clearing conifers from areas near homes, the severity of urban interface fires will likely increase.

8.2.1 Implications of global warming on fire management

In the 1990s, climate change and global warming became issues of wide concern and researchers began to address their implications on fire management and fire ecology. The rise of fire ecology research and funding in the 1970s declined dramatically in the 1980s as the US became a debtor nation (Pyne 1995). However, concern over potential global change reinvigorated fire research.

The connection between climate change and wildfire is twofold. First, when vegetation and soil organic matter burn, they release carbon dioxide, then as fires become larger and more intense, more carbon dioxide is released (Flannigan and Van Wagner 1991). Second, if temperatures rise throughout the world over the next fifty years as postulated, scientists expect the numbers of fires to increase and fire cycles, the consistent re-burning of an area, to change. Most upland spruce and spruce on permafrost are already water stressed much of the time. A warmer climate would exacerbate this problem, resulting in drier needles and branches, leading to more frequent and more intense fires. It could become too warm for spruce and other species, such as pine or—if it is very dry—grasses could replace some of the forested stands.

Flannigan and Van Wagner (1991) conducted a study in Canada, which found that a projected temperature rise of 1.5 to 5° C could possibly increase the area burned annually in Canada by 40 percent. However, the authors stated that their results were preliminary, as well as dependent on the predicted doubling of carbon dioxide in the atmosphere.

Pyne (1995) raised the possibility that concern about global climate change will lead to limitations on the use of prescribed fire and point fire management toward fire suppression. Another global concern with fires is the desire to increase carbon stocks. By putting fires out, as historically has been done in the US, carbon stocks increase. The danger is that ecosystem health will decline, increasing the likelihood that catastrophic fire will quickly dissipate this stored carbon. However, burning can improve the long-term productivity of many ecosystems, with a net increase in carbon storage (Pyne 1995).

The correlation between fire and climate change could certainly have implications for fire management agencies throughout the world. Scientists consider arctic ecosystems as indicators for climate change and global warming. They expect that these ecosystems will display the effects of global change first and most dramatically. In the case of wildfire, they will look for an increase in the number, intensity and size of fires in northern ecosystems. As a result, scientists will closely watch Alaska's tundra and boreal forest ecosystems.

8.3 Number and size of fires by cause, 1990s

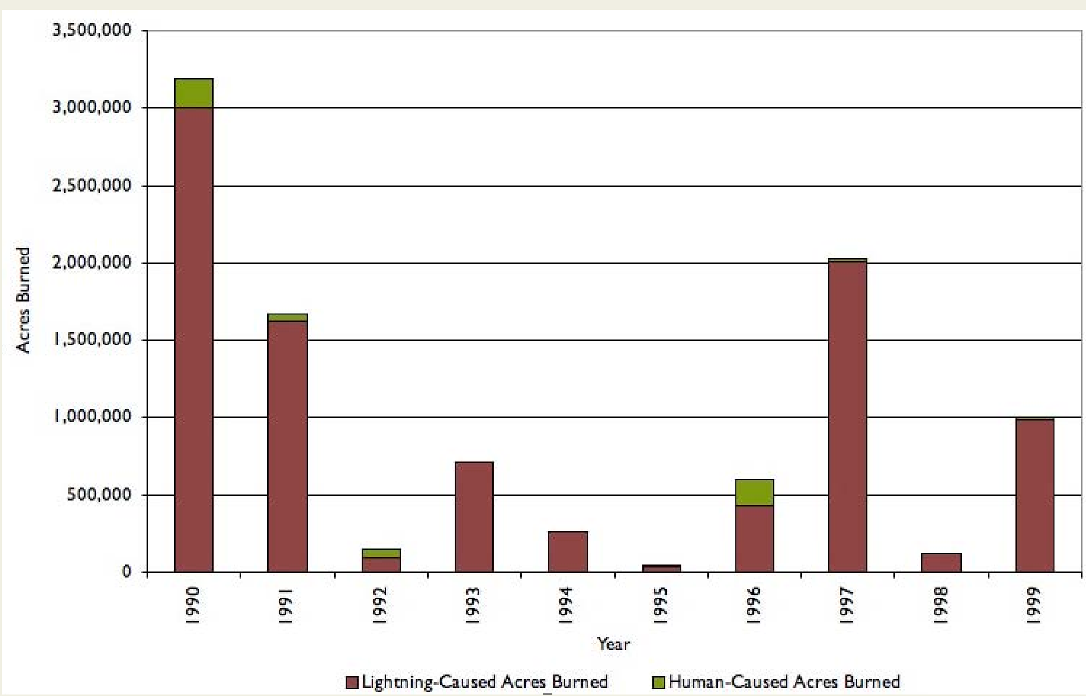
Four of the top ten fire years, in terms of the number of acres burned, occurred during this decade.

Table 10. Number of fires and acreage burned, 1990-1999

Year	Lightning-Caused Fires				Human-Caused Fires				Totals	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
1990	408	54%	3,005,371	94%	342	46%	183,707	6%	750	3,189,078
1991	323	43%	1,620,976	97%	425	57%	46,974	3%	748	1,667,950
1992	98	22%	89,483	60%	351	78%	60,523	40%	449	150,006
1993	271	36%	710,772	100%	488	64%	2,097	0%	759	712,869
1994	210	33%	258,763	97%	433	67%	6,959	3%	643	265,722
1995	65	15%	38,209	87%	359	85%	5,737	13%	424	43,946
1996	141	20%	428,015	71%	580	80%	171,252	29%	721	599,267
1997	239	33%	2,009,623	99%	477	67%	17,276	1%	716	2,026,899
1998	46	11%	119,336	99%	367	89%	1,416	1%	413	120,752
1999	151	31%	980,809	98%	335	69%	24,618	2%	486	1,005,427
Total	1,952	32%	9,261,357	95%	4,157	68%	520,559	5%	6,109	9,781,916
Average	195		926,136		416		52,056		611	978,192
Standard Deviation	117		992,314		80		68,992		149	1,026,310
Max	408		3,005,371		580		183,707		759	3,189,078
Min	46		38,209		335		1,416		413	43,946

SOURCE: Alaska Interagency Fire Coordination Center, Alaska Fire Service, 2004. Unpublished data.

Figure 9. Acreage burned by cause, 1990-1999



9. Summer 2004 Sets New Records

The average acreage burned over the first three years of the new decade was 940,000 acres. This was above the average over the previous 54 years of 754,000 acres, but it was not unusual. The 2004 season began with below normal fire activity. May was unusually wet and cool and models predicted a relatively quiet fire season. But June, 2004 was the second warmest on record and precipitation in the Fairbanks area was just 22% of normal. By the end of the summer, many new records had been set:

Fairbanks was blanketed in thick smoke for 42 days, surpassing the previous record of 19 days. Visibility was often below one-quarter mile and the instrument the borough used to measure particulates maxed out at just under 1,000 micrograms per cubic meter (300 is considered hazardous and 10 is normal in Fairbanks in the summer). However, scientists were surprised that there was no significant increase in the number of hospital emergency room visits or hospital admissions during this time (Dr. James Conner, Fairbanks North Star Borough Air Quality Office).

Aircraft, including firefighting aircraft, were frequently grounded. Roads were closed and several subdivisions had to be evacuated—some more than once. Several outbuildings and a few homes were lost.

The Alaska Fire Service and the Division of Forestry were stretched to the limit, but despite this, they had many successes. First and foremost, there were no major injuries or fatalities to either the public or firefighters. Many homes were saved and many fires in critical and full management areas were stopped before they grew large. There was also a remarkable level of interagency cooperation. They felt that they could improve their communication with the public during such crises.

Some citizens complained that they did not have accurate and timely information concerning the location of the fires. Some were upset that fires that started in limited zones ended up burning out of control and crossing into areas of full protection. Many were also concerned about the environmental impacts of new dozer lines in areas set aside for nonmotorized recreation.

The fire management agencies will be reviewing the fire management boundaries as they update the fire plan in 2005. They are also looking into fuel reduction projects in and around communities and on private property. During the fall and winter of 2004–2005, they conducted a series of public meetings in the Interior and in Anchorage to review the previous season.

Fire managers pointed out that a great deal of fuel has now been removed from the most populated area of interior Alaska and that these areas will slow the spread of future fires. Land ownership is constantly changing and there are more people living in outlying areas. It will be challenging to find ways to prevent fuel buildup while excluding fire from populated areas.

The number and size of fires that occurred in the first four years of the new millennium are shown in Table 11 and Figure 10.

A few of the records set by the 2004 fire season

- The state's warmest and third-driest summer on record
- The most lightning strikes ever recorded in the state (150,000 compared to an average of 45,000)
- The most money spent fighting fires in a given year in Alaska ($110 million compared to the ten-year average of $10 million)
- Fairbanks was affected by smoke for 42 days, surpassing the previous record of 19 days.
- The first time all available Alaska Type 2 crews (61) were used 156 times
- The most incident management teams (Type 1 and 2) ever used in Alaska
- The most interagency hotshot crews ever used in Alaska
- The most water-scooping aircraft ever used in Alaska
- The first time Lower 48 wildland fire engines had to be shipped to Alaska
- The first time engines from Southeast Alaska were mobilized to the Interior.

Source: DNR Division of Forestry, January, 2005

Smoke from wildland fires in Fairbanks, Alaska, in 2004.
Photo courtesy of the Fairbanks North Star Borough.

Table 11. Number of fires and acreage burned, 2000–2005

Year	LIGHTNING-CAUSED FIRES				HUMAN-CAUSED FIRES				ALL FIRES	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
2000	83	23%	740,915	98%	286	78%	15,381	2%	369	756,296
2001	28	8%	10,369	5%	321	92%	205,670	95%	349	216,039
2002	167	31%	1,881,458	86%	376	69%	305,223	14%	543	2,186,681
2003	75	16%	580,593	96%	401	84%	22,125	4%	476	602,718
2004	270	39%	6,505,394	100%	426	61%	17,788	0%	696	6,523,182
2005	328	53%	4,596,779	100%	296	47%	12,490	0.3%	624	4,609,269
TOTAL	951	31%	14,315,508	96%	2,106	69%	578.677	4%	3.057	14,894,185
Average	159		2,385,918		351		96,446		510	2,482,364
Median	125		1,311,187		349		19,957		510	1,471,489
S.D.	119		2,596,957		58		127,160		138	2,552,958
Maximum.	328		6,505,394		426		305,223		696	6,523,182
Minimum	28		10,369		286		12,490		349	216,039

Figure 10. Acreage burned by cause, 2000–2005

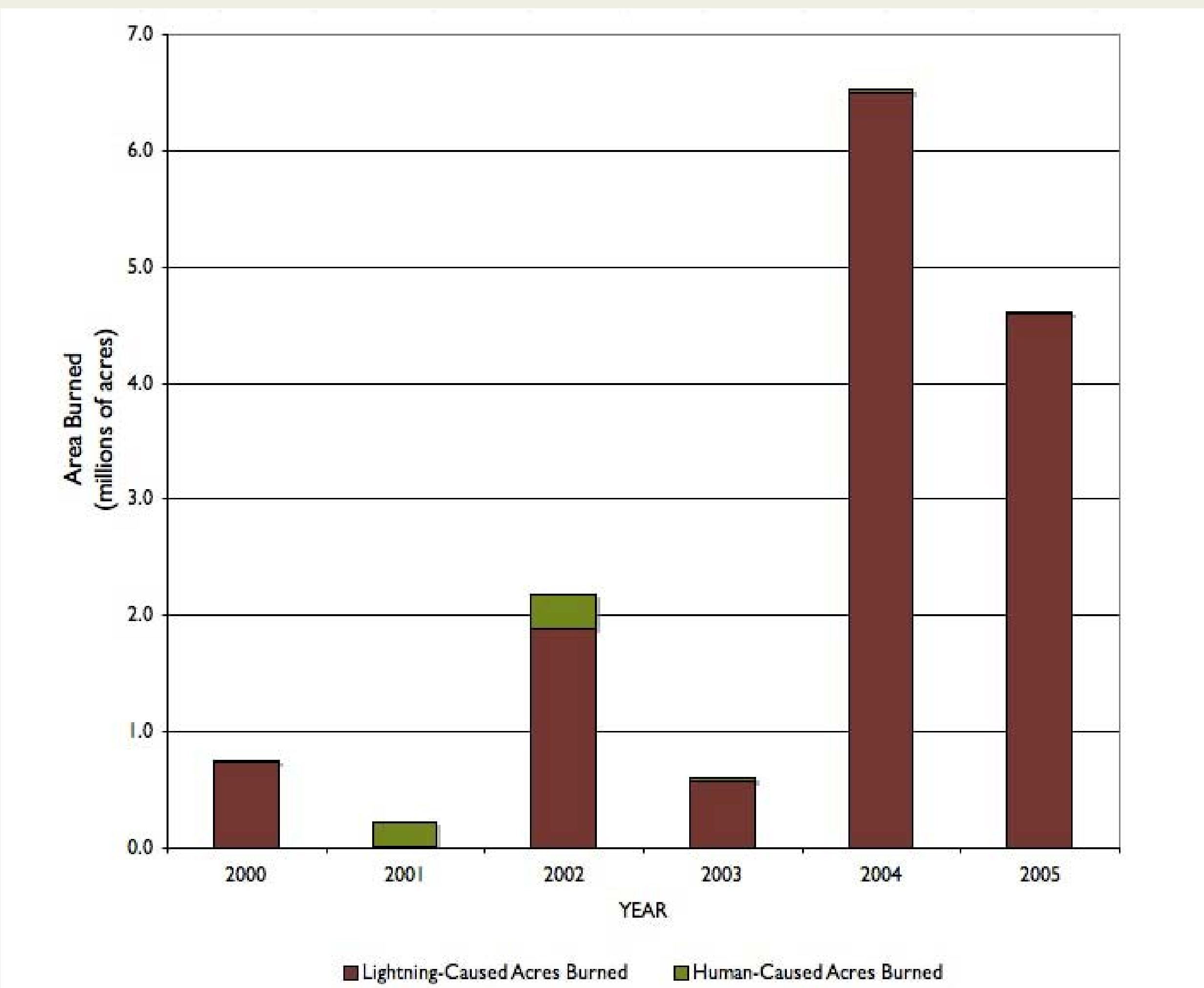
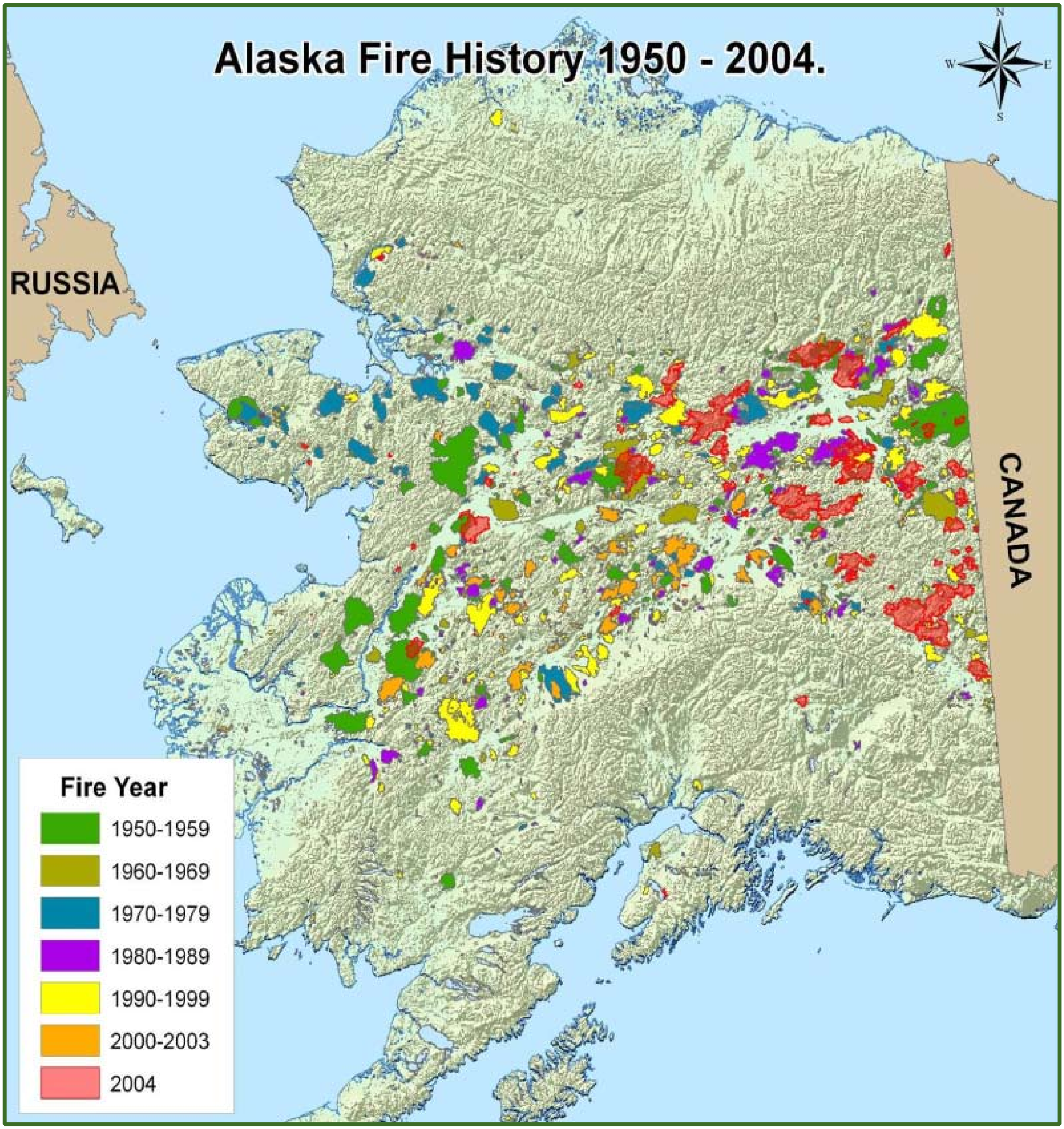


Figure 11. Map of Alaska fires by period, 1950–2004



Source: Alaska Fire Service, 2004.

10. Summary of Fire Data 1950-2005

Table 12 summarizes the number of fires and acreage burned over the 55-year period of record from 1950–2004 (data on lightning-caused acreage burned were not kept in the 1940s). On the average, over 756,000 acres burn each year—an area larger than the state of Rhode Island. However, there is tremendous variation in the number of acres burned each year, with standard deviations larger than the means. The variation is shown graphically in Figure 12.

The record year was 2004, when over 6.5 million acres burned. The "coolest" year was 1964, when just 3,430 acres burned. Given this variation, the median, or middle value, of almost 390,000 acres is a better indicator of central tendency.

On average, there are 160 lightning-caused fires each year, while there are an average of 274 human-caused fires each year. Lightning accounts for 37 percent of the total number of fires during this period, while humans started 63 percent. Although humans start more fires, these fires tend to be smaller than lightning-caused fires. Lightning accounts for 89 percent of the acres burned over the period, or a median of over 383,000 acres each year between 1950 and 2005.

Human-caused fires account for just 11 percent of the acreage burned over the same period. Several factors contribute to this. Human-caused fires are generally located near population centers where rapid detection and response are likely. Also, the occurrence of human-caused fires in these areas would mandate a full suppression strategy due to the proximity of people and structures. In contrast, fires ignited by lightning occur in both populated areas and remote areas, but remote fires may not be detected until they are larger. If fires start in an area of limited or modified protection, managers may simply monitor these fires without fighting them, resulting in larger acreage.

The map shown in Figure 11 indicates where the fires have occurred in Alaska by decade. This demonstrates that most fires occur in the interior of the state between the Alaska Range and the Brooks Range.

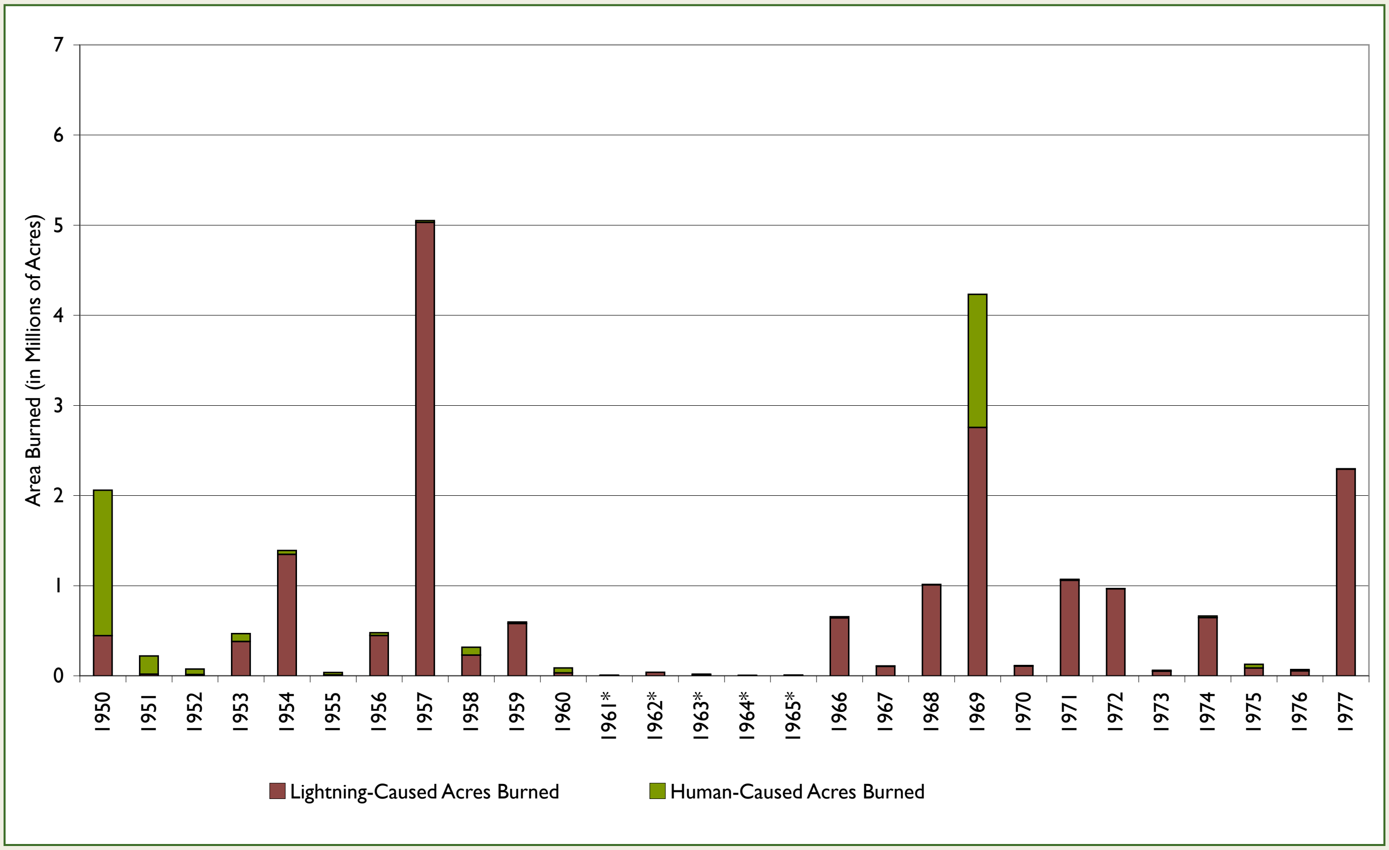
Table 13 and Figure 13 list the 10 most severe fire years in terms of acreage burned. These record years reflect favorable burning conditions such as drought, dry lightning, and high winds. It is notable that half of the ten largest fire years, in acres burned, have occurred since 1990.

Another way of comparing periods is by summarizing the data by decade, as shown in Table 14 and Figure 14. This indicates that the acreage burned in the past six years has exceeded every decade on record. This does not necessarily mean that this is a trend. Two extreme fire years such as 2004 and 2005 can skew the data to make it seem as though there is a trend when in fact, it is just an aberration.

Table 12. Summary of fire data over the period of record 1950-2005 (56 years)

Year	LIGHTNING-CAUSED FIRES		HUMAN-CAUSED FIRES		ALL FIRES	
	Number of Fires	Lightning-Caused Acres Burned	Number of Fires	Human-Caused Acres Burned	Total NUMBER of Fires	Total ACRES Burned 1950-2005
TOTAL	9,130	46,195,505	15,350	5,638,287	24,480	51,824,533
Average	163	824,920	274	100,684	437	925,438
Standard Deviation.	118	1,329,798	124	290,396	194	1,388,976
Median	137	383,232	252	17,522	433	397,981
Maximum (and year it occurred)	472 (1972)	6,505,394 (2004)	580 (1996)	1,612,222 (1950)	782 (1974)	6,523,182 (2004)
Minimum (and year it occurred)	11 (1952)	1,283 (1961)	49 (1962)	1,000 (1964)	102 (1962)	3,430 (1964)

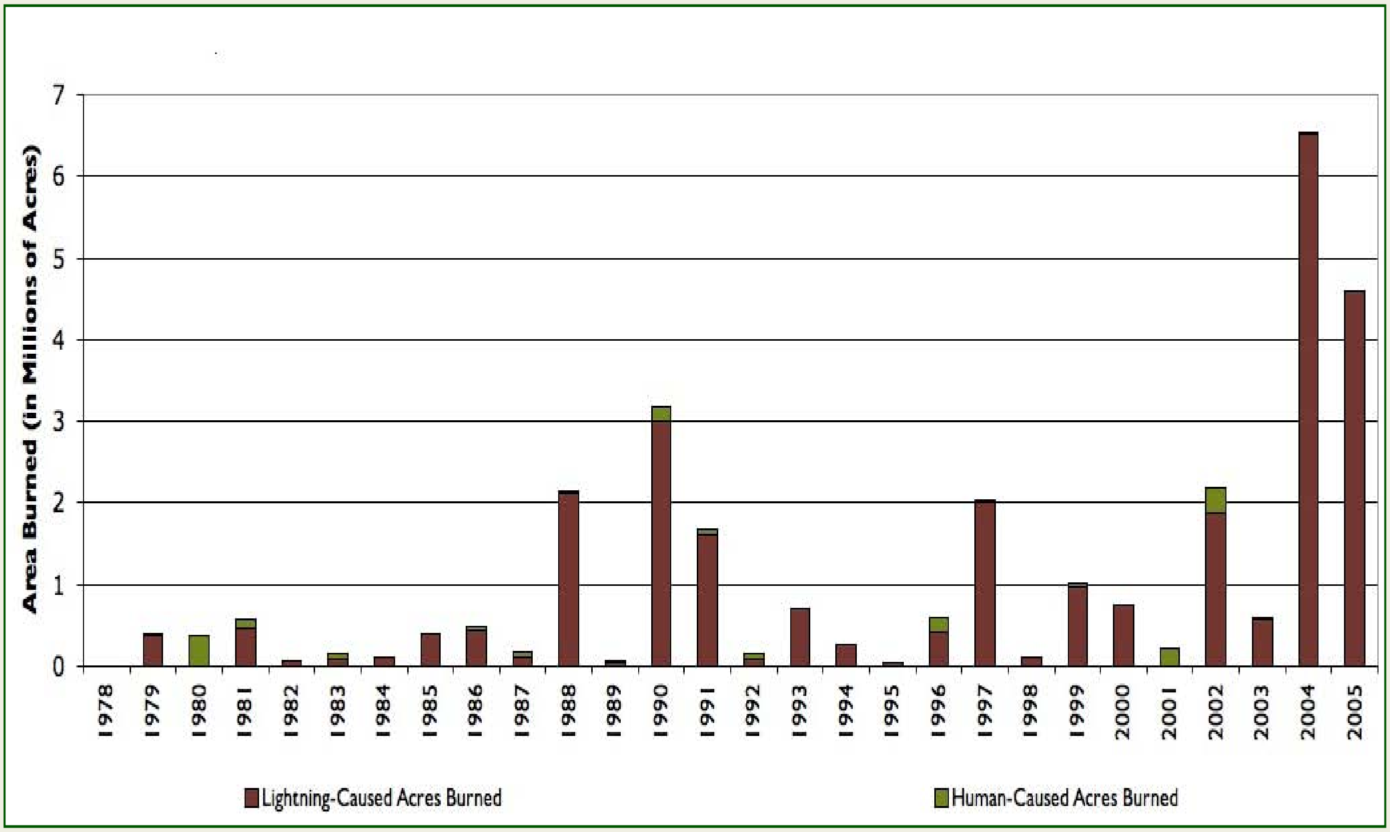
Figure 12. Acreage burned by year and cause, 1950–1977



Note that some records are known to be missing from the data for 1953,1957, 1967, 1969, 1971, and 1974 (Kasischke et al. 2002).

Firefighters work to protect a cabin north of Fairbanks, 2004.
Photo courtesy of the Alaska Fire Service.

Figure 12. (continued) Acreage burned by year and cause, 1978–2005



Alaska's low population density gives fire managers the flexibility to allow some wildfires burn.
Photo courtesy of Alaska Fire Service.

Table 13. Top ten fire years ranked by total acres burned (1950-2005)

Rank (largest to smallest)	Year	Lightning-Caused Acres Burned	Human-Caused Acres Burned (in millions of acres)	Total ACRES Burned
1	2004	6.51	0.02	6.52
2	1957	5.03	0.02	5.05
3	2005	4.61	0.01	4.62
4	1969	2.76	1.48	4.23
5	1990	3.01	0.18	3.19
6	1977	2.29	0.00	2.30
7	2002	1.88	0.31	2.19
8	1988	2.11	0.02	2.13
9	1950	0.45	1.61	2.06
10	1997	2.01	0.02	2.03

Figure 13. Top ten years in terms of total acres burned, 1950–2005.
(Note that 5 of the 10 most active fire years have occurred since 1990)

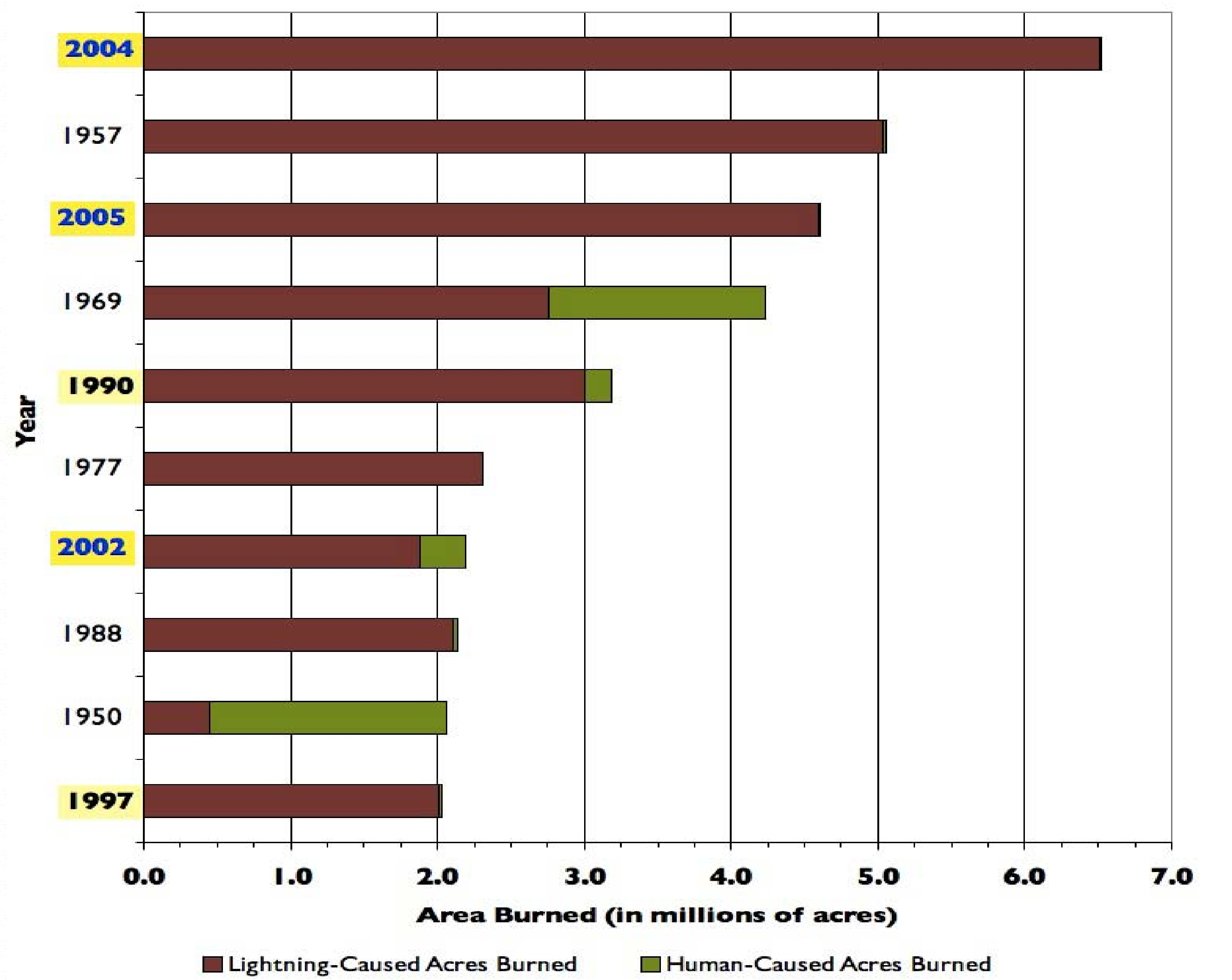


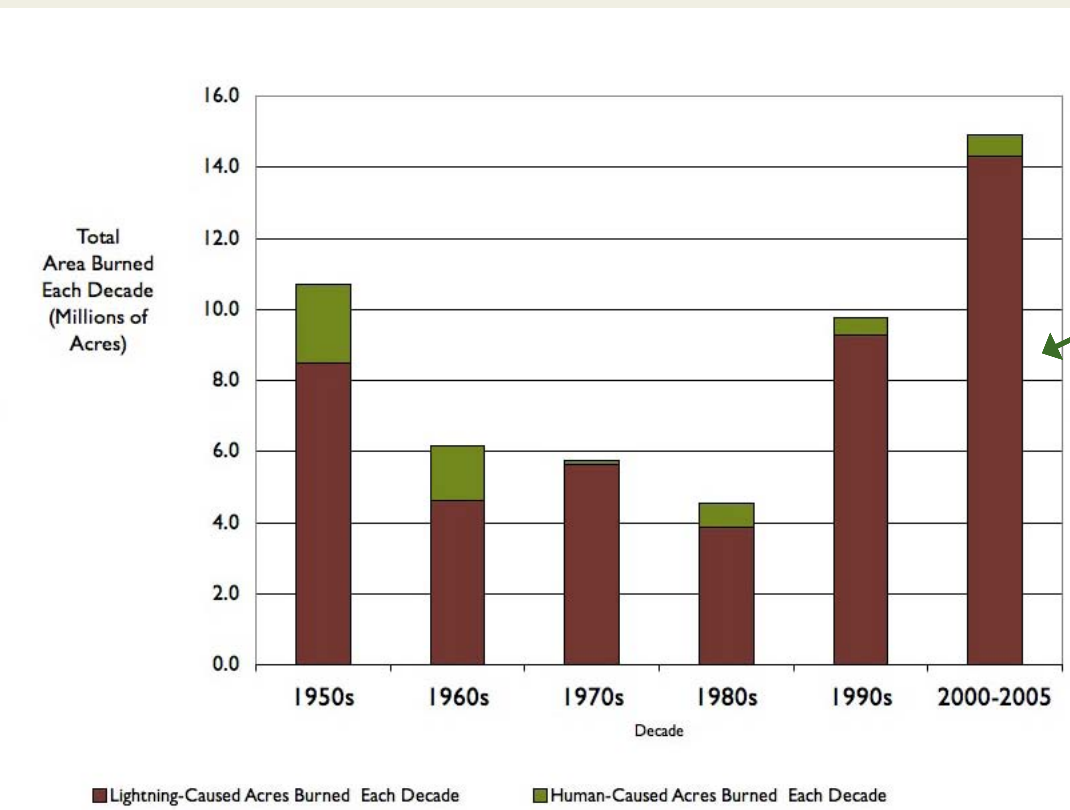
Table 14. Acreage burned by decade and cause, 1950–2005

Decade	Lightning-Caused Acres Burned Each Decade	% of All Acres Burned Each Decade	Human-Caused Acres Burned Each Decade	% of All Acres Burned Each Decade	Total Number of Fires Each Decade	TOTAL ACRES Burned Each Decade
1950s*	8,502,540	80%	2,183,060	20%	2,583	10,685,255
1960s*	4,603,532	75%	1,563,021	25%	2,462	6,157,639
1970s*	5,651,354	98%	109,454	2%	4,865	5,760,808
1980s	3,861,214	85%	683,516	15%	5,404	4,544,730
1990s	9,261,357	95%	520,559	5%	6,109	9,781,916
2000-2005	14,315,508	96%	578,677	4%	3,057	14,894,185
AVERAGE 1950-1999	637,600	86%	101,192	14%	428	738,607
AVERAGE 2000-2005**	2,385,918	96%	96,446	4%	509.5	2,482,364

* These are probably low. Some records are known to be missing from the data for 1953, 1957, 1967, 1969, 1971, and 1974 (Kasischke et al. 2002).

** Note that the average for the first 6 years of this decade is almost 4 times the average of the previous five decades..

Figure 14. Acreage burned by decade and cause, 1950–2005.



The area burned during the six years between 2000–2005 already exceeds that of every decade on record.

* These are probably low. Some records are known to be missing from the data for 1953,1957, 1967, 1969, 1971, and 1974 (Kasischke et al. 2002).

11. Conclusions

11.1 Flexibility, resourcefulness, and innovation in Alaska fire control

From the beginning, Alaska's fire control agencies displayed flexibility and resourcefulness in the face of many challenges. In 1939, the US Congress created the Alaskan Fire Control Service to protect a huge and largely unknown territory from fire, but the AFCS had little effect. In 1947, the Bureau of Land Management absorbed the AFCS into its Division of Forestry, but funding for fire control disappeared when Congress slashed its budget. The division was innovative in its approach to fire control in the 1950s and 1960s, as it started the Alaska Smokejumper program and an extensive aviation program. With passage of ANCSA in 1971 and ANILCA in 1981, substantial land management and ownership changes occurred throughout Alaska. Concurrently, a national transition away from fire control to fire management began. The AFCS, BLM and eventually the State of Alaska Division of Forestry found ways to meet all of these challenges.

Throughout their history, Alaska's fire control agencies were continually learning. Recognition of lightning's important role in Alaska fire occurrence was one of the first lessons. Creation of a cooperative fire control program through agreements with other agencies allowed the AFCS and BLM to meet higher fire suppression standards. Experimentation with tactics such as cloud seeding, chemical retardant, and aviation also helped the agency learn what would and would not work to suppress fires in Alaska. Agencies also assessed the effects of bulldozers and fireline explosives on frozen soils. This work led to restrictions on their use, as well as requirements for quick revegetation of fire lines.

11.2 Alaska's history is unique

Pyne (1982) stated that fire control in Alaska simply repeated the history of fire suppression in the contiguous US. In his opinion, Alaska's 1957 fire season—when over five million acres burned—provoked the same reaction the fires of 1910 did in the Lower 48. But this oversimplifies the situation.

Fire suppression and management in the contiguous states and Alaska evolved under different conditions and time periods. Table 14 summarizes some of the differences in the history of fire suppression and management in Alaska compared to the contiguous 48 states. Events, such as Interior Secretary Harold L. Ickes' visit to Alaska in 1938 and the 1947 fire season—as well as Alaska's unique geography and ecosystems—influenced the evolution of fire control in the far north. Although they shared the same basic tactics in field fire control, they followed different policies.

One of the primary differences in policy between Alaska and the lower 48 states is that, in Alaska, all the major land management agencies and landowners got together to create what is now called the Alaska Wildland Fire Coordinating Group (AWFCG). Since 1982, this group has jointly addressed fire management issues in the state. This created a unique situation in the US; a statewide fire plan that is based on land management objectives, not fire control agency jurisdictions. These differences, along with the fact that Alaska never had the same degree of fire suppression as the Lower 48, are important in assessing how suppression has affected Alaska's ecosystems. Alaska's unique history indicates that future fire management decisions will probably also require unique solutions.

11.3 Fire ecology plays a major role in Alaska fire planning

Fire plans were essential in restoring fire to the landscape because federal policy required total suppression unless a fire plan was in place that described when, where, and how fires would be treated. The fire plans also required land managers to take an active role in fire management decisions that previously were made almost exclusively by fire suppression agencies.

Alaska's Interagency Wildfire Management Plan (AWFCG 1998)—last updated in 1998—guides fire management decisions in the state. The plan is widely touted as a unique and successful example of agency cooperation. ADFG wildlife biologist Dale Haggstrom, who has been involved in fire planning in Alaska since its inception, believes that the plan has largely met its stated objectives. According to Haggstrom, "There are shortcomings that have been recognized over time and these are being addressed. Also, federal and state policies are evolving. The plan will be amended periodically to increase its effectiveness even further."

The plan specifically provides opportunities for fire on the landscape and the flexibility to manage fires to meet land and resource objectives. Fire is precluded from some parts of Alaska's ecosystems due to urban protection needs, but fire is being allowed in all ecosystems to some extent.

The plan is revised and amended by the Coordinating Group (the AWFCG). The selection of fire management options is the responsibility of the land management agencies and landowners represented in the Group. The fire management agencies, such as AFS and ADNR-DOF, simply facilitate the annual review of the fire management option boundaries, but they do not actually write the plan.

The final report of the 1995 Federal Wildland Fire Management Policy and Program Review stated that interagency management plans should "fully integrate ecological concepts that consider long-term dynamics" and "effectively incorporate current fire-related information, including scientific knowledge." In Alaska, ongoing research is examining the past and present role of fire in the boreal forest and tundra ecosystems. Also under study are the effects of fire and its exclusion on values such as timber, recreation, and air quality. New information from fire research is used in revising the plan.

The main ingredient to the fire plan's success is also its greatest fault. The plan focuses firefighting resources on areas where people and property are most threatened. Although this works well for a while, it sets the stage for catastrophic fire in the future by allowing the forest to become more spruce-dominated and fire prone. The only alternative is to use mechanical treatments and prescribed burning to break up the continuity of fuels near populated areas. Thus far, however, mechanical treatment on a large scale is expensive, while prescribed burning is both expensive and viewed as risky.

11.4 Prescribed fire

Errors in judgment during a wildland fire are often overlooked, but when a mistake is made on a prescribed fire, it is headline news. This makes administrators reluctant to use it. However, prescribed fire has been used in Alaska on a limited basis for almost 50 years. Beginning in the 1950s, the USFWS used fire in the Kenai National Moose Refuge to maintain browse for moose. The State Division of Forestry (DOF) cooperated with ADF&G in burning state lands at Creamer's Field Wildlife Refuge in Fairbanks and within the Tanana Valley State Forest (Division of Forestry 1994). They also burned 90,000 acres north of Tok, Alaska. The BLM participated in the planning and preparation for the "Frostfire" experimental research burn outside of Fairbanks in 1999, and in the last few years ADF&G and DOF completed several stand-scale prescribed burns of aspen in the Nenana Ridge Ruffed Grouse Project.

Alaska's population density (just over one person per square mile) is the lowest in the nation. This gives land managers greater flexibility in the use of both prescribed fires, which are set deliberately, and wildland fires, which are generally ignited by lightning and allowed to burn if they do not threaten resources. Unlike most of the Lower 48, many fires in Alaska do not threaten homes or viewsheds (although smoke can travel great distances and create health and transportation problems).

There is almost no market for black spruce, so harvesting large areas of it for timber products is unlikely. "Without a thriving forest industry, it is expensive and difficult to manage forest fuels and wildlife habitat near developed areas," said ADF&G's Dale Haggstrom, "We need to keep wildland fire management as an option in addition to mechanical treatments and prescribed burning. There is no reason why we should put out every fire in the Full areas and very good reason to let some of them burn if conditions appear safe to do so."

"I would go one step further and ask managers to consider using aerial ignition to help spread wildland fires when conditions are manageable and where burning is needed for either fuels management or wildlife habitat," Haggstrom said. "This would help ensure that areas that would benefit from burning are burned quickly. Actively managing some wildland fires will make it easier, in the long run, to protect people and property and sustain productive wildlife habitat. It is a risky business, but the alternative is worse."

There are no simple answers when it comes to fire. Small incremental burns cannot ameliorate the effects of decades of intensive fire suppression. Fire control organizations continue to find it more challenging to implement fire management than fire suppression because of the risks of losing control of either prescribed or wildland fires.

11.5 What now?

In sum, it is not possible keep fire out of the boreal forest. It is not a matter of whether it will burn, but when. Scientists do not fully understand what the natural fire regime is, but they have shown that excluding fire is not natural and will lead to unacceptable results; suppression just delays the inevitable. With suppression, fires will escape when the conditions are at their worst for fire control. This increases the risk to people and property, and increases the likelihood of large expanses going all at once under extreme conditions.

The same logic applies to smoke. Smoke is a natural, predictable part of life in interior Alaska, but we can reduce its effect by allowing more fires to burn under acceptable conditions instead of deferring that burning to the times when it is difficult or impossible to control.

Fire suppression will always be an essential part of fire management, but it will continue to evolve. In Alaska, one way to integrate fire management and fire suppression is to adjust current job requirements, or "position descriptions," to include not only traditional fire suppression, but also prescribed fire. The firefighter's passion for working hard and fighting fire will remain, but could be supplemented with new tasks in prescribed fire.

For decades, the hallmark of the AFCS and BLM Division of Forestry has been their resourcefulness and flexibility. Today, new challenges face the Alaska Fire Service, the State of Alaska Division of Forestry and other land management agencies. Fire management and urban interface fires are just two of these challenges, and they require the resourcefulness and flexibility for which these agencies are known.

Wildfires have burned in Alaska for thousands of years and will continue to do so. Fire management organizations will continue to adjust to changes in public perceptions and in the scientific knowledge of fire's role in the boreal forests of Alaska.

Table 15. Major differences in the fire control histories of Alaska and the contiguous US

EVENT or CATEGORY	ALASKA	CONTIGUOUS U.S.
Primary factor leading to organized fire control	Interior Secretary Ickes' visit to Alaska in 1938	1910 fires in the western U.S.
Most influential fire season that shaped the future of fire control	1947 Fire Season	1910 Fire Season
Type of area fire control agencies operated in	Remote territory, a large distance from Washington, D.C.	More populated with roads and fire breaks dividing area and providing access
Role of cooperative agreements	Vital to suppressing, detecting and reducing fires	Used to influence state forestry practices also used following WW I and WW II when military resources were available
Most significant early source of money and personnel for control efforts	World War II	The New Deal
Predominant fire control policy up to the 1970s	Suppress as many fires as possible with resources available	10 A.M. Policy (aggressive suppression of all fires, regardless of location)
Current method of delineation of fire protection responsibility	Geographic division between State and AFS north and south of the Alaska Range	Boundaries between different federal and state management jurisdictions
Influences on national fire control abilities	Alaska influenced Boise Interagency Fire Center, cooperative fire control, and use of aviation in suppression	Contiguous states created the majority of tactics and basic organization of fire suppression agencies

Appendix A: Alaska Fire Data 1940 - 2005

Table A-1. Number of fires and acreage burned by cause, 1950–2005

Note: Numbers in red are maximum; blue numbers are minimum.

Year	LIGHTNING-CAUSED FIRES				HUMAN-CAUSED FIRES				ALL FIRES	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
1950	27	12%	445,595	22%	197	88%	**1,612,222**	78%	224	2,057,817
1951	27	10%	17,484	8%	244	90%	202,210	92%	271	219,694
1952	**11**	8%	14,556	20%	125	92%	59,245	80%	136	73,801
1953	75	26%	381,143	82%	210	74%	85,605	18%	285	466,748
1954	63	24%	1,347,990	97%	199	76%	41,930	3%	262	1,389,920
1955	26	14%	10,467	28%	164	86%	26,765	72%	190	37,232
1956	64	28%	446,746	94%	162	72%	29,857	6%	226	476,593
1957	160	41%	5,029,081	99%	231	59%	20,915	1%	391	5,049,661
1958	92	33%	228,648	72%	186	67%	88,567	28%	278	317,215
1959	200	62%	580,830	97%	120	38%	15,744	3%	320	596,574
1960	62	26%	32,657	37%	176	74%	54,523	63%	238	87,180
1961	31	26%	**1,283**	25%	86	74%	3,817	75%	117	5,100
1962	53	52%	37,828	97%	**49**	48%	1,147	3%	**102**	38,975
1963	79	41%	13,859	85%	115	59%	2,431	13%	194	16,290
1964	63	38%	2,430	71%	101	62%	**1,000**	29%	164	**3,430**
1965	30	20%	2,918	41%	118	80%	4,175	59%	148	7,093
1966	73	22%	643,205	98%	251	77%	11,234	2%	324	645,439
1967	76	35%	104,162	96%	139	65%	4,843	4%	215	109,005
1968	265	59%	1,008,911	99%	180	40%	4,310	1%	445	1,013,301
1969	126	24%	2,756,279	65%	389	76%	1,475,541	35%	515	4,231,826
1970	140	28%	107,108	94%	347	71%	6,378	6%	487	113,486
1971	240	51%	1,059,921	99%	232	49%	9,187	1%	472	1,069,108
1972	**472**	73%	963,999	99%	173	27%	2,248	1%	645	966,247
1973	123	37%	50,480	84%	213	63%	9,336	16%	336	59,816
1974	384	49%	645,192	97%	398	51%	17,768	3%	**782**	662,960
1975	134	39%	86,208	67%	210	61%	41,637	33%	344	127,845
1976	227	40%	54,885	79%	345	60%	14,234	21%	572	69,119
1977	401	64%	2,292,431	99%	222	36%	3,377	1%	623	2,295,808
1978	82	25%	5,809	75%	242	75%	1,948	25%	324	7,757
1979	188	67%	385,321	99%	92	33%	3,341	1%	280	388,662

continued on next page

Table A-1. Number of fires and acreage burned by cause, 1950–2005

Note: Numbers in red are maximum; blue numbers are minimum.

Year	LIGHTNING-CAUSED FIRES				HUMAN-CAUSED FIRES				ALL FIRES	
	Number of Lightning-Caused Fires	Estimated % of All Fires That Year	Lightning-Caused Acres Burned	% of All Acres Burned That Year	Number of Human-Caused Fires	Estimated % of All Fires That Year	Human-Caused Acres Burned	% of All Acres Burned That Year	Number of Fires	TOTAL ACRES BURNED
1980	97	28%	2,600	1%	246	72%	362,339	99%	343	364,939
1981	233	46%	471,119	82%	271	54%	101,023	18%	504	572,142
1982	199	44%	70,121	98%	252	56%	1,735	2%	451	71,856
1983	360	50%	79,848	49%	357	50%	82,190	51%	717	162,038
1984	355	85%	116,108	96%	65	15%	4,398	4%	420	120,506
1985	208	37%	404,881	99%	356	63%	2,419	1%	564	407,300
1986	310	43%	436,567	91%	417	57%	40,888	9%	727	477,455
1987	175	27%	116,608	69%	483	73%	52,537	31%	658	169,145
1988	251	43%	2,109,974	99%	328	57%	24,565	1%	579	2,134,539
1989	45	10%	53,388	82%	396	90%	11,422	18%	441	64,810
1990	408	54%	3,005,371	94%	342	46%	183,707	6%	750	3,189,078
1991	323	43%	1,620,976	97%	425	57%	46,974	3%	748	1,667,950
1992	98	22%	89,483	60%	351	78%	60,523	40%	449	150,006
1993	271	36%	710,772	100%	488	64%	2,097	0%	759	712,869
1994	210	33%	258,763	97%	433	67%	6,959	3%	643	265,722
1995	65	15%	38,209	87%	359	85%	5,737	13%	424	43,946
1996	141	20%	428,015	71%	**580**	80%	171,252	29%	721	599,267
1997	239	33%	2,009,623	99%	477	67%	17,276	1%	716	2,026,899
1998	46	11%	119,336	99%	367	89%	1,416	1%	413	120,752
1999	151	31%	980,809	98%	335	69%	24,618	2%	486	1,005,427
2000	83	22%	740,915	98%	286	78%	15,381	2%	369	756,296
2001	28	8%	10,369	5%	321	92%	205,670	95%	349	216,039
2002	167	31%	1,881,458	86%	376	69%	305223	14%	543	2,186,681
2003	75	16%	580,593	96%	401	84%	22,125.00	4%	476	602,718
2004	270	39%	**6,505,394**	100%	426	61%	17,788	0.3%	696	**6,523,182**
2005	328	53%	4,596,779	100%	296	47%	12,490	0.3%	624	4,609,269
TOTAL	9,130	37%	46,195,505	89%	15,350	63%	5,638,287	11%	24,480	51,824,533
AVE	163		824,920		274		100,684		437	925,438
S.D.	118		1,329,798		124		290,396		194	1,388,976
Max	472		6,505,394		580		1,612,222		782	6,523,182
Min	11		1,283		49		1,000		102	3,430

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