ALASKA LEGISLATURE COMMITTEE FILES, 1989-1990 8672
6040 HOUSE RESOURCES

444

KENAI PENINSULA BOROUGH

144 N. BINKLEY • SOLDOTNA, ALASKA 99669
PHONE (907) 262-4441

DON GILMAN
MAYOR

RECEIVED
JUN 13 1988
COMMISSIONER'S OFFICE
COMMUNITY & REGIONAL AFFAIRS

June 8, 1988

Alaska State Geographic
Names Board
P.O. Box B
Juneau, AK 99811

Dear Sirs:

On June 7, 1988, the Kenai Peninsula Borough approved a motion to forward a letter of non-objection to the naming of a mountain at Latitutde 60°26'0" North; Longitude 149°33'30"East, Section 13, Township 4N, Range 2W, Seward Meridian located on the north shore of Kenai Lake and the south shore of Crescent Lake. The mountain is currently unnamed based on the section map - Seward B-7 quadrangle.

Debra A. McGhan has requested the mountain be named in memory of her deceased husband - Mt. McGhan.

If we may be of further assistance, please contact the Borough Clerk's Office, 262-4441 ext. 220/221.

Very truly yours,

Joanne Brindley

Joanne Brindley, CMC
Kenai Peninsula Borugh Clerk

HCR

45

HOUSE COMMITTEE REPORT

(9)
Date Referred: January 31, 1990 FURTHER REFERRALS:

Date of Committee Action: 3/12/90

The RESOURCES Committee considered: HCR 45

HOUSE CONCURRENT RES NO. 45 SPRUCE BARK BEETLE INFESTATION

Relating to spruce bark beetle infestation.

RECOMMENDATIONS:
[X] be replaced with CS HCR 45 (RES) [X] the same title / [ ] a new title
[ ] have attached amendment(s)
[X] do pass
[ ] do not pass
[ ] no recommendation
[ ] individual recommendations
[ ] additional referral to the ________ Committee

ADOPTS: ________ letter of intent

ATTACHES NEW FISCAL NOTE(s): (Dept)
[ ] fiscal impact ________
[X] zero fiscal note HRC
[ ] zero with analysis ________

APPROVES PREVIOUS: (Date/Dept)
[ ] fiscal note(s) ________
[ ] zero fiscal note(s) ________
[ ] zero fn/analysis ________

SIGNING DO PASS:

(signatures)

SIGNING: (Check approp. column)

	Do Not Pass	No Rec	Amend

Chairman's Signature

STATE OF ALASKA
1990 LEGISLATIVE SESSION

BILL VERSION: HCR 45
PUBLISH DATE:

FISCAL NOTE

REQUEST:

Revision Date:
Title:
Spruce Bark Beetle Infestation
Sponsor: Rep. Menard
Requestor: House Resources Committee

Agency Affected: All Agencies
BRU:

Components:

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96
PERSONAL SERVICES	0	0	0	0	0	0
TRAVEL	0	0	0	0	0	0
CONTRACTUAL	0	0	0	0	0	0
SUPPLIES	0	0	0	0	0	0
EQUIPMENT	0	0	0	0	0	0
LAND & STRUCTURES	0	0	0	0	0	0
GRANTS, CLAIMS	0	0	0	0	0	0
MISCELLANEOUS	0	0	0	0	0	0
TOTAL OPERATING	0	0	0	0	0	0

CAPITAL	0	0	0	0	0	0

REVENUE	0	0	0	0	0	0

FUNDING: (Thousands of Dollars)

GENERAL FUND	0	0	0	0	0	0
FEDERAL FUNDS	0	0	0	0	0	0
OTHER	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS: (Attach a separate page if necessary)

Prepared by: House Resources Committee
Division: Representative Curt Menard
Phone: 4944
Date: 3/14/90

Approved by Commissioner:
Date:
Agency:

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)

page ___ of ___

March 12, 1990
Bruce Baker, ADF&G

Briefing on Spruce Beetle Infestations and Fire in the Boreal Forest - a Fish and Wildlife Habitat Management Perspective

-The Boreal Forest. Unlike the coastal Sitka spruce-western hemlock rain forest where fire or other rather sudden and widespread tree mortality factors are rare or nonexistent, Alaska's boreal or northern forest includes white and black spruce, birch, and aspen and has historically been subject to fire and, at least in the southcentral part of the state, large-scale infestations of spruce beetle (Dendroctonus rufipennis).

-Fire and Habitat Diversity. Although the diverse plant communities in Alaska's present day boreal forest are a result of site differences (slope, soil type, drainage, permafrost, etc.), they are also due largely to a history of fire during the past two hundred years. These plant communities provide the variety of habitat conditions necessary to support the many species of wildlife that abound. This historic role of fire in maintaining a mosaic of plant communities and habitat types in the boreal forest has also been documented in Canada, Scandinavia, Finland, European Russia, and Siberia. Without fire, animal species dependent on any stage of plant succession other than the oldest, commonly white and black spruce, would become rare or would disappear.

-Alaska's Fire Management Categories. Of the four wildfire management categories used by state and federal agencies in Alaska, ranging from "critical protection" in areas of human habitation to "limited action" in remote areas, it is the most limited action that usually provides the greatest benefit to wildlife. Where the limited action alternative is not feasible, prescribed burning can be used as substitute for wildfire.

-Occurrence of Spruce Beetle Infestations. The spruce beetle is native to Alaska, and its populations commonly begin their buildup in blowdown or in felled white spruce and Lutz spruce (a hybrid between white and coastal Sitka spruce found on the Kenai Peninsula) greater than 5 inches in diameter that is not disposed of in a timely manner. They can then infest and continue their population increase in nearby standing trees. The major outbreaks reported in the 1960s and early 1970s on the Kenai Peninsula and near Tyonek corresponded with the clearing of hundreds of miles of seismic exploration lines.

-Spruce Beetle and Habitat Diversity. Like fire, spruce beetle infestations, common in southcentral Alaska's transition climatic zone, are a rather sudden and stand-wide tree mortality factor that can contribute positively to the mosaic of habitat types found in the boreal forest, a mosaic essential in maintaining the habitat diversity that a variety of fish and wildlife species depends on.

-Vegetation Surviving Spruce Beetle Infestations. Spruce beetle infestations do not kill all the spruce in their path. Much remains for future habitat, and less shade-tolerant deciduous plant species may even flourish. Localized spruce mortality from the spruce beetle can be high, and an example is the report of 90 percent mortality of white spruce 5 inches in diameter or larger in the Cooper Creek and Russian River campgrounds on the Kenai Peninsula (U.S.F.S., 1989). Published data from both sides of Cook Inlet indicate, however, that significant percentages of spruce, albeit in the smaller diameter classes, and other vegetation useful for fish and wildlife habitat, may survive intensive spruce beetle infestations and may do so over extensive areas. Seventy one percent of all white spruce survived following a 1974-75 spruce beetle infestation along Resurrection Creek on the Kenai Peninsula (Werner and Holsten, 1983). Field data from the large and very intensive spruce beetle infestation that started near Tyonek and which by 1972 had covered more than 70,000 acres, indicate that 35.4 percent of the white spruce 5 inches diameter and larger survived, along with all the birch and other deciduous plants (Baker and Kemperman, 1973).

-Historic Infestations and Fire. Although spruce beetle infestations can result in an abundance of dead wood, historically there have been large areas of intensive infestation that have not burned over in the years or decades immediately following beetle infestation. Major infestations include a 200,000-acre outbreak reported along the Copper and Chitina rivers in the 1920s, another large outbreak of the insect that extended into Alaska from British Columbia during the 1940s, infestations that built up on the Kenai Peninsula and which by 1971 covered about 260,000 acres, and the Tyonek-Beluga River infestation that by 1972 had covered more than 70,000 acres. Vast areas along the Copper River remained unburned at least a half century following the infestation there.

-Forest Productivity. Alaska's mature white spruce stands are very productive for fish and wildlife, as are stands in various stages of post-fire or post-beetle infestation plant succession. It is the mosaic of these stand types that results in a high level of fish and wildlife habitat diversity. Unlike Scandinavia and Finland, for example, Alaska's forest ecosystems still support in abundance the complexes of fish and wildlife species that they did before white settlement.

-Timber Harvest and Habitat Management in the Boreal Forest. While it may be possible in some site-specific situations to design timber sales to provide moose browse, most timber sales in the boreal forest present wildlife habitat biologists with the challenge of helping to mitigate against potentially adverse habitat impacts that can result from logging, associated road building, and the changing land use patterns that commonly follow. It has not, for example, been demonstrated that species such as the grizzly bear are likely to fare as well on logged over lands as they do in unlogged stands.

United States
Department of
Agriculture

Forest Service

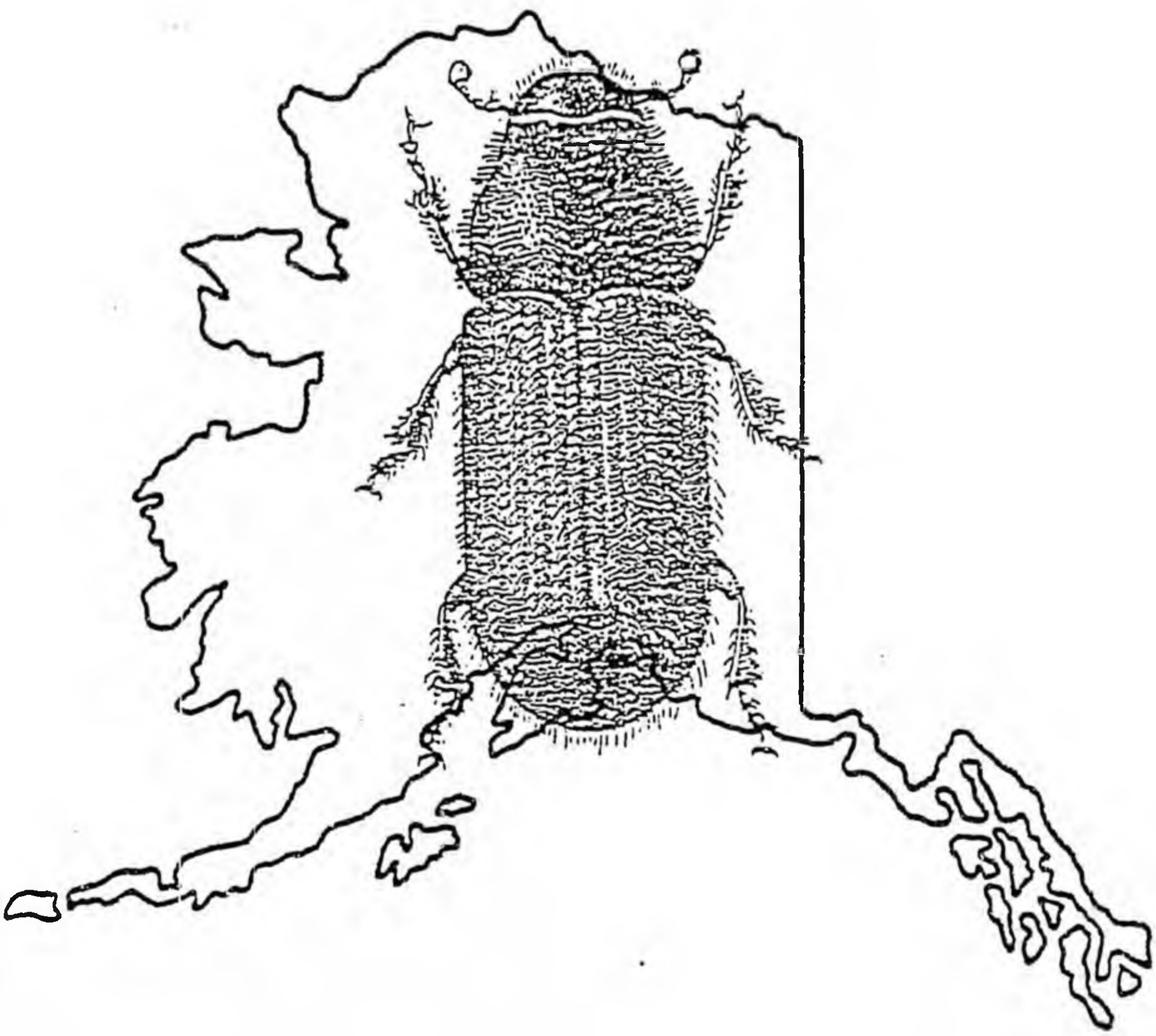
Alaska
Region

Forest Pest Management Report

Technical Report: R10-90-18

Spruce Beetle Activity in Alaska: 1920-1989

February 1990



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TECHNICAL REPORT R10-90-18
SPRUCE BEETLE ACTIVITY IN ALASKA 1920-1989

FEBRUARY 1990

Prepared by:

Edward H. Holsten, Forest Entomologist
Forest Pest Management
Region 10, Alaska

Approved by:

Gene Lessard, Group Leader
Forest Pest Management
Region 10, Alaska

Dennis Pendleton, Acting Director
State & Private Forestry
Region 10, Alaska

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SPRUCE BEETLE ACTIVITY IN ALASKA, 1920-1989

The most destructive forest insect in Alaska is the spruce bark beetle, *Dendroctonus rufipennis* (Kirby). This insect has killed mature spruce on hundreds of thousands of acres of Alaska's forested lands (Werner et al. 1977). All species of Alaska spruce are susceptible to beetle attack, but black spruce (*Picea mariana*) is rarely attacked.

The occurrence of spruce bark beetle outbreaks and their related impacts have been a common feature of Alaska's forested landscape for decades in south-central Alaska. Statements such as: "It is estimated that in this area at least 60 percent of the spruce is already dead or dying. In a few years green spruce will be hard to obtain, and travel will be more difficult by windfalls resulting from the rotting of the roots of the dead trees. The danger of forest fires will also be increased;" were common in Alaska decades ago (Capps and Tuck 1935).

An on-going infestation of the spruce bark beetle in the Cooper Landing area of the Kenai Peninsula has resulted in public outcry concerning the impact(s) on forest resources resulting from the death of millions of spruce trees. Newspaper articles covering the pro's and con's of spruce beetle outbreaks, impacts, proposed suppression, etc. abound. Statements such as "___an epidemic of spruce bark beetles has swept the Kenai Peninsula, outrunning government efforts to stop its spread around the headwaters of the Kenai River. Officials say the dying forests now pose a fire hazard in the populated canyon_____." (Anch. Daily News, Oct. 25. 1989) have been common in the press recently. We can expect an increase in public awareness of spruce beetle infestations as many of Alaska's spruce forests become more susceptible through the effects of aging, fire suppression, and the lack of management.

Most spruce beetle infestations have, and will continue to occur in the Lutz (*P.* X *lutzii*) and white spruce (*P. glauca*) stands of south-central Alaska where weather conditions appear to be more favorable for increases in populations of spruce beetles. Outbreaks have been uncommon in the Sitka spruce (*P. sitchensis*) forests of maritime Alaska (Werner et al. 1977). However, results of a recent study (Holsten and Werner 1990) have demonstrated that host suitability may be as important as host susceptibility and weather conditions in the development of spruce beetle outbreaks in Alaska. In terms of progeny production, white spruce as a host produces more beetles than Lutz spruce which is more productive than Sitka spruce. Cold winter temperatures and thrifty fast growing stands have probably helped maintain spruce beetles at endemic levels in interior Alaska. When these factors are ameliorated however, spruce beetle populations can increase rapidly to outbreak levels: a condition which became apparent along the Yukon River in the last five years. Further massive outbreaks can be expected in interior Alaska, especially in forests bordering the major drainages such as the Yukon and the Kuskowkim. In the absence of fire and management, these forests are becoming more susceptible to spruce beetle outbreaks.

Forest pest outbreaks in the United States appear to have increased both in frequency and severity during the last twenty years and Alaska is no exception as spruce beetle outbreaks have increased in severity and occurrence. These pest outbreaks are apparently a symptom of an overall decline in the health of the Nation's forests (USDA For. Serv. 1989). This is not an irreversible trend. Action can and must be implemented on our more important forested lands. Achieving a desired level of productivity, whether productivity is timber, recreation, wildlife or some mix of these resources, generally requires that forest vegetation be alive and healthy. Silvicultural changes are the most important and long lasting, cost effective actions to reduce forest pest impact on the condition of the forest (USDA For. Serv. 1989). On those lands where economics and other societal values allow treatment, emphasis must be placed on achieving long-term improvements. We must avoid practices that promote short-term outputs but are detrimental to the forest health. Such practices can have a negative impact on long-term productivity. There is an urgent need for research studies which delineate the effects (impacts) of bark beetle infestations on such non-timber forest resources as recreation, wildlife and fisheries, and stream flow.

An interesting finding from this review of Alaska spruce beetle infestations is that many areas have been repeatedly infested over the years: Eklutna-1950's&1980's; Tlikakila River 1950's&1980's, Resurrection Creek-1957&1977, Skwentna River-1930's&1989, Willow Creek-1930's&1980's; Tustumena Lake 1950's&1980's; and most of the northern portion of the Kenai National Wildlife Refuge, to name a few. The general result of the early infestations was a reduction in the size of the residual stems because the majority (up to 90%) of all stems greater than 6" in dbh were killed by spruce beetles. Type conversion did not occur in many areas because there were plenty of small spruce remaining (Beckwith and Curtis 1972). It appears that these stands of small spruce became over-stocked and less thrifty with age and again became susceptible to spruce beetle outbreaks. Many of the repeatedly infested areas are undergoing a type conversion as little or no natural spruce regeneration is present. In order to bring these sites back into spruce, some site preparation such as brought about by fire or logging must be undertaken followed by planting. Type conversion has also occurred in mixed hardwood/spruce stands that have been infested. For example, the severe spruce beetle infestation near Tyonek in the 1970's resulted in 65% mortality of all spruce over 5" dbh. Birch became the dominant species in the residual stand (Baker and Kemperman 1974).

The following summaries present a brief, but complete overview of all documented spruce bark beetle infestations in Alaska presented by year and general location. Outbreaks are grouped into three geographic areas: (1) Interior Alaska -- those forested areas north of the Alaska Range; (2) South-central Alaska which encompasses the Kenai Peninsula and other forested areas south of the Alaska Range excluding the Sitka spruce forests which are placed in the (3) Maritime Region which includes the forests of southeast Alaska, Prince William Sound, and portions of Cook Inlet. Factors contributing to the genesis of a spruce bark beetle outbreak, location of the outbreak, acreage infested, and impact(s) of the outbreak are discussed if available from the literature. A brief discussion of spruce beetle biology, tree hosts, population dynamics, and impacts, etc. is presented in Appendix A. A summary of all outbreaks by geographic location is presented in Table 1 at the end of this report. The bibliography concluding this report lists, by year, the majority of Alaska reports, publications, etc. pertaining to the spruce bark beetle.

SUMMARIES BY YEAR AND LOCATION

1920-1930

SOUTH-CENTRAL: The first recorded Alaska spruce beetle outbreak occurred in white spruce stands along the Copper River drainage between Chitina and McCarthy. The outbreak started in the early 1920's and by the mid-1920's covered more than 200,000 acres (Moffit 1922). The cause of the outbreak is not known but may have been related to drought and logging activities associated with the Kennecott Copper development (Fig. 1a).

1931-1940

SOUTH-CENTRAL: USGS geological survey parties described wide-spread white spruce mortality northwest of Anchorage (Capps 1935, Capps and Tuck 1935). Large spruce beetle outbreaks occurred in the late 1920's to the early 1930's along the Skwentna and Susitna Rivers and in the Willow Creek/Kashwitna area during the early 1930's (Fig. 1b).

MARITIME: A large spruce bark beetle outbreak infested more than 100,000 acres of Afognak Island's Sitka spruce forests in the 1930's (Williams 1933). The outbreak was over by the mid-1940's (Furniss 1948). Areas most heavily impacted included Blue Fox Bay, along Kupreanof Straight, and Whale Island. A 1933 timber inventory estimated that 23% of the spruce had been killed with mortality amounting to 149,679,000 board feet (bf) over 107,776 acres (Williams 1933). The cause of the outbreak is not known (Fig. 2a).

194 1950

SOUTH-CENTRAL: Scattered mortality of white spruce was noted in 1950 in trees bordering the Kenai Burn of 1947 (Furniss 1950). Spruce beetles had attacked and bred in fire scorched trees then moved into nearby green trees (Fig. 1b).

Spruce beetle activity was appa nt in 1947 along the lower slopes on the southeast side of Knik Arm between Anchorage and the Knik River crossing (Furniss 1950). Beetle populations apparently increased in fresh blowdown near Eagle River and Chugiak as well as in logging slash near Eagle River.

MARITIME: From 1940-1948, a spruce bark beetle outbreak occurred in the Edna Bay area of Kosciusko Island located in southeast Alaska. Considerable mortality also occurred on Bluff and Barrier Islands (Furniss 1946, Furniss and Jones 1946). The outbreak was possibly caused by a combination of factors including blowdown, overmature low-vigor spruce growing on shallow, dry soils. Approximately 50,000,000 bf of high value Sitka spruce was killed over 6,400 acres (Fig. 2b).

INTERIOR: Increasing mortality of white spruce caused by the spruce beetle was first reported in 1943 from the Haines cut-off area (Hughes 1948) during construction of the Haines Cut-off Highway. Spruce mortality averaged 50% in stands from mile 89 northward to the south end of Dezadeash Lake

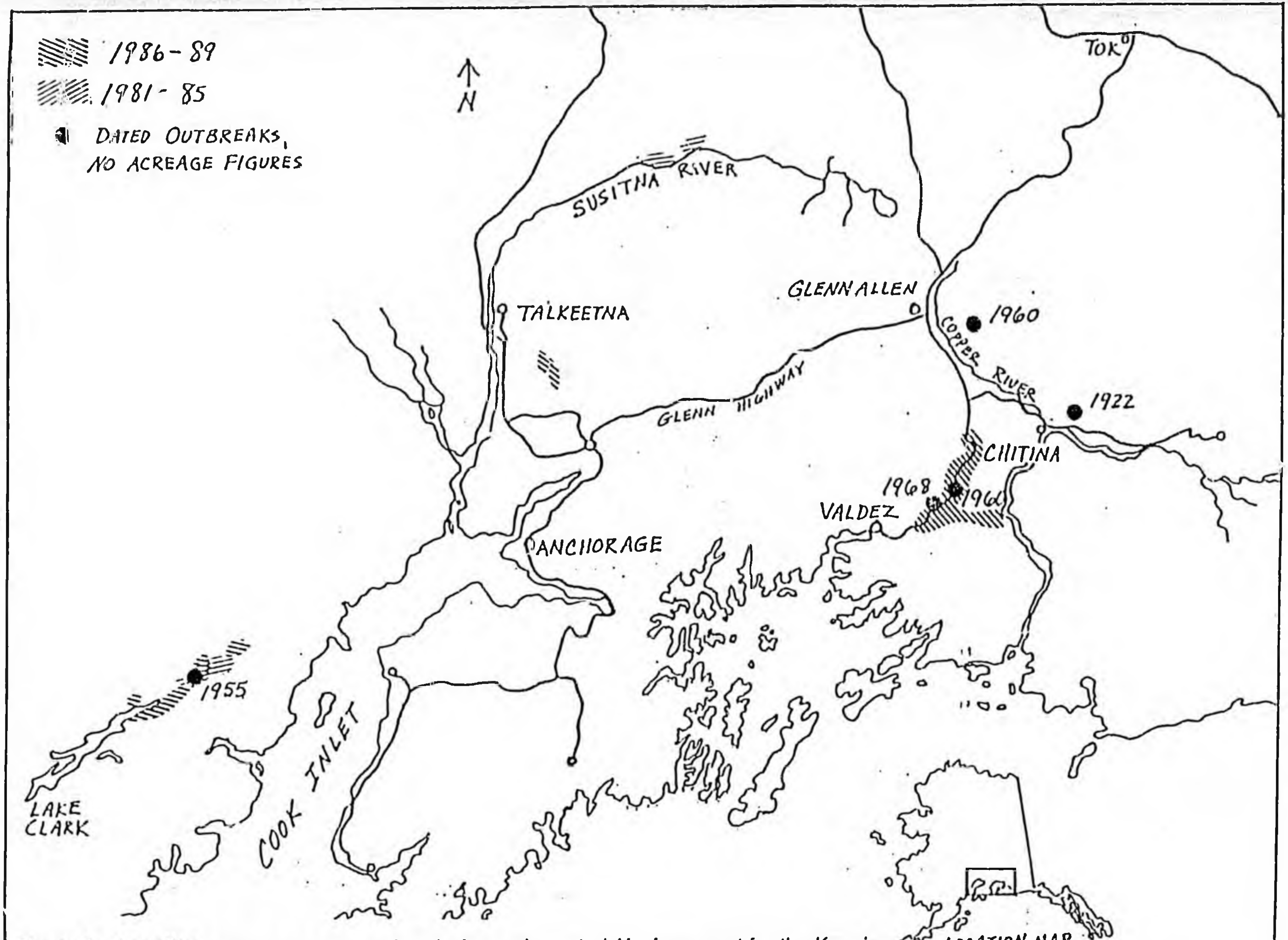

Figure 1a. Location of spruce beetle outbreaks in south-central Alaska except for the Kenai Peninsula.

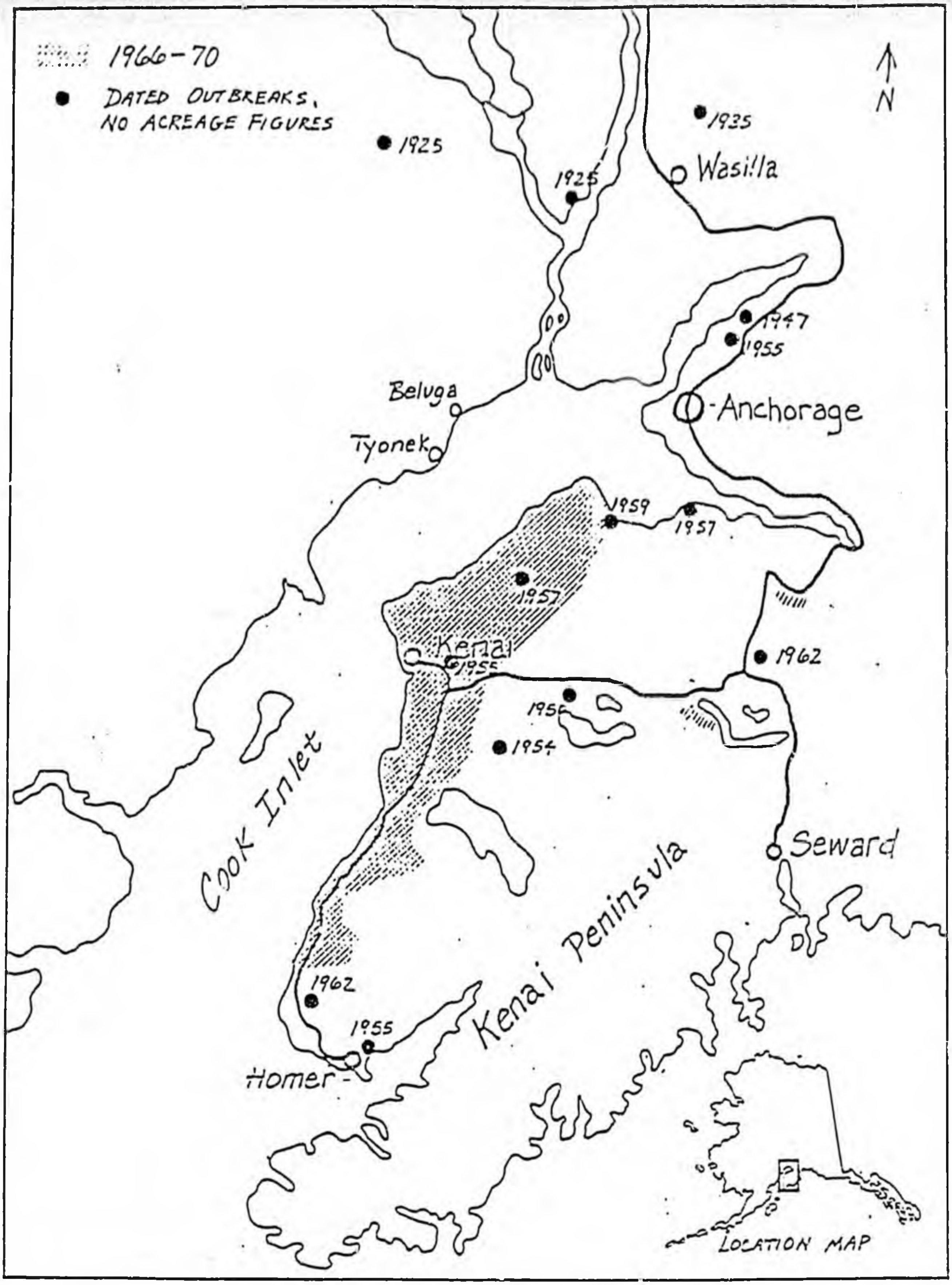

Figure 1b. Location of spruce beetle outbreaks in south-central Alaska up to 1970; specifically on the Kenai Peninsula.

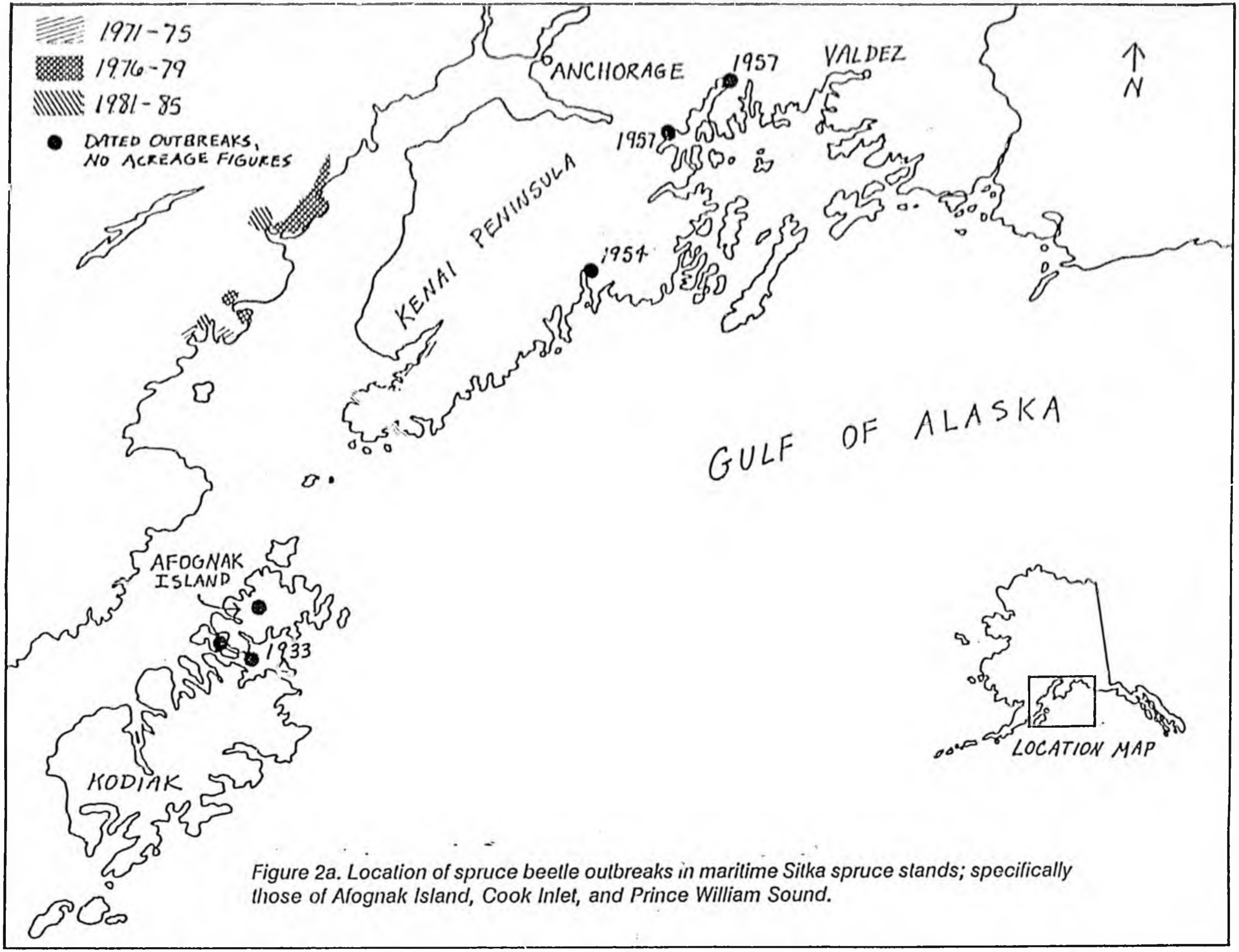

Figure 2a. Location of spruce beetle outbreaks in maritime Sitka spruce stands; specifically those of Afognak Island, Cook Inlet, and Prince William Sound.

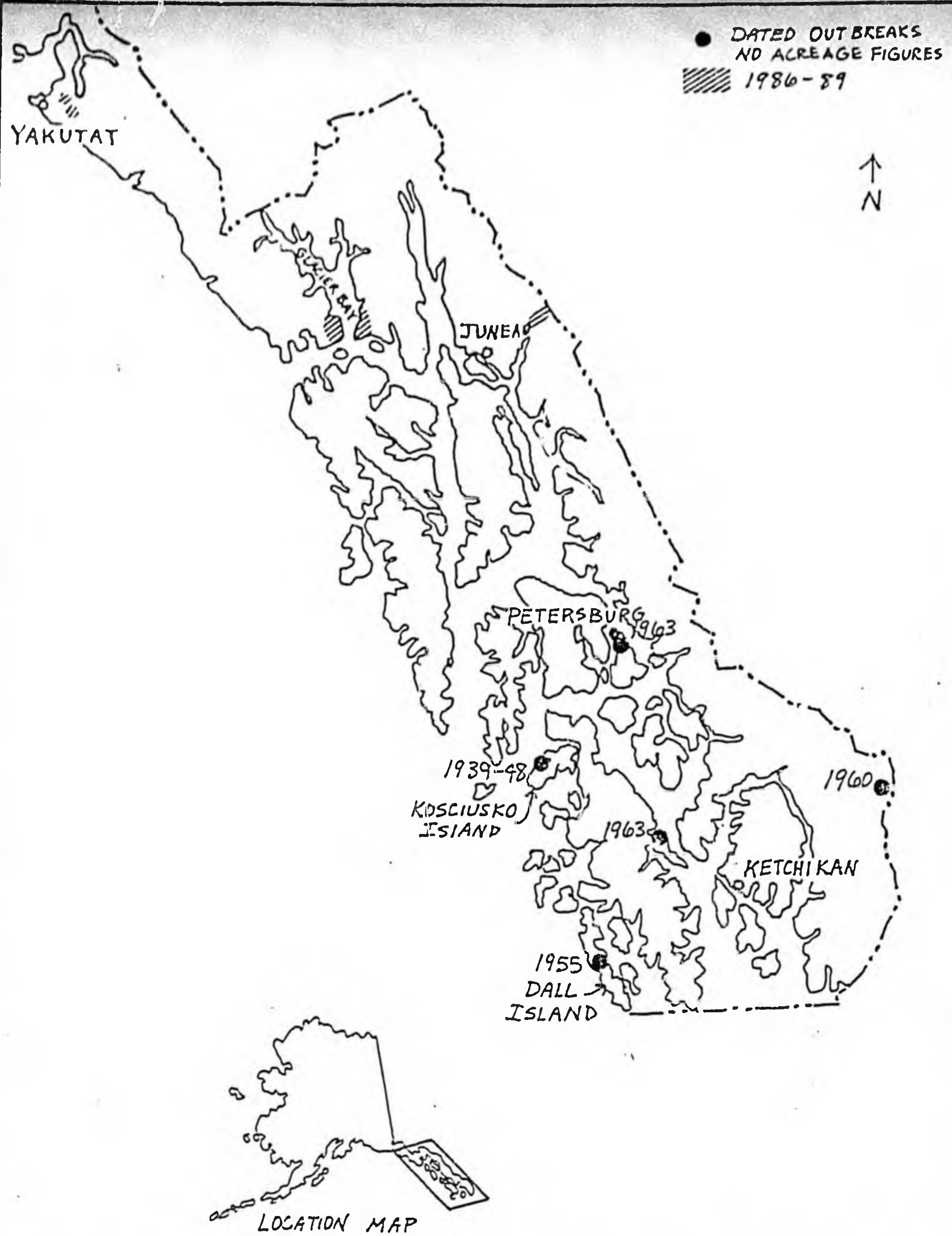

Figure 2b. Location of spruce beetle outbreaks in southeast Alaska's maritime Sitka spruce stands.

(Canada) at mile 127 then northeasterly towards Champagne, Y.T., Canada. The infestation barely made it into Alaska and caused little mortality.

1951-1955

SOUTH-CENTRAL: Spruce bark beetle activity was reported (McCambridge 1954) from the vicinity of Skilak and Tustumena Lakes; no acreage figures were given. A 1954 ground check indicated that wood pecker and parasite activity were quite high and spruce beetle populations were declining. Powerline and road construction were undertaken near Soldotna and Homer and large quantities of slash were left on the ground. Spruce beetle populations apparently increased in this material and began attacking and killing standing live spruce at a light, but steady rate (McCambridge 1955) (Fig. 1b).

Infested spruce were once again apparent northeast of Anchorage in 1955. The scattered outbreak (single trees or small groups) encompassed several thousand acres in the vicinity of Eklutna (McCambridge 1955) (Fig. 1b).

An on-going spruce beetle outbreak was detected in white spruce stands near Lake Clark (McCambridge 1955). Extensive areas of previous beetle activity as well as current tree mortality were observed along the Tlikakila River, NE of Lake Clark. The infestation was scattered over 100,000 acres in 1955 and declining (Fig. 1a).

MARITIME: A small number of standing infested Sitka spruce were observed in 1954 near the Bear Lake logging operation near Seward (McCambridge 1955). This spruce beetle activity declined in the following years (Fig. 2a).

1955 aerial detection surveys noted pockets of recent spruce beetle activity on the south side of Port Bazan on Dall Island (McCambridge 1955). This outbreak lasted from 1952-1957 and impacted 200 acres of Sitka spruce resulting in a volume loss of 1.5 million bf (500 trees killed each averaging 3,000 bf)(Downing 1956 a,b). Salvage logging was promptly undertaken (Fig. 2b).

1956-1960

SOUTH-CENTRAL: Spruce bark beetle activity increased on portions of the Kenai Peninsula in the late 1950's. Several small outbreaks were detected in 1957 on the Chugach National Forest (CNF) near the east fork of Sixmile Creek and mid-way up the Resurrection Creek (Downing 1957). Elsewhere on the Kenai, bark beetle activity was noted along the shore on the east side of Chickaloon Bay and mid-way up the Swanson River on the Kenai National Moose Range (KNMR). Losses within the KNMR were in close proximity to a large burned-over area (Fig. 1b).

Bark beetle activity on the CNF increased in 1958 with infestations noted along Resurrection Creek, Palmer Creek, Granite Creek, Quartz Creek. Losses were expected to be high in 1959 (USDA For. Serv. 1958). As expected, spruce beetles caused heavy losses of white and Lutz spruce on portions of the Kenai Peninsula (Downing 1959). Specifically, infestations covered approximately 16,000 acres of the CNF in the following areas: Quartz Creek-Summit Lake, Granite Creek, Resurrection and Palmer Creek. Control of the outbreaks through salvage logging and chemical measures was considered. A larger, scattered infestation covering tens of thousands of acres was located on the northern ponion of the KNMR extending from Chickaloon River on the east to Moose Pt. on the west and north to Pt. Possession (Downing 1959). Infestations did not increase in size in 1960 on the Kenai but intensified

(Downing 1960). Two new spruce beetle outbreaks however, were detected near Copper Center; one along the Little Tonsina River and the other on the east side of the Copper River. Several thousand trees were killed and the outbreak was expected to continue (Downing 1960) (Fig. 1b).

North of Anchorage, losses due to bark beetles declined in 1957 along the Matanuska River and the southeast side of Knik Arm.

MARITIME: A spruce beetle infestation in Sitka spruce stands bordering Blackstone Bay near Whittier was detected in 1957. This two thousand acre outbreak had been on-going since 1952 (Downing 1957). Another smaller (500 acre) outbreak was detected along Pt. Pakenham in the College Fjiord area of Prince William Sound. Both outbreaks declined in 1958 (USDA For. Serv. 1958) (Fig. 2a).

1961-1965

SOUTH-CENTRAL: Bark beetle activity was static in 1961 (Crosby 1961) but increased in 1962 on the Kenai Peninsula (Crosby 1962). Two new hot spots were detected: one near Anchor Point and the other about 40 miles north of Seward. It was estimated that there would be a 2- to 3-fold increase in numbers of newly attacked trees in 1963. Also, recent (1962) beetle infested spruce were detected in the Copper River area near Chitinia. The increases in spruce beetle populations expected in 1963 failed to materialize and by 1965, spruce beetle populations were at low, endemic levels throughout the State (Crosby 1963, 1964, 1965). No active beetle infestations were noted from either aerial survey or highway reconnaissances (Fig. 1a,b).

MARITIME: Spruce beetle activity was reported in 1963 from central Prince of Wales Island and from a point near Petersburg (Crosby 1963). Only a few trees were attacked in each area. Several areas of recent Sitka spruce blowdown in southeast Alaska failed to produce the expected build-up of spruce beetle populations (Fig. 2b).

1966-1970

SOUTH-CENTRAL: The late 1960's was a period of rapid expansion of spruce bark beetle outbreaks on the Kenai Peninsula. Patches of tree mortality occurred in a variety of areas of the CNF in 1966: west shore of Kenai Lake, junction of the Russian and Kenai Rivers, and near Jerome Lake. The use of trap trees as a control measure for the suppression of spruce beetle populations was contemplated for a section of Snug Harbor Road where infestations were increasing due to large amounts of breeding material (scorched spruce) from the 1959 Kenai Lake Burn (Crosby 1966, Galea 1968). Elsewhere on the Kenai spruce beetle populations increased. Considerable tree mortality was observed in 1966 on 100 acres near the mouth of Chickaloon River and further south on the Kenai Peninsula near Anchor Point. The Chickaloon River infestation within the Moose Range extended its borders noticeably during 1967 and by 1969 bark beetle populations covered 40,000 acres from Pt. Possession to Homer. A continuation of drought conditions had provided the catalyst for numerous minor outbreaks created by a succession of land clearing, petroleum exploration and various right-of-way activities to erupt into the present major epidemic (Crosby and Curtis 1969). By 1970 two hundred thousand acres were infested on the KNMR with and additional 60,000 infested acres on State and private lands accounting for more than a billion bf of spruce mortality. The spruce beetle infestation extended almost unbroken from Pt. Possession to Clam Gulch with two smaller outbreaks occurring in the Deep Creek drainage near Ninilchik. This major outbreak expanded from a minor outbreak of less than 100 acres in 1966 into a major epidemic covering more than four townships (USDA For. Serv. 1970, Curtis 1970) (Fig. 1b).

Bark beetle activity likewise increased in the late 1960's on portions of the CNF: a high incidence of bark beetle activity was observed in 1967 in the Granite Creek area. Scattered spruce mortality had been noted in this area since 1957. Approximately 1,300 acres of infested spruce occurred between East Fork River and the Granite Creek Guard Station (Crosby 1967). An eight acre stand of spruce was infested around a proposed Forest Service Campground near Juneau Falls. A 400 acre hot spot within the 1,300 acre Granite Creek/East Fork infestation was treated with a combination of trap trees and chemicals (Crosby and Curtis 1968). By 1969, spruce beetle populations were subsiding on the CNF. Another 300 acres of the Granite Creek infestation were treated (Crosby and Curtis 1969). Spruce beetle population build-up was detected in 1970 in the 1969 blowdown which occurred in the Six Mile area, Resurrection Creek drainages and in the Summit Lake area. Likewise, spruce beetle populations were increasing around the edges of the 1969 Russian River Burn (USDA For. Serv. 1970, Curtis 1970) (Fig. 1b).

Spruce mortality was observed in 1968 on 200 acres along Caribou Creek near mile 108 of the Glenn Highway. Likewise, increased tree killing was observed on scattered over-mature spruce along the east side of the Tonsina River in the vicinity of Stuart Creek (Crosby and Curtis 1968); beetle populations declined in both areas by 1970 (Fig. 1a).

The 1969 drought conditions as well as land clearing practices resulted in increased spruce beetle population build-up causing heavy tree killing of white spruce in suburban Anchorage areas. Similar conditions occurred in the white spruce stands between Palmer and Eureka (Crosby and Curtis 1969).

MARITIME: The only documented spruce beetle activity occurred in 1968 along a five mile stretch of the Salmon River at the head of Portland Canal in southeast Alaska. Two hundred acres of river bottom Sitka spruce were killed by spruce beetles. The infested timber was probably pre-disposed to beetle attack by prior flooding and subsequent damage to tree roots. Salvage logging was employed (Crosby and Curtis 1968) (Fig. 2b).

1971-1975

SOUTH-CENTRAL: The early 1970's saw an overall decline of spruce beetle activity on the Kenai Peninsula and a dramatic increase in infestations on the west side of Cook Inlet. Increased activity however, was noted on the eastern edge of the Moose Refuge where 400 acres along Mystery Creek were infested. The anticipated build-up of spruce beetle populations in portions of the CNF did not materialize. The 700 acre treatment area in the Granite Creek area was effective as no new infestations were detected in 1971 (Curtis and Swanson 1972) (Fig. 1c).

Spruce beetle populations in 1972 started to decrease on the northern half of the Kenai Peninsula following six years of outbreaks. These outbreaks followed several years of drought. Rainfall within the infested area was below the long-term average for six of the ten years from 1961-1970. The general result of this infestation was a reduction in size of the residual stand. Type conversion had not occurred as there were plenty of small size spruce (Beckwith and Curtis 1972). The most serious outbreak in progress on the Kenai Peninsula was occurring south and west of Tustumena Lake from Clam Gulch to the Anchor River. Tree killing was reported scattered over 60,000 acres (Baker and Curtis 1972) (Fig. 1c).

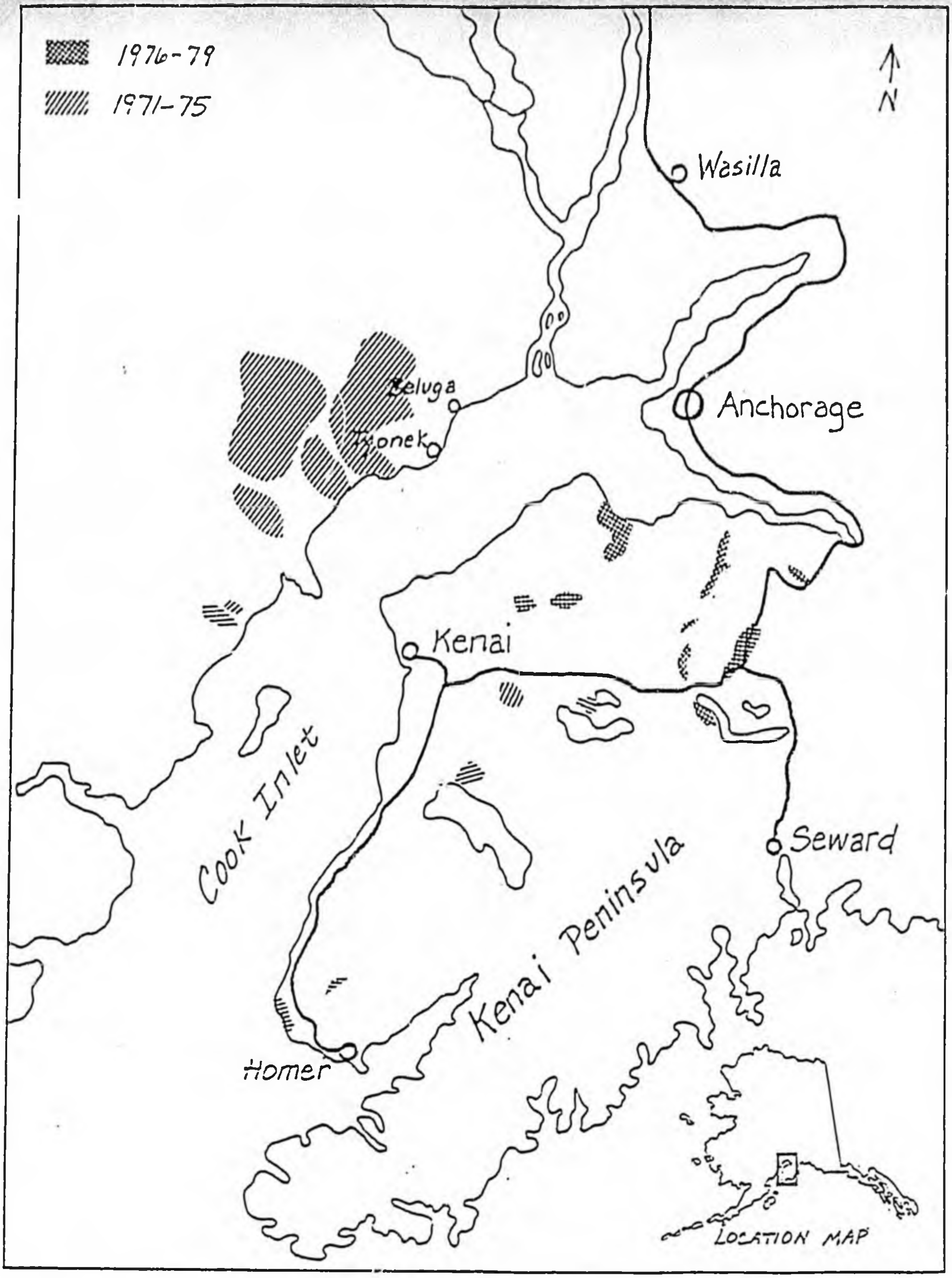

Figure 1c. Location of spruce beetle outbreaks from 1971-1979 in south-central Alaska; specifically on the Kenai Peninsula and the west side of Cook Inlet.

Spruce beetle populations were generally at low levels on the CNF with localized patches of spruce mortality occurring near Canyon and Granite Creek drainages (Baker and Curtis 1972). Spruce beetles continued to breed in patches of blowdown along Resurrection Creek (Fig. 1c).

A "new" large outbreak was detected in 1972 on the west-side of Cook Inlet where more than 70,000 acres of spruce mortality occurred near Trading Bay and Tyonek. This outbreak appeared to be in progress for 3-4 years. The cause of the outbreak was not definitely known but was believed to be associated with seismic line clearing debris from 1965-68 and the severe drought of 1968-69.

The Tyonek infestation impacted 103,000 acres in 1973. The Alaska State Division of Lands initiated a salvage sale near Tyonek that covered 223,000 acres with a total of 425 mm bf of mixed species (spruce 285 mm bf). Bark beetle populations continued to decline on the Kenai Peninsula where only 53,000 acres of active infestations were noted (Baker and Laurent 1974).

Spruce beetle caused tree mortality was concentrated in 1974 near Beluga Lake on the west-side of Cook Inlet and impacted an additional 140,000 acres. Tree killing was expected to intensify along the Beluga River in 1975. The Kenai Peninsula outbreaks declined further in 1974-no significant infestations were observed (Baker et al. 1975). The following table summarizes recent Cook Inlet spruce beetle outbreaks (in acres) (Baker et al. 1975):

	KENAI PENIN.	W. COOK INLET	TOTAL
Late 60's thru 1973	253,700	120,600	374,300
1974	300	143,400	143,700
TOTAL	254,000	264,000	518,000

Assuming an average gross volume of 4,500 bf per acre, spruce beetles caused more than two billion board feet of spruce mortality.

The spruce beetle remained in outbreak status on the west-side of Cook Inlet in 1975 with infestations totalling 167,000 acres. Population levels were expected to decline in 1976 (Hostetler et al. 1976). Of the estimated 425 mm bf of timber in the Tyonek Sale; 88 mm of spruce was cut and decked by Dec. 1975. An estimated additional 25 mm bf of spruce and 20 mm of hardwoods had been cut. Spruce beetle populations on the Kenai Peninsula remained at low levels in 1975 with a few small scattered populations (Fig. 1c).

MARITIME: Five to six thousand acres of infested Sitka spruce were detected in 1972 on BLM lands along the southwest shore of Cook Inlet near Mt. Iliamna (Baker and Curtis 1972). Infested areas were adjacent to several patches of blowdown which occurred in 1967-68. This infestation subsided by 1974. In southeast Alaska, forty Sitka spruce were killed by spruce beetles in Saw Mill Creek Campground near Sitka. These trees were previously defoliated by the spruce aphid possibly predisposing them to spruce beetle attacks (Baker and Curtis 1972) (Fig. 2a).

1976-1980

SOUTH-CENTRAL: Spruce beetle activity decreased in 1976 on the west side of Cook Inlet; of the 167,000 acres of active infestations reported in 1975, only scattered spots remained in 1976. Most of the activity was confined to an area east of Lone Ridge, nw of Tyonek. Spruce beetle activity remained at low levels on most of the Kenai Peninsula. Increased spruce mortality however, was detected in 1976 on almost 8,000 acres along the Resurrection Creek drainage of the CNF. This increased mortality is a result of beetle populations breeding in the extensive windthrow of 1974 and 1975 (Rush et al. 1977). The Resurrection Creek outbreak increased in 1977 by 5,000 acres and encompassed 12,830 acres (USDA For. Serv. 1978). Spruce beetle caused tree mortality on the CNF increased by 18% over 1977 levels. Much of this increase occurred in the Summit Lake area where more than 3,000 acres of spruce were infested. Close to 1,000 acres of spruce forests were impacted near Upper Russian Lake (USDA For. Serv. 1979) (Fig. 1c).

Elsewhere on the Kenai Peninsula spruce beetle populations increased: 47,000 acres were infested throughout the Moose Range in 1978. The heaviest impacted area was near Barabara Lake (7,620 acres).

Spruce beetle activity on the west side of Cook Inlet increased in 1978; 64,000 acres of very light (less than 0.25 trees/acre) spruce mortality was detected near Lower Beluga Lake. As of October 1978, a total of 58.9 mm bf of spruce had been harvested on the Westside Salvage Sale (USDA For. Serv. 1979).

Spruce beetle populations exploded and by 1979/80 infestations covered approximately 380,000 acres throughout the State. This was an increase of 250,000 acres over 1978 levels (USDA For. Serv. 1980, 1981). Mortality was apparent on the CNF where 33,098 acres were infested. The Summit Lake infestation increased by 50% and covered 13,924 acres; the Resurrection Creek infestation had increased to 15,240 acres. Elsewhere on the Kenai, spruce beetle populations increased: Barabara Lake area-12,162 acres; west of Tustumena Lake-19,698 acres. Infestations on west side of Cook Inlet covered approximately 374,452 acres north of Beluga Lake (Fig. 1c).

MARITIME: For the first time in many years, Sitka spruce mortality was detected in 1980 on 1,000 acres in southeast Alaska; areas most heavily impacted were along the Taku River near Juneau. The infestation appeared to be about three years old; probably originating near Klackman Mountain (USDA For. Serv. 1981). Scattered groups of spruce beetle infested spruce were detected along the south-west shore of Kachemak Bay across from Homer on the Kenai Peninsula (Fig. 2a,b).

INTERIOR: The only spruce beetle impacted areas occurred in the white spruce stands along the Kuskokwim River. Light spruce beetle activity was detected on 2,600 acres 15 miles south of Devil's Elbow in 1978 (USDA For. Serv. 1979). The Devil's Elbow outbreak declined in 1979. Infestations (4,000 acres) then increased five miles northeast of Little Russian Mission (USDA For. Serv. 1980). Spruce beetle activity decreased by 50% in 1980; only 2,481 acres of scattered infested spruce were aerially detected along the Kuskokwim River (Fig. 3).

1981-1985

The early 1980's experienced increased spruce beetle activity in southeast and south-central Alaska. Little activity was detected in the interior.

SOUTH-CENTRAL: Spruce beetle populations infested 490,220 acres in 1982 vs. 240,000 acres in 1981. The increase was most apparent in the Beluga Lake area on the west side of Cook Inlet. New infestations were detected in 1982 on 49,291 acres of white spruce along both sides of the Susitna River from Devil's Canyon to Gold Creek (USDA For. Serv. 1983).

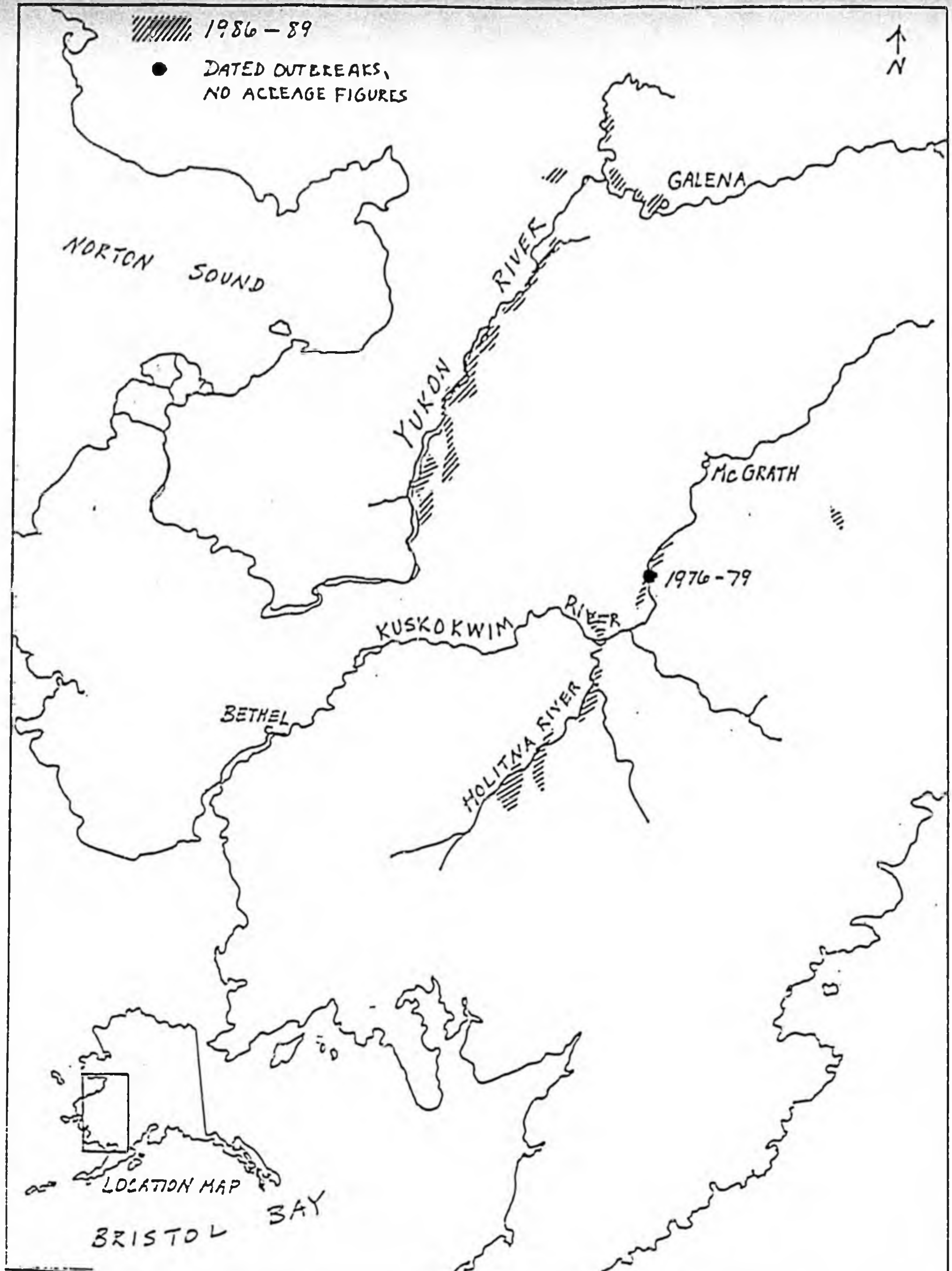

Figure 3. Location of spruce beetle outbreaks in interior Alaska's white spruce stands.

Infestations on the CNF decreased from 41,051 acres in 1981 to 37,929 acres in 1982. After three years of increase, the Summit Lake infestation declined, and by 1982,extended over 9,924 acres. The Resurrection Creek infestation had not expanded and still affected 15,240 acres. Beetle activity increased in 1981 near Cooper Lake, Mystery Hills, Round Mountain, and other areas near Cooper Landing. Elsewhere on the Kenai, infestations increased: 41,369 vs. 27,303 acres in 1981. The largest increase was detected northeast of Mystery Hills on the Kenai National Wildlife Refuge (KNWR) where 29,688 acres were infested in 1982; a 40% increase over 1981 levels. On the southern end of the Kenai, bark beetle populations were 50% less in 1982 than the 1981 level of 2,560 acres (USDA For. Serv. 1983). Scattered spruce beetle activity was still observed on the southeast side of Kachemak Bay. Heavy spruce beetle activity was noted in 1982 on Kalgin Island; on-going for at least two years (Fig. 1d).

Spruce beetle populations decreased slightly in 1983 but increased by 22% in 1984 and covered 432,603 acres state-wide (USDA For. Serv. 1983, 1984). Bark beetle activity was static on the CNF with the exception of the Resurrection Creek outbreak which expanded in 1983 and encompassed 20,320 acres. 44,745 acres of the KNWR were impacted in 1983; the majority occurring in the Mystery Hills area. Infestations also increased further south on the Kenai Peninsula where 8,344 acres of scattered infestations were aerially detected. Of interest in 1983, 1,524 acres of spruce beetle activity was detected north of Valdez along the Richardson Highway near the confluence of the Tiekel and Tsina Rivers (USDA For. Serv. 1983) (Fig. 1a,d).

By 1984 bark beetle activity increased on the CNF where 56,342 acres were impacted. Intense spruce beetle activity continued on 12,484 acres in the Cooper Landing/Russian River areas-most notably west of Juneau Creek. Other areas on the Chugach appeared to be static or declining. The Mystery Hills outbreak increased dramatically; 53,713 acres of Wildlife Refuge lands were infested north of the Sterling Highway and following Mystery Hills up to and including the Big and Little Indian drainages. Infestations on the southern end of the Kenai Peninsula more than doubled and covered 22,177 acres; the majority (15,690 acres) occurred along the Fox River drainage. The spruce beetle activity detected along the Richardson Highway in 1983 increased to 5,293 acres in 1984. Scattered spruce beetle activity also increased in the Anchorage bowl and Chugiak/Eagle River areas: Ship Creek-3,523 acres; Eklutna Lake-3,597 acres. Beetle activity was aerially detected on 31,509 acres along the Tikakila River near Lake Clark; the same area infested almost 30 years ago. This scattered beetle activity declined by 1985 (Fig. 1a,d).

Spruce bark beetle infestations decreased statewide in 1985 by 40% over 1984 levels; infestations covered covered 255,270 acres. Decreases were most apparent on the CNF and the west side of Cook Inlet. Increased activity however, was still apparent in the Cooper Landing/Russian River areas (USDA For. Serv. 1985). Infestations decreased by 28% on the KNWR but were still evident on 43,326 acres in the Mystery Hills/Skilak Lake areas.

Infestations decreased (63%) on the west side of Cook Inlet where spruce beetle activity was detected on 64,234 acres north of Beluga Lake (USDA For. Serv. 1985). The Richardson Highway outbreak increased; more than 5,000 acres were infested.

MARITIME: The largest increase in spruce beetle activity in Sitka spruce occurred in southeast Alaska in Glacier Bay National Park. This infestation was first detected in 1982 and was apparent on 5,000 acres. It was thought to have been active for four years. The outbreak expanded in 1983 and impacted 6,350 acres (USDA For. Serv. 1983) and by 1985, the outbreak had expanded to the east and north and covered 12,200 acres in the Park (USDA For. Serv. 1985). Other outbreaks in southeast such as the Taku River infestation of 2,000 acres and the Whiting River 900 acre infestation died out (Fig. 2b).

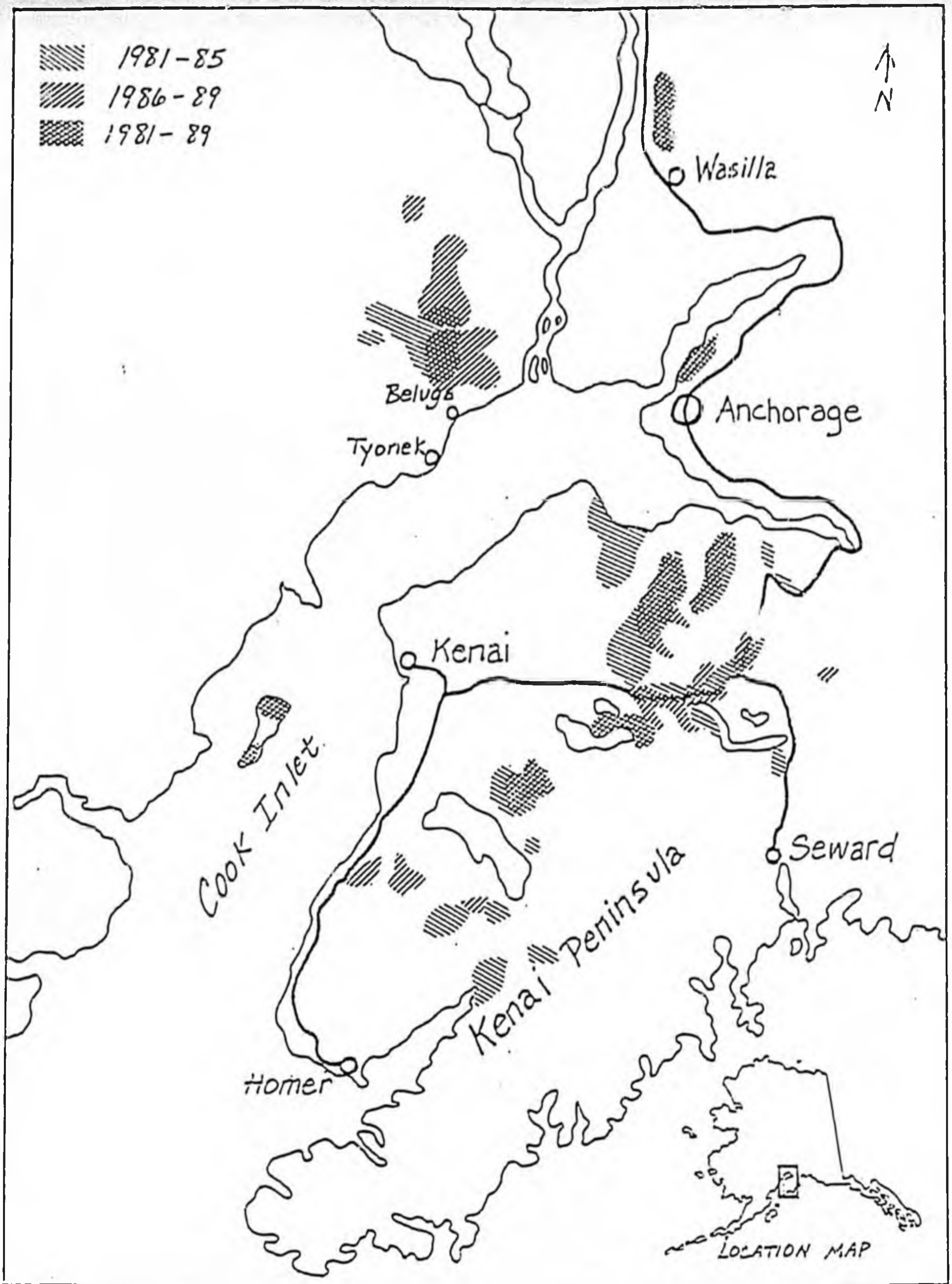

Figure 1d. Location of spruce beetle outbreaks from 1981-1989 in south-central Alaska; specifically on the Kenai Peninsula and the west side of Cook Inlet.

Of interest though, was the detection of 200 acres of Sitka spruce mortality within Kachemak Bay State Park across from Homer on the Kenai Peninsula. This beetle activity was locate near Mallard Bay and was associated with nearby spruce windthrow (USDA For. Serv. 1985) (Fig. 2a).

1986-1989

Spruce beetle activity in the late 1980's was most apparent for the first time in interior Alaska's white spruce stands. Populations decreased in south-central and southeast Alaska.

SOUTH-CENTRAL: Spruce mortality continued on 40,423 acres of the CNF in 1986 (USDA For. Serv. 1986). A slight increase in activity was noted in the Cooper Landing/Russian River area. The majority of the KNWR infestations were still occurring north of Mystery Hills. Approximately 10,000 acres of light scattered beetle activity was detected in the Ninilchik River and Crooked Creek areas.

Spruce beetle infestations continued in 1986 on the west side of Cook Inlet where 100,000 acres were impacted nw of Little Mt. Susitna and west of Beluga Mountain. Spruce beetle activity in the Anchorage and Eagle River/Chugiak areas was apparent although decreasing; Fort Richardson lands had 5-10,000 acres of infested spruce. The Tiekel River outbreak along the Richardson Highway covered close to 20,000 acres. Spruce beetle infestations decreased in 1987; decreases most apparent on west side of Cook Inlet and on the CNF (USDA For. Serv. 1987). Activity was still apparent in the Summit Lake, Cooper Landing, and Russian River Campground areas. Spruce beetle activity increased in 1987 by 9,000 acres on KNWR where 63,099 acres were infested; mostly in the Mystery Hills/Skilak Lake area. Infestations declined further south on the Kenai along the Fox River drainage. Spruce beetle activity further declined in the Anchorage/Eagle River areas. The Tiekel River outbreak however, intensified by 3,500 acres and encompassed 23,586 acres (Fig. 1a).

Spruce beetle populations remained static in 1988 although heavy localized infestations were apparent along the road cooridor in the Cooper Landing area and near Upper Trail Lake (USDA For. Serv. 1986). Scattered spruce beetle activity has been apparent for 2-3 years on 41,000 acres southwest of Tustumena Lake. Spruce beetle populations declined further in the Anchorage/Eagle River areas. However, further north of Anchorage spruce beetle activity increased: 14,000 acres were detected south of of the Matanuska River near Kings Mountain; 19,000 acres were detected for the third year between Willow and Little Willow Creek. The Tiekel River outbreak decreased in size (Fig. 1a,d).

Most spruce beetle infestations in south-central Alaska's spruce forests declined in 1989 (USDA For. Serv. 1989). Only 7,000 and 10,000 acres of active infestations were detected on KNWR and the CNF, respectively. Likewise, spruce beetle activity decreased on the west side of Cook Inlet with the exception of recent activity (2,600 acres) detected along the Skwentna River north of Beluga.

MARITIME: Sitka spruce mortality increased in 1986 in the Kachemak Bay area of the Kenai Peninsula. Scattered infestations covered 3,600 acres: 1,168 acres in Mallard Bay; 1,300 acres near Bear Cove. Most of this mortality was associated with numerous pockets of blowdown. Likewise there were 500 acres of scattered spruce mortality north of Seldovia associated with logging debris left during road construction. By 1988, spruce beetle infestations increased to 10,000 acres in the Kachemak Bay area. The spruce beetle outbreak in Glacier Bay National Park in southeast Alaska increased from 12,000 to 18,000 acres (USDA For. Serv. 1986) (Fig. 2a,b).

Nearly 2,000 acres of scattered spruce have been infested during the past three years in the Yakutat Forelands. These infestations are believed to have originated in blowdown and salvage sale units. The level of mortality in this infestation however is quite low (3-5% of the stand infested) (USDA for. Serv. 1988) (Fig. 2b).

Bark beetle populations continued to spread in the Kachemak Bay area in 1989 but declined in Glacier Bay National Park and the Yakutat Forelands (USDA For. Serv. 1989).

INTERIOR: One of the largest spruce beetle infestations to occur in interior Alaska was detected in 1986 along the Yukon River. Spruce mortality was spread along 50 miles of river and impacted 63,000 acres. This outbreak had been on-going for at least two years and more than likely originated in windthrown spruce as well as flood damaged spruce (USDA For. Serv. 1986). This outbreak impacted an additional 15,000 acres in 1987 and spread up the south fork of the Nulato River (USDA For. Serv. 1987). By 1989 this outbreak encompassed 140,000 acres with increased activity detected along the Nulato River and near the mouth of the Koyukuk River (Fig. 3).

Scattered spruce beetle infestations detected in 1988 along the Kuskokwim River continued on 10,000 acres between Sleetmute, Devil's Elbow and McGrath. Recent spruce beetle infestations were detected in 1989 southeast of McGrath along the Windy Fork and south fork of the Kuskokwim Rivers: 2,257 and 3,738 acres, respectively. The 14,000 acres of scattered spruce beetle infestations detected in 1988 approximately 30 miles southwest of the Taylor Mountains declined to low levels in 1989 (USDA For. Serv. 1989) (Fig. 3).

TABLE 1. AREAS OF SPRUCE BEETLE OUTBREAKS (IN ACRES) IN ALASKA BY GEOGRAPHIC LOCATION.

	SOUTH-CENTRAL	MARITIME	INTERIOR
1920-1940	200,000 (Copper River)	--	--
1930-1940	*1/ (Swentna R.) (Willow Crk.)	100,000 (Afognak Is.)	--
1940-1950	* (Kenai Lk.) (Knik Arm)	6,400 (Kosciusko Is.)	* (Haines Cut-off)
1950-1955	2,000 (Eklutna) 100,000 (Tlikakila R.)	200 (Dall Is.)	--
1956-1960	16,000 (CNF) 20,000 (KNMR)	2,000 (Blackstone Bay) 500 (College Fjiord)	--
1961-1965	* (Anchor Pt.) (Chitina)	* (Pr. of Wales Is.)	--
1966-1970	100 (Chickaloon R.) 39,900 (Pt.Possession) 220,000 (KNMR) 1,300 (CNF) 200 (Caribou Crk.)	200 (Salmon R.)	--
1971-1975	400 (KNMR) 60,000 (Clam Gulch) 223,000 (Tyonek) 140,000 (Beluga R.)	6,000 (Trading Bay)	--

1976-1980	16,240 (CNF-Res.Crk.) 13,000 (CNF-Summit L.) 1,000 (CNF-Up.Russ.) 47,000 (KNMR) 364,000 (Beluga Lk.)	2,000 (Taku R.) 900 (Whiting R.)	2,600 (Kusko.R.) 4,000 (Kusko.-Russ.Miss.)
1981-1985	49,291 (Susitna R.) 55,000 (KNWR) 2,560 (Anchor Pt.) 5,000 (CNF-Res.Crk.) 15,344 (Fox R.) 5,524 (Rich.Hiway) 12,484 (CNF-Cooper Ldg.) 3,523 (Ship Crk.) 3,597 (Eklutna Lk.) 31,509 (Tilkakila R.)	12,200 (Glacier Bay) 200 (Kachemak Bay)	--
1986-1989	10,000 (Ninilchik R.) 7,000 (Fort.Rich.) 18,586 (Rich.Hiway) 50,000 (KNWR) 14,000 (Kings Mtn.) 19,000 (Willow Crk.) 2,600 (Skwentna R.)	9,800 (Kachemak Bay) 5,800 (Glacier Bay) 2,000 (Yakutat)	140,000 (Yukon R.) 10,000 (Kusko.R.) 6,000 (s.f.Kusko.R.) 14,000 (Taylor Mtn.)
TOTAL	1,769,158	148,200	176,600

1/ *-infestations reported but no acreage estimates given.

APPENDIX A

SPRUCE BEETLE

Dendroctonus rufipennis (Kirby)

HOSTS: White, Sitka, Lutz, and black spruce.

DISTRIBUTION: Wherever spruce is found; a serious forest pest in south-central Alaska throughout Cook Inlet and Kenai Peninsula.

DAMAGE: Larvae feed beneath bark, usually killing affected trees.

DESRCIPTION: Adult spruce beetles are maroon to black, cylindrical in shape, approximately 5 mm long and 3mm wide. Larvae are stout, white, legless grubs, 6 mm long when full-grown. The pupae are soft-bodied, white, and have some adult features.

BIOLOGY: The life cycle of the spruce beetle may vary from one to three years, with a two-year cycle being the most common. Temperature plays an important part in determining the length of time required for beetle development.

Adult beetles become active in the spring (late May--early June) when air temperatures reach a threshold of 16o C (61o F). At this time, beetles emerge from trees in which they overwintered and fly in search of a new host material. These dispersal flights may be short-range even though beetles are capable of flying for several miles without stopping.

Spruce beetles prefer to attack the sides and bottom surfaces of windthrown or other downed materials which have been on the ground less than one year. In the absence of such host material, large-diameter live trees may be attacked instead, and if beetle populations are high, these trees may be killed.

Beetle attacks, whether on windthrown or on standing timber, are mediated by pheromones which insure that individual trees will be attacked "en masse", and fully colonized by subsequent broods. Trees that are mass-attacked form attractive centers which result in groups of trees being killed by spillover attacks.

Female beetles initiate attacks and begin constructing an egg gallery in the cambium parallel to the grain of the tree. They are joined by males and after mating, lay eggs in small niches along the sides of the egg gallery. Most eggs will hatch by August.

As they feed in the cambium, larvae construct their own galleries perpendicular to the egg gallery. Normally, spruce beetles pass the first winter in the larval stage, resume feeding the next spring, and pupate by summer. About two weeks later, pupae transform into adults which pass the second winter, either in the old pupation site, or more commonly, in the bases of infested trees. The following spring, two years after initial attack, the new adults emerge and attack new host material. In some years when temperatures are abnormally high, or on certain warmer microsites, spruce beetles may complete their development within one season and new adults will emerge one year after attack.

Most major outbreaks of spruce beetle have originated from stand disturbances -- blowdown, logging, or right-of-way clearance. Stand susceptibility to beetle attack is influenced by stocking, with slow growth and moisture stress playing an important part in predisposing trees to attack.

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H+S Resources

TELECOPY COVER SHEET

Kenai Peninsula Legislative Information Office

Phone - (907) 262-9364
Fax - (907) 262-1881

TO: Juneau L.I.O.

ATTN: ____________ FAX: ____________ PHONE: ____________

FROM: ____________ PHONE: ____________

INSTRUCTIONS: Please deliver To House and Senate Resource committee's to be included in testimony on Spruce Beetle infestation. Thank you

DATE: 2-13-90 TIME: 12:45

DISCARD ORIGINALS ___ HOLD FOR PICKUP ___

NUMBER OF PAGES (not counting the cover sheet): 2

TRANSMITTED BY: Vesta

Alaska State Legislature

Please enter into the record my testimony to the Resources Committees - House & Senate committee name

committee on Cooperland Bark Beetle, dated 2-13-90
bill/subject

Enclosed letter from Sen. Stevens

Signed: Duane Anderson
Testifier

"The Little People"
Representing (Optional)

Box 38
Address

Soldotna, AK

Phone No. ________

9/86 Legislative Information Office

1

United States Senate

COMMITTEE ON APPROPRIATIONS
WASHINGTON, DC 20510-6025

January 25, 1990

Duane Anderson
P.O. Box 38
Soldotna, Alaska 99669

Dear Duane:

I understand that you spoke with my staff assistant, Duane Gibson, at the 1989 Agricultural Symposium regarding the use of bark beetle-infested trees for log homes throughout Alaska. I am intrigued by this idea, which would make good use of what would otherwise simply be a fire hazard.

In an effort to assist you, I have made an inquiry with the Alaska Housing Finance Corporation and asked them about financing alternatives might be available for financing these log homes.

Thank you for your interest in this important matter -- we need to find a solution to this spreading problem, and utilizing as much infested wood as possible is a good start.

With best wishes,

Cordially,

Ted Stevens

TED STEVENS

(2)

STATEMENT OF
DUANE HARP
DISTRICT RANGER, SEWARD DISTRICT
CHUGACH NATIONAL FOREST, USDA FOREST SERVICE

Before the
Joint House and Senate Resources Committee
Alaska Legislature

Concerning
Beetle Infestation on the Kenai Peninsula.

March 12, 1990

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

As Dr. Holsten has pointed out, the Kenai Peninsula has been infested with an epidemic of spruce bark beetle over the past 10 years. In particular, the Cooper Landing area has been severely affected.

In 1986, the Forest Service initiated plans to deal with the beetle epidemic. Based on an environmental assessment completed in July 1987, a decision was made to 1) reduce the spread of the infestation by thinning green stands of spruce trees susceptible to beetle attack, 2) to salvage harvest timber where feasible and 3) to reduce the threat of fire to the Cooper Landing area by harvesting dead and dying trees and by constructing fuelbreaks around trailheads and campgrounds. That decision was appealed, and consequently, harvest was limited to dead trees in areas posing only the highest fire threat to Cooper Landing.

The threat of wildfire to the Copper Landing area is very real. The Kenai Peninsula has a history of large wildfires including a burn of over 350,000 acres in 1947, the 10,000 acre Kenai Lake Burn of 1959, and in 1969, the 86,000 acre Swanson River Burn and the 2,600 acre Russian River Burn. Each of these fires was man caused. Each summer we experience fire starts in the Cooper Landing area. To date, weather and wind conditions have allowed us to suppress the fires before they became large.

Since the 1987 decision, the beetle infestation has increased in intensity. Currently, in the Cooper Landing area, some 27,000 acres of spruce on National Forest System lands are affected. Estimates of tree mortality range from 65 to 95 percent of all spruce 5 inches in diameter and larger. Of the total affected acreage, only 950 acres are currently scheduled for harvest; and to date, less than 100 acres have actually been logged. The Forest Service continues to reduce hazardous fuels in and around heavily used areas such as campgrounds and trailheads.

Over the past three years, the U.S. Forest Service, the State Division of Forestry, and the residents of Cooper Landing have become increasingly concerned about the potential for a catastrophic wildfire in the Cooper Landing area. Trees which have been dead for five years or more are now starting to fall, creating large concentrations of dry fuels on the forest floor. These concentrations increase both the severity of a fire and the difficulty of suppressing one. If no additional fuel reduction work is done, we can expect such hazardous fuel conditions to exist for 20 to 40 years.

In response to these concerns, in June 1989, the Forest Service, State Division of Forestry, U.S. Fish and Wildlife Service, and the Kenai Peninsula Borough strengthened plans for responding to a wildfire in the Cooper Landing area.

Last August, the Chugach National Forest began planning to deal with the present situation. In October, I initiated an environmental assessment process to examine alternatives to meet two primary objectives on National Forest System lands: 1) to reduce the risk of a catastrophic wildfire in the Cooper Landing area to an acceptable level; and 2) to restore forest health by re-establishing a vigorous and diverse forest. A working group consisting of Cooper Landing area residents, representatives of the local timber industry, the environmental community, the Kenai Borough Economic Development District, the Department of Fish and Game, and the Division of Parks, was formed to participate in the planning process. The State Division of Forestry, the U.S. Fish and Wildlife Service, and the Kenai Peninsula Borough are also key in integrating and coordinating our efforts with their own plans.

The working group recommended a concentrated effort in three areas: 1) reduce fire hazards around residences and on private property, 2) construct fuelbreaks in strategic locations, and 3) reduce large concentrations of dead fuel. Public forums to discuss these actions are scheduled this week in Soldotna, Anchorage, and Cooper Landing.

The deadline for a decision based on the environmental assessment is June 29, 1990. However, it has become apparent that the situation is too urgent to wait and that some action is needed before the 1990 fire season. As a result, the Forest Service plans to construct two major fuelbreaks and several smaller fuelbreaks in critical areas. In addition, we will increase our fire suppression forces and fire prevention efforts. The Forest Service and State Division of Forestry will also conduct a workshop for Cooper Landing residents on how to make homes fire resistant.

I must stress that the fuelbreaks are only a small part of the solution to the problem. The 200 to 500 foot wide breaks will provide lines of defense for fighting wildfires. To adequately lower the risk of wildfire hazardous fuels must be reduced over a large area. The forest health and vigor must also be restored so that bark beetle infestations will not reach epidemic proportions in the future. The environmental assessment scheduled for completion in late June will assist me in making that decision for the National Forest System lands in the Cooper Landing area.

It is also crucial that actions be implemented on State of Alaska lands. The Division of Forestry has been working closely with us in developing coordinated strategic plans to deal with the spruce bark beetle epidemic and associated wildfire problem. I urge the Committee to give full support to the Department of Natural Resources efforts to work with the Forest Service on this important issue.

HCR

54

HOUSE COMMITTEE REPORT

(9)
Date Referred: February 12, 1990 FURTHER REFERRALS:

Date of Committee Action: 3/12/90

The RESOURCES Committee considered: HCR 54

HOUSE CONCURRENT RES. NO. 54 ALASKA YOUTH REFORESTATION CORPS

Relating to the Alaska Youth Reforestation Corps.

RECOMMENDATIONS:
[ ] be replaced with ______________ [ ] the same title / [ ] a new title
[ ] have attached amendment(s)
[X] do pass
[ ] do not pass
[ ] no recommendation
[ ] individual recommendations
[ ] additional referral to the ______________ Committee

ADOPTS: ______________ letter of intent

ATTACHES NEW FISCAL NOTE(s): (Dept)
[X] fiscal impact DNR - DIV. OF FORESTRY
[ ] zero fiscal note ________
[ ] zero with analysis ________

APPROVES PREVIOUS: (Date/Dept)
[ ] fiscal note(s) ________
[ ] zero fiscal note(s) ________
[ ] zero fn/analysis ________

SIGNING DO PASS:

[signatures]

SIGNING:
(Check approp. column)

	Do Not Pass	No Rec	Amend
[signature]		✓	
[signature]		✓	

[signature]
Chairman's Signature

STATE OF ALASKA
1990 LEGISLATIVE SESSION

BILL VERSION: HCR 54
PUBLISH DATE: 2/12/90

FISCAL NOTE

REQUEST:

Revision Date:
Title: Relating to the Alaska Youth Reforestation Corps
Sponsor:
Requestor: House Resources

Agency Affected: Natural Resources
BRU: Forest Management
Components: Forest Management

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96
PERSONAL SERVICES	36.5	36.5	37.6	37.6	38.7	38.7
TRAVEL	8.0	4.0	4.0	4.0	4.0	4.0
CONTRACTUAL	40.0	40.0	41.0	41.0	42.0	42.0
SUPPLIES	6.0	6.0	6.5	6.5	6.5	6.5
EQUIPMENT	100.0		2.0		2.0	
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	190.5	86.5	91.1	89.1	93.2	91.2
CAPITAL						
REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND	190.5	86.5	91.1	89.1	93.2	91.2
FEDERAL FUNDS						
OTHER						
TOTAL						

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

Prepared by: George K. Hollett
Division: Forestry
Phone: 762-2503
Date: 3/13/90

Approved by Commissioner:
Date:
Agency:

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3/6/90

Revised Cost Estimates - Local Youth Reforestation Corps

Alternative to 2/14/90 memo on YRC under HCR 54

Objective: Train local youth for employment by reforestation contractors at least cost to State.

First Year

Forest Technician III (Extend existing Technician?)	$12,000	(3 months)
5 each Temporary For. Tech I/II (Anchorage rates used)	32,250	(2½ months @ $25
6 passenger pickup	20,000	
Mileage/Replacement	8,000	
Recruiting, etc.	2,000	
Support Funds (200-400)	5,000	
Equipment	5,000	
	$84,250	

Subsequent Years

For. Tech. III	$ 12,000	(3 months)
5 each Temporary For. Tech I/II	32,250	(2½ months @
Vehicle Mileage/Replacement	8,000	
Recruiting, etc.	1,000	
Support Funds (200-400)	5,000	
Equipment Replacement	1,000	
	$59,250	

NOTE: If welfare reform program workers were substituted at no cost to the reforestation program the costs for each crew would become $52,000 the first year but only $27,000/year subsequently.

Seedling Production Site Analysis

3/6/90

	+	−
Eagle River	Present Facility Capable of 800,000 Trees/year	Topsoil needed for bare root production
	Substantial investment at present site ($1 million min. to replace)	Palmer inmates far away
	Ready access to commercial air + ground transportation	No on-site seed production capacity
	Natural gas greatly saves on heat bills!	No dedicated building for operations.
	Site has room to add greenhouses up to 5.0 mm annual level	
	Inmates from Anchorage close by	
	Maintenance facility/tools/equipment on site.	
	Limited wind exposure	
	Rare extreme cold temperatures	
	Dedicated cone/seed processing building in place.	
Fairbanks	Most of seedlings will be planted in the Tanana Vicinity	Facility would have to built from "0"
	Researchers based at UAF	No natural gas
	Soils physically suitable for bare-root nursery	Extreme cold - high utility costs.
		Extended use of "grow lights"
		Bare root trees only for local use
		Unknown actual space availability.
Plant Materials Center - Palmer	Existing plant researchers on-site	No natural gas present/likely
	120 acres of land unused	Unused acreage is an island
	Bare root production physically possible	High winds likely to cause bare root losses.
	Near Palmer inmates	Far away from Anchorage inmates
	Seed orchard possible in the future	High greenhouse maintenance
		Facility would have to be built from "0"
		Extreme winds/temps.

Seedling Production Site Analysis 3/6/90

	+	−
PT. Mckenzie	More than adequate acreage for:	Facility would have to built from "0"
	Buildings (Work/Maintenance)	Lengthy commute for all labor/inmates
	Greenhouses (nearly unlimited)	Requires new maintenace equipment/tools
	Bare-root production	Subject to extreme temps/winds.
	Seed orchards	Removes agricultural land from productio
	Provenance testing	Requires well for water
		No natural gas?

Experimental Farm on Trunk Road

This site has not been thoroughly investigated that I am aware of. The individual who would know is on leave all this week. This is what I would guess to be the case:

+	−
Near Palmer inmates	Limited level land available
Natural gas available?	Facility would have to be built from "0"
Central location to ground transportation	Anchorage inmates far away
	High wind exposure/temp. extremes

3/6/90

Highest Benefit-Cost Scenario - Same or Higher level of production.

Nursery — * Concentrate on seedling production at Eagle River Facility.

* Set asside acreage at Pt. Mckenzie for provenance test and seed orchard.

* Establish provenance testing / seed orchards in Tanana Basin (Delta Ag.) and Lower Yukon River (Native cooperator a possibility).

* Use welfare program reform workers to supplant entry level worker need

Reforestation — * Establish a nursery "intern" program utilizing six "temporary" technician positions to be filled by residents of communities near cooperators.

* Use contracts to do majority of site preparation and planting

* Cooperate with Native groups to secure local grants to enable hiring youth crews. (From BIA)

* Consider small, local resident crews only where DOF has road net offices. Crew size should be limited to 5 people plus a dedicated technician so that the entire crew and their equipment fits into one vehicle such as a 6 pax. pickup.

* Where welfare program reform allows, use crews of these individuals in lieu of "local resident" crew above. Technician still needed!

Rationale — Take advantage of existing facilities/maintenance/logistics at Eagle River. The site is large enough to accommodate any forseeable program expansion needs. Provenance testing / seed production will identify best species for different conditions.

Train people where the activity is needed to do the work. State contracts and support for grant applications will provide a market for the individual trained to do the work. A predictable, steady flow of work will favor in-State worker use over "imported" labor.

3/6/90

REFORESTATION OVERVIEW

The question has been asked as to what the Division would do if the Governor's $500,000 CIP for backlog reforestation was granted plus the authorization to utilize $250,000 annually in program receipts in addition to the present operational budget funding. The following is a preliminary analysis of the activities that would occur under that scenario.

Governor's CIP Request: NOTE - House Election Districts appear in "()". The Kenai Peninsula (5&6) would accomplish contracted site preparation on 50 acres and planting 38,000 seedlings on 70 acres. The Mat-Su (16) would accomplish contracted site preparation on 50 acres and planting 50,000 seedlings on 90 acres. Tok (17) would accomplish contracted site preparation on 855 acres, direct seed 80 acres and plant 104,500 seedlings on 190 acres. Delta (17) would accomplish contracted site preparation on 220 acres, direct seed 70 acres and plant 75,000 seedlings on 150 acres. Fairbanks (18&19) would accomplish contracted site preparation on 1242 acres, direct seed 220 acres and plant 654,500 seedlings on 1190 acres. Haines (2) would accomplish contracted site preparation on 155 acres and plant 81,000 seedlings on 155 acres. In the remainder of Southeast (1-4) there would be 26,000 seedlings planted on 50 acres. The regeneration center cost for seed collection and processing, and supplies for sowing/growing the seedlings are covered under the operating budget.

No projection of fund drawdown rate has been made. The rate of expenditure would depend largely on the method of regeneration proposed, weather, seedling availability, and staffing to prepare and administer contracts. The CIP would see some 1,039,000 seedlings grown and planted on State land. This would not completely eliminate the backlog of acres needing treatment. It would allow the Fairbanks Area increase the annual sales offerings back up to 8 million board foot once the program was completed. The per cent of the site preparation, seeding and planting backlog treated will be 31.8% for Northern Region, 12.5% for Southcentral Region, and 52.6% for Southeast Region. The backlog of acres requiring regeneration surveys or prescribed burning won't be addressed by the CIP.

Program Receipts Authorization: This money would be used to provide the continued production of 800,000 seedlings per year at the existing Eagle River Regeneration Center Facility. There would have to be personal services funding for one Maintenance Worker II that would be obligated to nursery maintenance (cost $47.4), one Forest Technician IV (Assistant Nursery Manager at a cost of $38.2) and one Forrest Technician III (Nursery Foreman at a cost of $34.3).

One Forester I at Fairbanks would be added to assist in contract preparation/administration (cost $46.0) and a similar position would be added at either Delta or Tok to cover those two areas needs (cost $47.3). One Forester I would be added to Southcentral Region to assist in contract preparation/administration (cost $42.2). The entire amount of the projected authorization would be taken up with personal services. Actually there would be some $255,400 allocated under this proposal. Support monies for these positions would have to come from operating budgets for other programs under this scenario.
These positions would also enable earlier determination of areas needing treatment and reduce the impact of the addition efforts on the present staff. The nursery would be maintained on a timely basis. Inmate labor would be adequately supervised and what seedlings produced would be of high quality.

Ongoing Operating Budget Reforestation Program: This program will marginally keep pace with the present harvesting activities. The cost of the nursery to produce 800,000 seedlings per year are included under this item with the notable exception of adequate staffing. In Northern Region (House Districts 17,18,19) there would be 500 acres site prepared and planted and 660 acres where regeneration surveys would be completed. In Southcentral Region House Districts 5,6,16,24,26) there would be 115 acres site prepared, 55 acres direct seeded, 52 acres planted and 390 acres receiving regeneration surveys. In Southeast Region (House Districts 1,2,3,4,6) there would be 50 acres prescribed burned, 70 acres planted and 1100 acres receiving regeneration surveys.

What won't get done under this scenario?

The regeneration center won't be producing seedlings to assist native corporations and other interested landowners in reforesting their harvested, burned over or insect ravaged lands. There won't be local community or youth training programs in place. The efforts to take care of the backlog areas on State land, particularly around Fairbanks, will take several additional years to complete due to a shortage of field help. The nursery operation will continue to be short of dependable help - that is still dependent on inmate labor. Such areas as the Kenai insect infestation or future burns on State lands will not be reforested. State lands in the Tyonek area will remain in grass rather than return to a productive forest. Private individuals must secure their seedlings from "outside" nurseries. The State will not be a participant in tree improvement efforts.

HCR

56

Alaska State Legislature

Representative Niilo Koponen

Pouch V
Juneau, Alaska 99811
(907) 465-4992

House District 21

119 N. Cushman, Suite 207
Fairbanks, Alaska 99701
(907) 456-8172

MEMORANDUM

To: Rep. Cliff Davidson, Co-Chair
Rep. Curt Menard, Co-Chair
House Resources Committee

From: Rep. Niilo Koponen

Re: HCR 56 scheduling

Date: 2/15/90

Please find attached a sponsor statement and backup material on HCR 56, relating to Global Warming. I would appreciate your scheduling a hearing on this resolution at your earliest convenience. Teleconference participation has been requested.

Should you require further information, please contact Dana Owen in my office, 4992.

Thank you for your consideration of this matter.

attachments
NK/do

Alaska State Legislature
Representative Niilo Koponen
House District 21

Pouch V
Juneau, Alaska 99811
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119 N. Cushman, Suite 207
Fairbanks, Alaska 99701
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Sponsor Statement

House Concurrent Resolution 56
Relating to Global Warming

This resolution was introduced to begin the process of addressing the serious and complicated problem of global climate change from human activities.

While the national and international governments and agencies work to address global policy initiatives, many states and local governments are instituting action on their own, believing time is of the essence. In addition, national organizations of state governments and legislators are working on developing national strategies.

While day to day political pressures preclude us from dealing with such issues in depth, this resolution in intended to begin the process of identification and action as to what we, as the State of Alaska, can do to address the issue.

Impacts on communities

- River and sea level increase leading to increased flooding and loss of coastal land and low lands adjacent to rivers.
- Foundations of structures, roads, airports, water and sewer and other improvements threatened.
- Loss of subsistence livelihood through loss of habitat.

Examples of what can be done now to reduce the impact

- Apply least cost planning to new capital projects.
- Increased energy efficiency of heated structures including heating systems and appliances.
- Increased efficiency of diesel electrical generation. Co- generation of fuels, waste heat recovery, fuel substitutions, alternative and renewable fuel source development.
- Promoting methods of increasing efficiency in all modes of transportation.
- Sustainable yield harvesting of timber. Increased tree planting where feasible (trees absorb carbon dioxide).
- Re-cycling of waste products, such as aluminum cans, bottles, newspaper, etc.
- Working with congressional members toward national recognition and action on the problem.
- Education of our children on the problems and solutions (they will pay for our inaction).

Immediate benefits of doing something now

- Reducing impact of global warming.
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- Decreased cost in operating heated structures and electrical appliances.
- Reduced cost and increased life in operation of moving vehicles.
- More affordable housing.
- Productive local jobs.
- Increased standard of living, less time and money spent on energy.
- Assured source of wood (in forested areas).
- Increased capacity of landfills.
- Sustained ecosystem for fish and game.

(9)

Date Referred: February 12, 1990 FURTHER REFERRALS:

Date of Committee Action: 2/27/90

The RESOURCES Committee considered: HCR 56

HOUSE CONCURRENT RES. NO. 56 GLOBAL WARMING

Relating to global warming.

RECOMMENDATIONS:

[X] be replaced with CS HCR 56 (RES) [X] the same title [ ] a new title

[ ] have attached amendment(s)

[X] do pass

[ ] do not pass

[ ] no recommendation

[ ] individual recommendations

[ ] additional referral to the ________ Committee

ADOPTS: ________ letter of intent

ATTACHES NEW FISCAL NOTE(s): (Dept)

[ ] fiscal impact ________

[ ] zero fiscal note ________

[ ] zero with analysis ________

APPROVES PREVIOUS: (Date/Dept)

[ ] fiscal note(s) ________

[ ] zero fiscal note(s) ________

[ ] zero fn/analysis ________

SIGNING DO PASS:

[signature]

[signature]

[signature]

[signature]

SIGNING: (Check approp. column)

	Do Not Pass	No Rec	Amend
[signature]		✓	

[signature]

Chairman's Signature

STATE OF ALASKA
1989 LEGISLATIVE SESSION

BILL VERSION: CS HCR 56 (RES)
PUBLISH DATE: -

FISCAL NOTE

REQUEST:

Revision Date:
Title: Global Warming
Sponsor: Rep. Koponen
Requestor: House Resources Committee

Agency Affected: All Agencies
BRU:
Components:

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94
PERSONAL SERVICES	0	0	0	0	0	0
TRAVEL	0	0	0	0	0	0
CONTRACTUAL	0	0	0	0	0	0
SUPPLIES	0	0	0	0	0	0
EQUIPMENT	0	0	0	0	0	0
LAND & STRUCTURES	0	0	0	0	0	0
GRANTS, CLAIMS	0	0	0	0	0	0
MISCELLANEOUS	0	0	0	0	0	0
TOTAL OPERATING	0	0	0	0	0	0
CAPITAL	0	0	0	0	0	0
REVENUE	0	0	0	0	0	0

FUNDING: (Thousands of Dollars)

GENERAL FUND	0	0	0	0	0	0
FEDERAL FUNDS	0	0	0	0	0	0
OTHER	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS: (Attach a separate page if necessary)

Prepared by: House Resources Committee
Division: Representative Curt Menard
Phone: 4944
Date: 2/28/90

Approved by Commissioner:
Date:
Agency:

Distribution (by preparer):
- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)

page ___ of ___

GLOBAL WARMING IMPACTS UPON ALASKA

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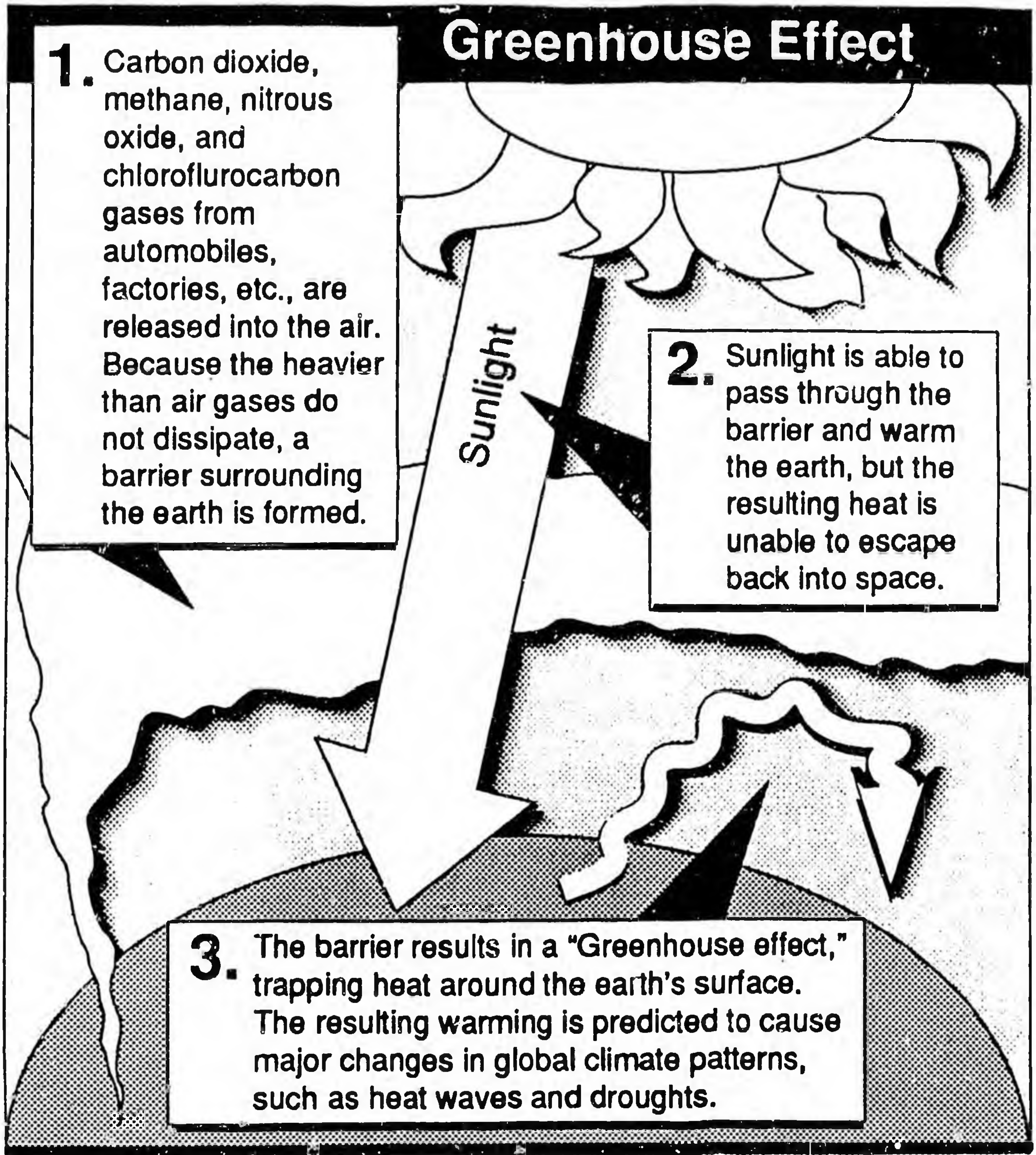
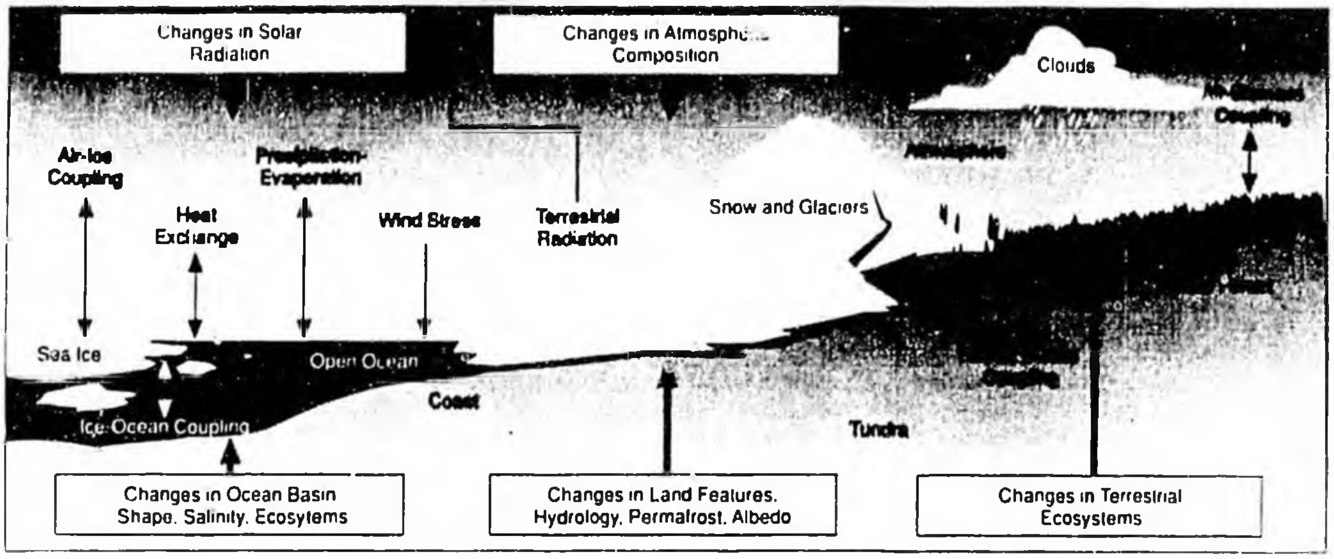


The Associated Press

PROPOSAL FOR A

POLAR CENTER FOR GLOBAL CHANGE STUDIES

UNIVERSITY OF ALASKA FAIRBANKS



Affiliated Research Units:
(including Federal agencies on the UAF campus)

Agricultural and Forestry Experiment Station
Geophysical Institute
Institute of Arctic Biology
Institute of Marine Science
Institute of Northern Engineering
Institute of Northern Forestry
U.S. Geological Survey

OCTOBER 1989

Ad-Hoc

CENTER STEERING COMMITTEE
(appointed by the Vice Chancellor for Research)

Chair: Gunter Weller, Professor, Geophysical Institute

Co-Chair: William S. Reeburgh, Professor, Institute of Marine Science

Members:

AGRICULTURE/FORESTRY
Keith VanCleve, Professor, Forest Sciences
Glenn Juday, Asst. Prof., Forest Sciences

BIOLOGY/WILDLIFE
Stephen F. MacLean, Professor, Biology/Wildlife
Joshua P. Schimel, Asst. Prof., Biology/Wildlife

ENGINEERING
Douglas Kane, Professor, Civil Engineering
Douglas Goering, Asst. Prof. Mechanical Engineering

GEOPHYSICS
Thomas E. Osterkamp, Professor, Geophysics
Gunter Weller, Professor, Geophysics

MARINE SCIENCE
William S. Reeburgh, Professor, Marine Science
H. Joseph Niebauer, Professor, Marine Science

SOCIAL SCIENCE
Gerald A. McBeath, Professor, Political Science

Staff: Laura Lee McCauley, Office of Vice Chancellor for Research

SUMMARY

An ad-hoc committee of University of Alaska Fairbanks faculty located in five UAF colleges and schools proposes the establishment of a Polar Center for Global Change Studies at UAF, to provide a framework for developing, coordinating and implementing interdisciplinary research initiatives on global change, which are presently beyond the scope of any individual research institute. The focus of these studies will be on the high latitudes, which the University through its location and expertise is uniquely qualified to address. UAF, building upon the strength of its existing research institutes, has an opportunity to contribute to both national and international research programs in this area.

This proposal reviews the need for interdisciplinary Earth system research at high latitudes, the rationale for implementing a center within the University to facilitate such research, the purpose and functions of the proposed Center, a plan for implementing the Center, and budget requirements for the remainder of this fiscal year and the next.

We believe that the Center should be based on the concept of the NSF Science and Technology Centers, namely "to exploit opportunities in science and technology where the complexity of the research problems or the resources needed to solve these problems require the advantages of scale, duration, and/or equipment and facilities that can only be provided by a campus-based research center." We hope that the Center will provide a lively, stimulating, intellectual atmosphere which will foster and conduct innovative research on all aspects of global change and will take advantage of the new, greatly expanded opportunities in this area over the next decade or more.

TABLE OF CONTENTS

INTRODUCTION

A consensus on the need to come to grips with a number of growing problems of the global environment has been evolving rapidly over the past few years among scientists, the public, and decision makers. Driving this consensus is the realization that in the span of a single human generation, the Earth's life-sustaining environment is expected to change more rapidly than it has over any comparable period of human history. Much of this change will be of our own making. Increasing atmospheric concentrations of greenhouse gases, due in part to the burning of fossil fuels, may significantly alter our climate. Agriculture, forestry and other land-use practices, industrial activities, waste disposal, and transportation have altered terrestrial and coastal ocean ecosystems, thus affecting, for example, biological productivity, water resources, and the chemistry of the global atmosphere. These fundamental changes, evident also in the decline of stratospheric ozone and in acid precipitation, transcend the traditional boundaries of scientific disciplines.

Contemporary advances in technology, such as the ability to observe the earth from space and the rapidly accelerating capabilities for data handling, numerical modeling, and telecommunications, make it possible to study the whole globe. These capabilities, coupled with our growing understanding of the components of the Earth system -- the atmosphere, oceans, soil and solid earth, and biota -- and the physical, chemical, and biological processes that link them, permit, for the first time, an integrated and interdisciplinary approach to Earth system studies.

The ground swell of commitment is most evident in the formulation of the International Geosphere-Biosphere Program of the International Council of Scientific Unions and the U.S. Global Change Research Program, the U.S. national contribution to the international program. These are programs of fundamental research that are unprecedented in terms of disciplinary breadth, multinational involvement, and the promise for practical benefit through understanding the coupling between the physical and biogeochemical processes that together determine the climate and environment of the earth.

The goal of the U.S. Global Change Research Program is: "To gain a predictive understanding of the interactive physical, geological, chemical, biological, and social processes that regulate the total Earth system and, hence, establish the scientific basis for national and international policy formulation and decisions relating to natural and human-induced changes in the global environment and their regional impacts." The strategy for implementing the U.S. Global Change Research Program calls for identification of scientific objectives, the integration of traditional scientific disciplines, and the establishment of new coordination mechanisms.(1) The president's FY 1990 budget proposed a funding level of $191.5 million for the U.S. program.

Given the goals of the U.S. Global Change Research Program it is clear that attention should first be concentrated on those sensitive regions of the globe where anticipated changes will be greatest.(2) The Arctic is a region characterized by one of the most extreme environments of the planet, where limited sunlight, extreme temperature excursions, and a short growing season impose harsh constraints on terrestrial and marine ecosystems. Sea ice, snow cover, glaciers, tundra, permafrost, boreal forests, and peatlands are each a sensitive indicator of global change, susceptible to subtle variations in sunlight, surface temperature, ocean heat transport, air and ocean chemistry, and the particulate loading of the atmosphere.

Polar lands and oceans are more than passive indicators of change in the coupled earth system, however.

- The basic circulation patterns of the global atmosphere are fixed by arctic and antarctic boundary conditions through pole- equator temperature differences;

- high-latitude air/ice/ocean interactions play an important role in determining regional and global climate and ocean circulation patterns; and

- arctic air/land interactions -- particularly those involving peatlands and permafrost -- involve potentially important sources and sinks of trace gases and of elements key to life.

Biological activity in arctic lands and in the euphotic zone of the Arctic and Antarctic Oceans may reflect coupling of orbitally induced variations in insolation, global carbon dioxide abundance, and surface temperature. Global warming induced by the greenhouse effect will be particularly felt in polar regions, most likely resulting in changes in extent of sea ice, increased thawing of permafrost, and melting of polar ice masses, with profound societal impacts around the globe. These are just a few of the reasons why the polar regions are particularly appropriate for scientific emphasis in the U.S. Global Change Research Program.(3)

These challenges impose new requirements on the way that research in the earth and biological sciences will be planned, organized, and executed.

- A first requirement is that today's scientists begin to work together at a new and unprecedented level of interaction: in planning, in execution of field programs, in the analysis and interpretation of data, and in the building of coupled models of the environment.

- Associated with this is a need for education, and perhaps also reeducation of scientists who work in these fields to develop the expertise to address global change issues.

- A third requirement is for communication and effective coordination between relevant programs and research activities.

- A fourth requirement is for continued public education and information dissimination to decision makers.

Both the international and national programs call for the development of regional research centers for global change studies to facilitate regional collaboration and research on global change issues, with special emphasis on those aspects of processes that manifest themselves distinctly in that region. These centers will be charged with assimilating, synthesizing, and interpreting regional data sets for integration into global-scale synthesis and modeling efforts. They will also extract the relevant regional component from global model output. In this way, these centers can provide to resource managers and decision makers information of particular importance to the region.

RATIONALE

Within the context of the regional research centers for global change studies we have a unique opportunity to contribute to the goals of the U.S. research program, the State of Alaska, and the University by enhancing existing research activities and developing new and relevant scientific and educational initiatives.

Present research activities at high latitudes addressing global change can be summarized under four broad headings:

- Detection and monitoring of global change
- Study of system interactions and feedbacks
- Study of biological responses to global change
- Study of socio-economic impacts

University of Alaska Fairbanks (UAF) research activities address these topics and their implications for the high latitudes, and represent roughly $6 million annually in research dollars (Attachment 1). The main strength of UAF research expertise is in the areas of geophysics, marine science, and arctic biology and can provide an excellent starting point from which to build a more comprehensive and interdisciplinary program.

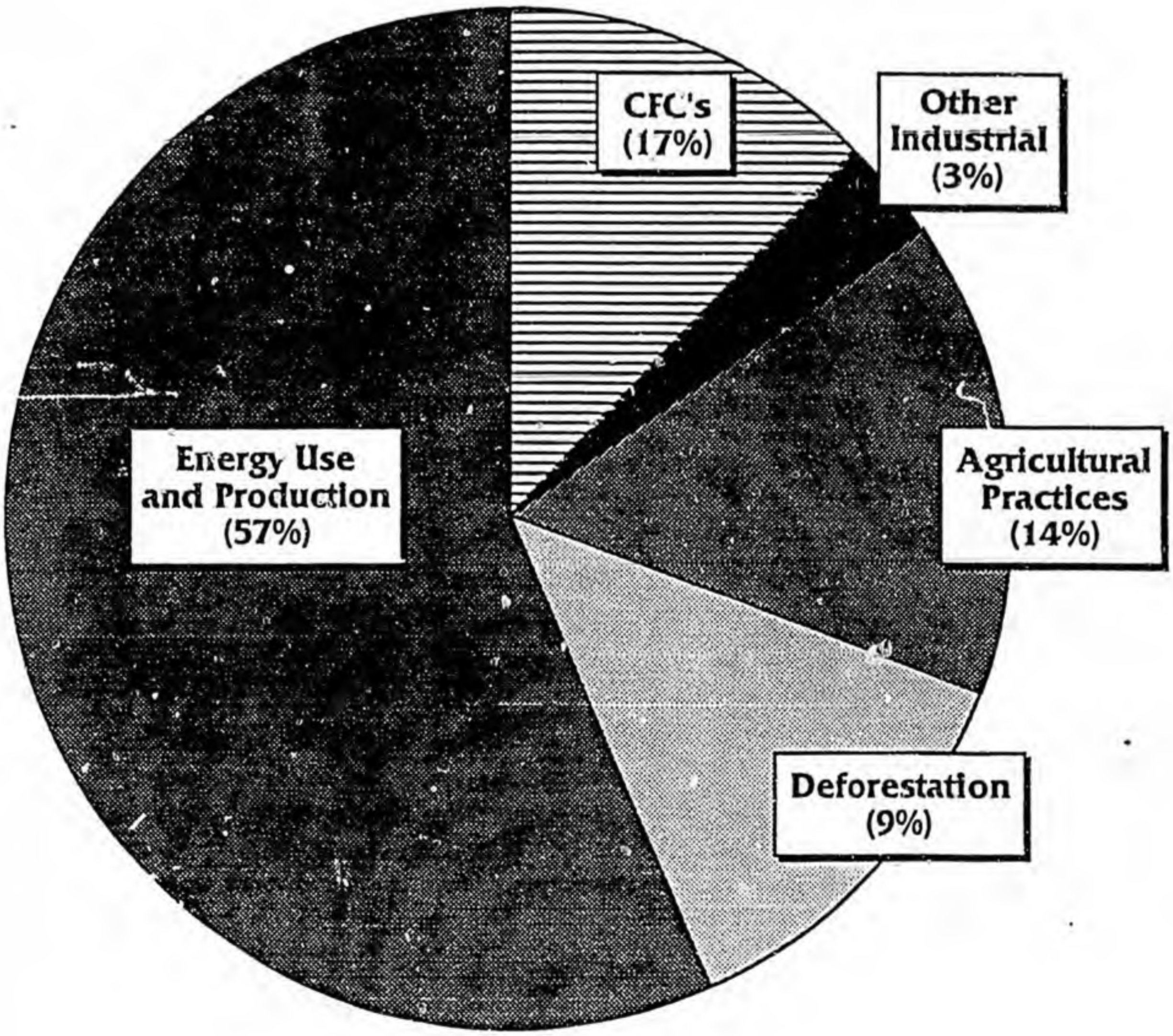
As the U.S. Global Change Research Program notes, the success of the program is dependent on achieving disciplinary integration. This means drawing upon the strengths of existing and separate fundamental disciplines, which building the interdisciplinary approaches that an integrated Earth picture demands. True interdisciplinary research is described by Stephen Schneider of NCAR as blending inextricably the techniques and intellectual cultures of two or more disciplines throughout the research effort, rather than bringing into juxtaposition research results arrived at along disciplinary lines. A university research community is the ideal setting for effectively fostering interdisciplinary collaboration, communication, and research.

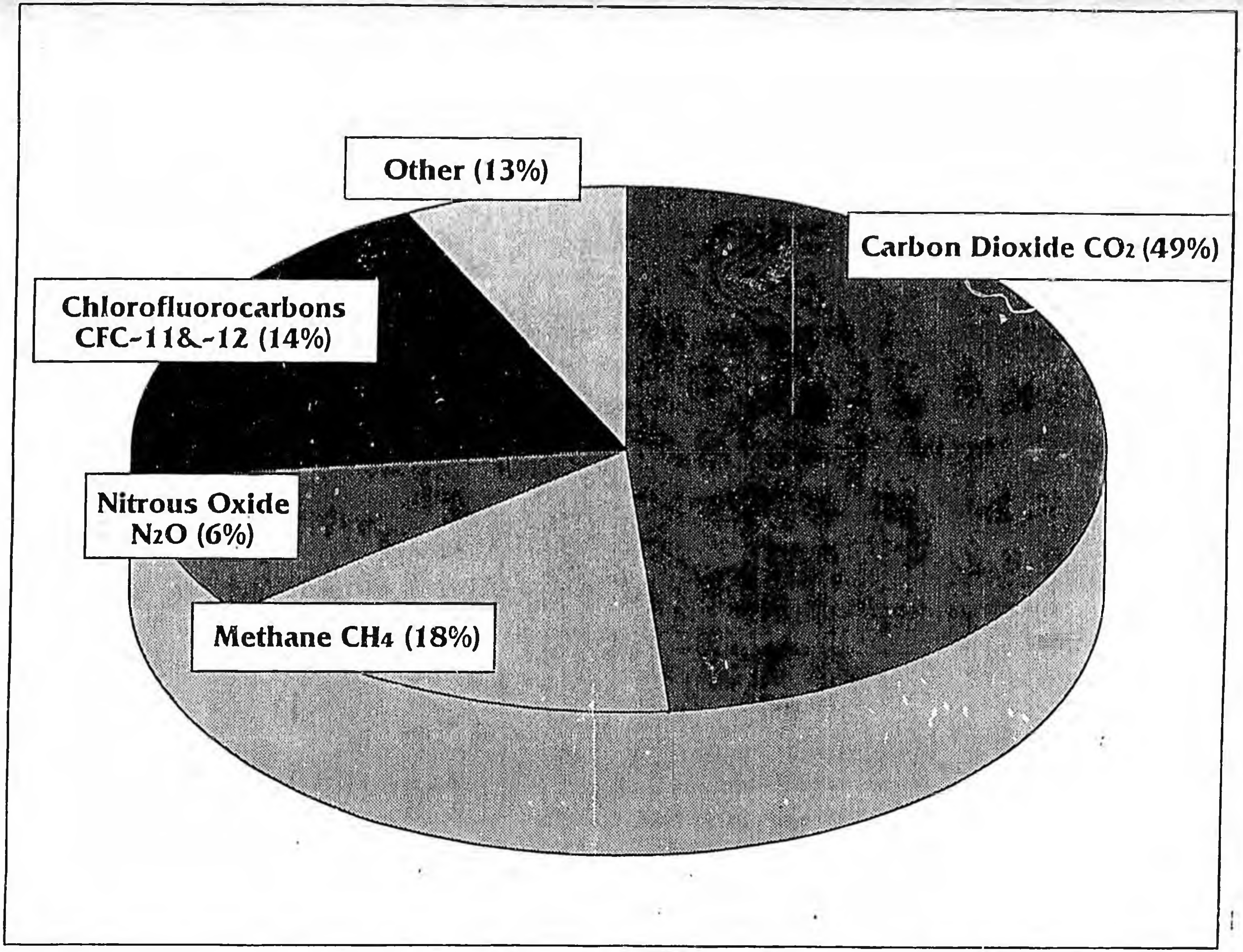
While there is presently considerable relevant research activity at UAF, it is largely the result of individual initiative and is undertaken with a disciplinary focus. However, the size and flexibility of the research community at UAF will lend itself well to the need for cross-disciplinary and interdisciplinary activities, provided there is a framework to cultivate these activities. Such a framework could be provided by a center which will provide a means of identifying and addressing crucial needs for enhancing current capabilities. This document proposes the establishment of such a Center for Global Change Studies at UAF, with a focus on the polar regions.

Several U.S. universities have taken organizational steps to address global change problems. The Center for Global Change at the University of Maryland, the Earth System Science Center at Pennsylvania State University and the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire are in operation now. Plans for similar centers are underway at the University of Michigan, University of California San Diego and Irvine campuses, and many others are on the drawing board.

We expect that the UAF Center would provide a framework and mechanism for pioneering the way interdisciplinary research is done in the polar regions. It would also provide a mechanism for more efficient use of facilities and resources, with a greater scientific and practical return for the investment. Other possible benefits include increased visibility for the State of Alaska and the University, and a mechanism for providing key information from a regional standpoint for state officials to consider in making policy decisions.

Activities Contributing to Global Warming




Other (13%)
Carbon Dioxide CO2 (49%)
Chlorofluorocarbons CFC-11&-12 (14%)
Nitrous Oxide N2O (6%)
Methane CH4 (18%)

GLOBAL WARMING IMPACTS UPON ALASKA

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Manmade contributions to global warming come from the following sources:

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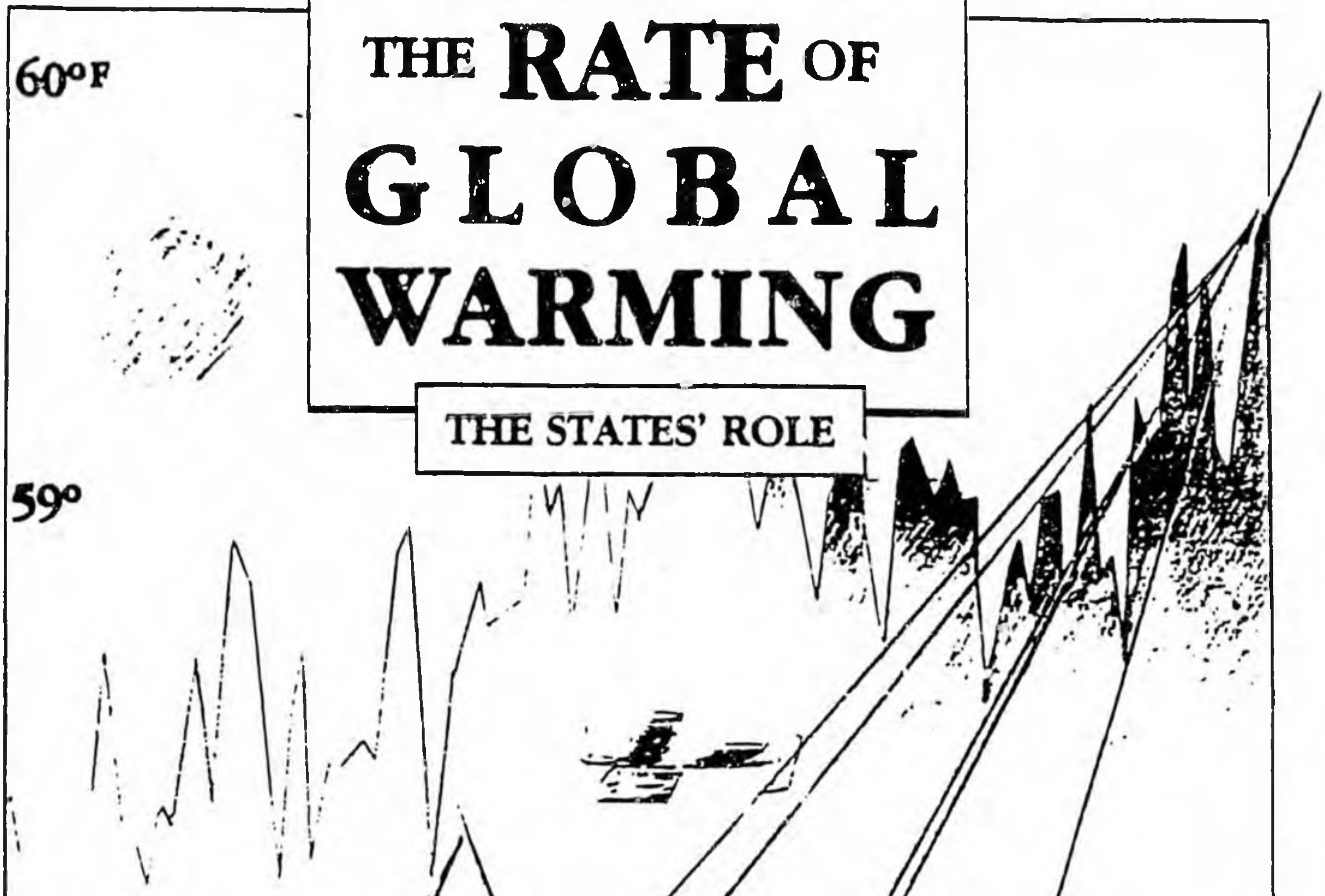
REDUCING THE RATE OF GLOBAL WARMING

THE STATES' ROLE



RENEW AMERICA

REDUCING THE RATE OF GLOBAL WARMING

THE STATES' ROLE

Prepared By:
Sheila Machado
Rick Piltz

November 1988

Renew America is a non-profit, tax-exempt educational organization dedicated to the efficient use of all natural resources. Renew America provides individual citizens, state agencies and private organizations with information to assist grassroots change to ensure a clean, safe and livable environment for future generations. For further information on Renew America or to obtain additional copies of this report, contact: Renew America, 1001 Connecticut Avenue, N.W., Suite 719, Washington, DC 20036 (202)466-6880. See page 33 for ordering information.

CORRECTION

THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY

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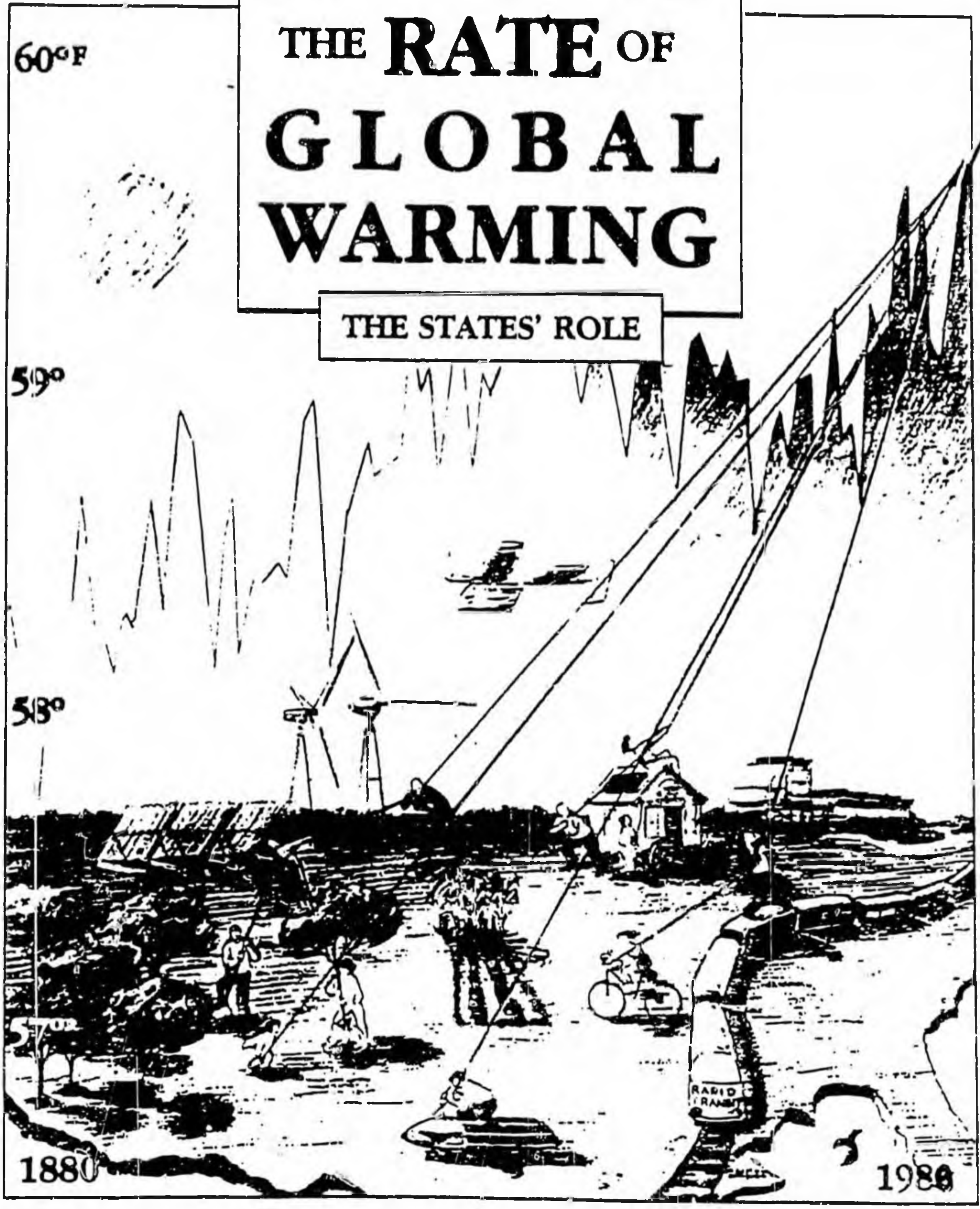

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Executive Summary

Record-breaking temperatures during the summer of 1988 were reported on front pages across the country and made the "greenhouse effect" a household term. The long heat wave parched farmlands from New Mexico to Pennsylvania and from Idaho to South Carolina. For the South it was a second year of drought conditions. In the Midwest crop yields were rated from poor to very poor. In New England the heat wave drove electric consumption to a new high.

There is much debate about the relationship between the heat wave-drought conditions and the greenhouse effect, but certain facts stand out— the earth has warmed to a record level, and the four or five warmest years of this century have been in the 1980s.

Scientists believe that a warming of the global climate, due to man-made emissions of heat-trapping greenhouse gases, is almost certain and may have already begun. Unless this warming trend is halted, or radically slowed, it will produce a host of profound and irreversible ecological disturbances in the coming decades.

According to a forthcoming U.S. Environmental Protection Agency (EPA) report to Congress, unchecked global warming would have severe ecological and economic effects in the United States. More than just long, hot summers are in store. Sea levels will rise due to warming of the ocean, and polar ice caps may melt. As a result, coastal lowlands will be flooded. Climate changes will create unpredictable crop yields, stress on water resources, and economic dislocation. Averting such a disaster will require significant changes in public policy and uses of technology. More than just a strengthening of government regulations on air pollution, the changes require a fundamental transformation of our energy-supply system.(1)

There is no single, simple technological "fix" that will eliminate the greenhouse threat. Substituting nuclear power for fossil fuels may only result in a costly process of trading one set of environmental problems for another. Dealing with the challenge effectively will require a

Inside

State-by-State Matrix Tables

multiplicity of actions, and broad cooperative efforts—international, national, state and local, public and private. The actions we take in the United States will be critical.

With five percent of the world's population, the United States is responsible for roughly 20 percent of the global greenhouse effect. The United States is the single largest contributor to the atmospheric buildup of carbon dioxide (CO_2) from the burning of fossil fuels—coal, oil, and natural gas—in power plants, motor vehicles, industrial processes, and buildings.

Of the greenhouse gases, CO_2 makes the largest contribution—about half—to global warming. Substantially cutting CO_2 emissions is a crucial, and achievable, approach to the goal of stabilizing the atmospheric chemistry. At the same time, reducing fossil fuel consumption can help ease the problems of acid rain and ground-level ozone pollution.

The keys to reducing our use of fossil fuels are to implement major, across-the-board improvements in energy efficiency, and to make a transition to an energy system based on solar and other renewable non-fossil energy resources. Switching from coal and oil to natural gas in generating electricity would reduce CO_2 emissions in the short-term. How the federal government proceeds in dealing with the greenhouse effect will set a model for other nations.

There is an especially important role for the states. Most major federal environmental-protection laws rely heavily on the states for implementation, especially for compliance monitoring and enforcement. Many states already have laws and programs in place that can serve as building-blocks for a more aggressive strategy to reduce emissions of greenhouse gases. Some states have also played a pioneering role in developing creative approaches to promoting energy conservation and renewable energy.

Global warming confronts us with extraordinary challenges: How do we effectively cope with a phenomenon that we have barely begun to experience—one which could completely alter our environment and shake our society to its foundations in the 21st century? How do we develop public understanding, make institutional decisions and commit the necessary resources to slow the rate of global warming?

Meeting these challenges will require farsighted and skillful leadership. The United States has a fundamental responsibility to provide this leadership through the actions of its public officials and private citizens.

This is the first report that attempts to track and quantify individual state carbon dioxide emissions contributing to the greenhouse effect, as well as state policies that may help reduce the rate of global warming. Information on other greenhouse gases is not yet available on a state-by-state basis. This report is not intended to be a comprehensive study of the problem, but an early indicator of possible nuts-and-bolts solutions based on current knowledge.

The information in the matrices shows indicators of the problem in each state, as well as information on current state policies and programs that could help reduce the rate of climate change. In a future report as additional information on greenhouse gases becomes available, we intend to rank states to show which are taking action to reduce emissions. We realize that state-by-state variations in emissions of greenhouse gases are due to a complex combination of economic and other factors, so caution

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should be used in interpreting the data in a comparative context.

We encourage comments from readers that will improve our information base for doing a fair evaluation.

Some of the indicators are:

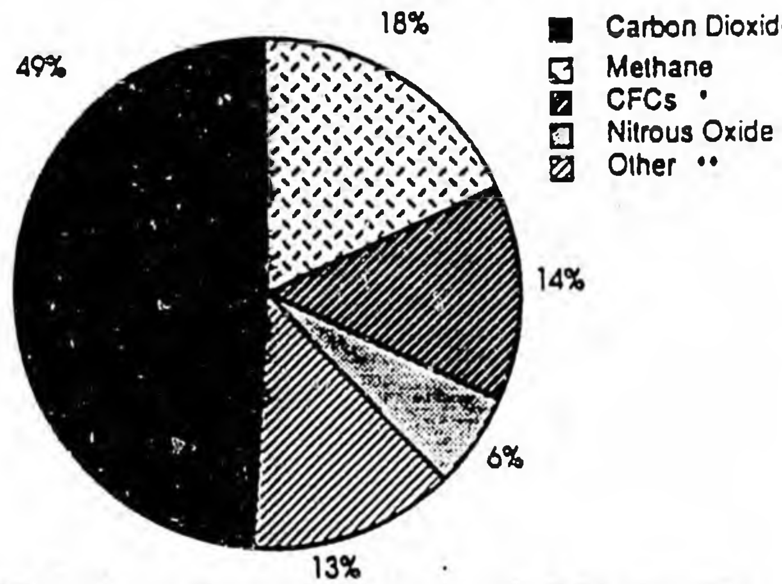
- From 1976 to 1986, 42 states reduced their petroleum emissions, but 38 states increased their coal emissions.
- Eighty million Americans in 30 states now live in areas that exceed EPA ozone-pollution standards.
- Electric power plants contribute 33.4 percent of total U.S. carbon emissions from fossil fuels. At least ten states have substantial statutory authority and policies requiring that utilities use least-cost planning and investment practices.
- Fifteen states offer alternative energy tax credits.
- Transportation contributes 31.8 percent of total U.S. carbon emissions from fossil-fuel use. Sixteen states fund ride-sharing programs. Seven states have state public transportation technical assistance programs independent of the federal Urban Mass Transportation Act (UMTA).

States can initiate action and provide models of effective programs, but a strong federal presence is required to ensure that all states implement effective policies. Increasing federal fuel-efficiency standards for cars and trucks is critical, and on other issues new federal legislation must provide incentives and deadlines for timely action in all states.

Moving expeditiously to reduce emissions of greenhouse gases will provide a wide array of benefits. Those steps can simultaneously strengthen the economy, lead to an efficient, renewable energy system, reduce our dependence on imported oil, give us an edge in technological innovation, reduce acid rain and other forms of air pollution, protect the stratospheric ozone layer, create new forests, reduce soil erosion, and promote a sustainable agriculture. On the other hand, failure to take the steps necessary to stabilize the earth's atmospheric chemistry could lead to an extraordinary combination of disasters.

Global warming is an unprecedented challenge to policymakers all over the world and the stakes are extremely high. Although a great deal is yet to be learned about global climate change, we know enough now to begin to take straightforward actions that will produce long-term benefits.

Estimated Relative Contributions to The Greenhouse Effect in the 1980s



Note: The first four gases listed are long-lived and mix well in the atmosphere, so their concentrations and greenhouse contributions can be measured fairly accurately. The 'other' category is more uncertain because the gases are short-lived and their concentrations vary from one area to another.
Source: James Hansen, et al., *Journal of Geophysical Research* 8/20/88
* CFC-11 and CFC-12.
** Tropospheric ozone and other halocarbons.

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The emission rate for each of the greenhouse gases has been increasing, as has their concentration in the atmosphere. The exact rate and amount of future warming is uncertain. But the average temperature of the earth is now warmer than at any time since record keeping started in the 19th century. The rate of warming appears to have accelerated in the past decade. (2)

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A temperature change of this magnitude occurred at the end of the last Ice Age, about 15,000 years ago, when a 5°C shift totally remapped the global ecosystem, completely changing the location of various types of forests. The global warming now underway is predicted to bring about changes far more rapidly than the changes that occurred at the end of the last Ice Age. Although it is not yet possible to predict how specific local areas will be affected, the changes in climate that will accompany this continuous warming are predictable in general. (4)

WHAT WILL HAPPEN?

In the United States, longer, hotter summers are expected. Sea water will expand as it warms, increasing sea levels by several feet and threatening coastal cities and developed areas, as well as causing the loss of beaches and wetland habitats. Polar ice caps may melt, causing even more massive flooding. Forests will die off on an unprecedented, region-wide scale. Warming will deplete fresh water resources through evaporation and cause soil to dry up. Farming patterns will be disrupted, with major losses in some parts of the country. Agricultural pests may spread northward into new regions.

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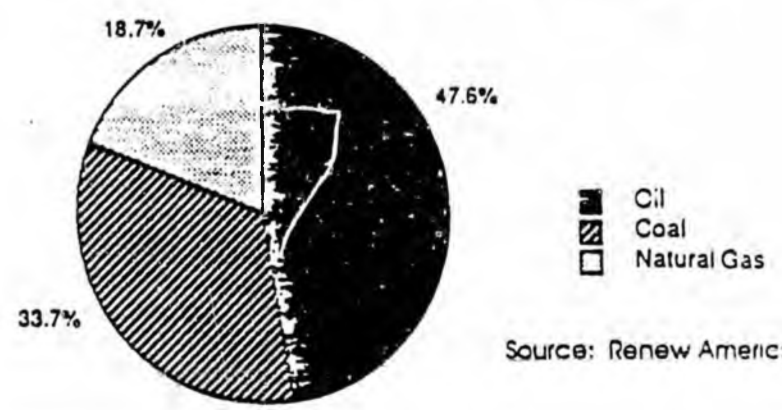

Source: Renew America

1986 Carbon Emissions from Fossil Fuels

	Total Emissions (million metric tons)	Emissions from Oil (million metric tons)	Emissions from Coal (million metric tons)	Emissions from Natural Gas (million metric tons)	Emissions from Oil (% of total)	Emissions from Coal (% of total)	Emissions from Natural Gas (% of total)	Tons Carbon/ $Million GSP
	1	2	3	4	5	6	7	8
Alabama	28.99	9.50	16.50	2.99	32.8	56.9	10.3	527
Alaska	7.96	4.69	0.30	2.97	58.0	3.8	37.3	407
Arizona	15.16	6.27	7.39	1.50	41.4	48.7	9.9	285
Arkansas	14.62	6.11	5.62	2.89	41.8	38.4	19.8	462
California	85.23	61.47	1.07	22.69	72.1	1.3	26.6	160
Colorado	16.53	6.35	7.36	2.82	38.4	44.5	17.1	279
Connecticut	10.35	8.68	0.52	1.15	83.9	5.0	11.1	147
Delaware	4.51	2.38	1.63	0.48	52.8	36.6	10.6	385
Florida	43.55	27.83	11.46	4.26	63.9	26.3	9.8	245
Georgia	35.51	14.12	17.30	4.09	39.8	48.7	11.5	345
Hawaii	4.40	4.36	0.00	0.04	99.1	0.0	0.9	228
Idaho	2.73	2.01	0.22	0.50	73.6	8.1	18.3	207
Illinois	55.04	21.94	19.64	13.46	39.9	35.7	24.5	263
Indiana	49.13	14.76	28.68	5.69	30.0	58.4	11.6	579
Iowa	16.03	6.51	6.54	2.98	40.6	40.8	18.6	366
Kansas	18.20	7.52	6.29	4.39	41.3	34.6	24.1	429
Kentucky	30.01	8.81	18.72	2.48	29.4	62.4	8.3	565
Louisiana	51.73	26.11	4.29	21.33	50.5	8.3	41.2	695
Maine	4.43	4.17	0.22	0.04	94.1	5.0	0.9	256
Maryland	17.60	8.49	6.86	2.25	48.2	39.0	12.8	230
Massachusetts	21.70	16.48	2.50	2.72	75.9	11.5	12.5	188
Michigan	47.12	17.03	20.27	9.82	36.1	43.0	20.8	308
Minnesota	17.75	9.24	5.02	3.49	52.1	28.3	19.7	235
Mississippi	13.51	7.65	2.72	3.14	56.6	20.1	23.2	424
Missouri	27.44	11.18	12.78	3.48	40.7	46.6	12.7	329
Montana	6.32	2.42	3.32	0.58	38.3	52.5	9.2	520
Nebraska	7.96	3.73	2.75	1.48	46.9	34.5	18.6	300
Nevada	7.25	2.70	4.04	0.51	37.2	55.7	7.0	373
New Hampshire	3.58	2.80	0.62	0.16	78.2	17.3	4.5	193
New Jersey	31.21	24.08	1.95	5.18	77.2	6.2	16.6	202
New Mexico	12.01	3.90	6.04	2.07	32.5	50.3	17.2	509
New York	49.57	32.57	6.31	10.69	65.7	12.7	21.6	137
North Carolina	29.78	13.23	14.55	2.00	44.4	48.9	6.7	295
North Dakota	10.39	2.25	7.76	0.38	21.7	74.7	3.7	968
Ohio	67.21	20.78	35.74	10.69	30.9	53.2	15.9	382
Oklahoma	21.37	7.79	5.44	8.14	36.5	25.5	38.1	429
Oregon	7.28	6.17	0.07	1.04	84.8	1.0	14.3	176
Pennsylvania	65.57	23.66	32.90	9.01	36.1	50.2	13.7	357
Rhode Island	2.42	2.02	0.02	0.38	83.5	0.8	15.7	159
South Carolina	14.78	6.74	6.59	1.45	45.6	44.6	9.8	330
South Dakota	2.94	1.89	0.72	0.33	64.3	24.5	11.2	300
Tennessee	28.72	10.80	15.15	2.77	37.6	52.8	9.6	397
Texas	154.87	78.60	29.03	47.24	50.9	18.7	30.5	510
Utah	9.88	3.73	4.72	1.43	37.8	47.8	14.5	412
Vermont	1.31	1.22	0.02	0.07	93.1	1.5	5.3	152
Virginia	23.35	13.69	7.56	2.10	58.6	32.4	9.0	224
Washington	16.20	12.89	1.57	1.74	79.6	9.7	10.7	209
West Virginia	28.42	4.80	21.89	1.73	16.9	77.0	6.1	1179
Wisconsin	22.04	8.76	9.26	4.02	39.7	42.0	18.2	287
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(See pp. 22-23 for explanatory notes)

CORRECTION

THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY

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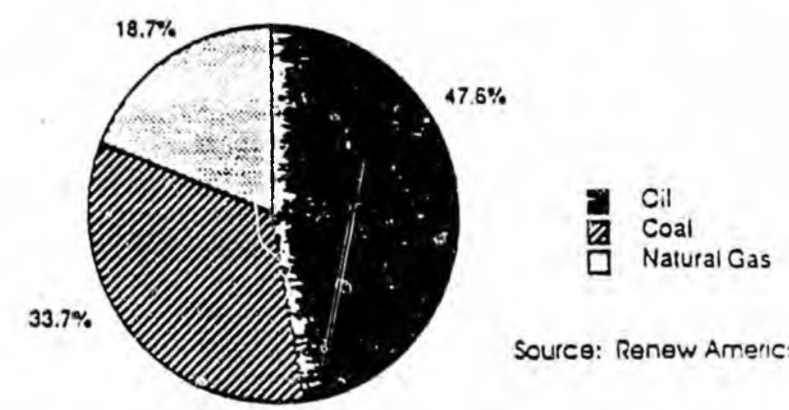

Source: Renew America

"...collectively suggest a world that is different from the world that exists today....The landscape of North America will change in ways that cannot be fully predicted. The ultimate effects will last for centuries and will be irreversible. Strategies to reverse such impacts on natural ecosystems are not currently available." (6)

THE GREENHOUSE GASES

- **Carbon dioxide**
- **Chlorofluorocarbons and Halons**
- **Methane**
- **Nitrous oxide**
- **Tropospheric ozone**

Carbon Dioxide—Mainly a Fossil Fuel Problem

Carbon dioxide contributes about half to the impact of all greenhouse gases. While CO_2 is essential to life–without it altogether the earth would freeze–if the natural CO_2 balance is disturbed, the atmosphere overheats. Human activity adds CO_2, primarily through the burning of fossil fuels in transportation, electricity generation, industrial manufacturing, and heating of buildings. The quantity of carbon-dioxide emissions attributable to the burning of fossil fuels in the United States, and in each state, can be estimated using available data and formulas.

Figure 1 summarizes 1986 total U.S. carbon emissions by fossil-fuel type. Oil—including motor fuel, heating oil, and oil used in industrial processes — makes the largest overall contribution to the CO_2 build-up.

The 1986, 1976, and 1966 "Carbon Emissions from Fossil Fuels" matrices provide data on total state-by-state emissions, and the amount and percentage from each fossil-fuel type—oil, coal, and natural gas (See pp. 6, 19-21). The combustion of each fossil fuel varies in its emissions of carbon per unit of energy released. Coal releases the most CO_2 to produce a given amount of energy and natural gas the least. (Following standard practice, the matrices express emissions data in terms of tons of carbon, rather than CO_2. One ton of CO_2 contains 12/44 ton of carbon.)

The 1986 Carbon Emissions Matrix reveals wide variation among states in total emissions, with Texas having the highest total (154.87 million metric tons) and Vermont the lowest (1.31 million).

In West Virginia, coal accounts for 77 percent of the state's total carbon emissions, while in California coal's contribution is just one percent. Natural gas accounts for 41 percent of Louisiana's carbon emissions, while oil is the leading contributor in Hawaii (99 percent).

The 1986 Carbon Emissions Matrix also shows that states vary widely in their tonnage of carbon emissions per million dollars of gross state product (the total value of goods and services produced in the state). In general, the states with the higher emission rates on this indicator are those with the most coal-based electricity generating systems, or those with a heavy concentration of petrochemical plants. Those with a lower ratio of carbon emissions to economic product tend to have few coal-fired power plants.

A comparison of the 1986, 1976, and 1966 Carbon Emissions matrices shows that the 1275 million tons of U.S. total emissions from burning of fossil fuels in 1986 was 28 percent higher than the total in 1966. This increase was due to a substantial increase in consumption of both oil and coal. Over the most recent ten year period, the trend is more encouraging. Total carbon emissions were reduced by five percent from 1976 to 1986, as 42 states reduced their petroleum emissions. This reduction was slowed by increasing coal emissions in 38 states.

Carbon dioxide is the only greenhouse gas for which it is possible to calculate state-by-state emissions from fossil fuels. No federal agency or independent organization has broken down emissions of other greenhouse gases by state. However, the available carbon emissions data suggest how far the states still have to go in reducing fossil fuel burning.

1986 Carbon Emissions from Fossil Fuels

	Total Emissions (million metric tons)	Emissions from Oil (million metric tons)	Emissions from Coal (million metric tons)	Emissions from Natural Gas (million metric tons)	Emissions from Oil (% of total)	Emissions from Coal (% of total)	Emissions from Natural Gas (% of total)	Tons Carbon/ $Million GSP
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Wisconsin	22.04	8.76	9.26	4.02	39.7	42.0	18.2	287
Wyoming	11.63	2.09	8.41	1.13	18.0	72.3	9.7	996
TOTAL	1275.30	606.96	430.35	238.01	47.6	33.7	18.7	306

(See pp. 22-23 for explanatory notes)

The best way to reduce carbon dioxide emissions from fossil fuels is to: 1) reduce fossil-fuel use through increases in end-use energy efficiency; 2) replace fossil-fuel combustion with alternative, renewable fuel sources; and 3) shift the fossil-fuel mix from higher to lower carbon-dioxide-emitting fuels.

Deforestation is also a major contributor of carbon dioxide to the atmosphere, through the burning and decay of trees. Planting trees can reverse this process and help reduce CO_2 levels. Forestry alone cannot solve the CO_2 problem, but it could play a significant role.

Figure 2 summarizes 1986 U.S. carbon emissions from various sectors—electricity generation, transportation, industrial/commercial, and residential.

Reducing the CO_2 build-up must be the main focus of state action to slow global warming. States have numerous possible tools for accomplishing this (For more discussion, see the "What States Can Do section of this report).

Chloroflourocarbons — Air Conditioners and Refrigerators

In contrast to other greenhouse gases, chlorofluorocarbons (CFCs) and the related bromine-containing compounds, the halons, are not naturally present in the atmosphere. CFCs have been manufactured during the past 50 years for use as solvents, refrigerator fluids, aerosol propellants, hospital sterilants, and foam packaging. Halons are used predominantly in fire extinguishers and firefighting practices. CFCs and halons destroy the life-protecting stratospheric (upper-atmospheric layer) ozone shield, allowing more harmful ultraviolet radiation into the lower atmosphere.

CFCs are used in an estimated 90 million car and truck air conditioners, 100 million refrigerators, air conditioners in 45 million homes and most buildings, and 30 million freezers.(7)

In 1987 representatives of most of the industrialized nations signed the Montreal Protocol, an agreement to cut CFC production in half by 1998. In 1988, the U.S. Congress ratified this pledge. However, in a September 1988 report, EPA concluded that, even with full worldwide participation in the Montreal Protocol, the concentration of ozone-depleting chemicals would at least double during the next 87 years—a phenomenon that would have very disturbing implications both for the stratospheric-ozone shield and for global warming. (8)

Simply put, the use of chlorofluorocarbons and halons must be eliminated absolutely as quickly as possible. Their ozone-depleting effects can be reduced in the short term through the use of alternative products. Currently, four states—Maine, Vermont, Massachusetts, and Rhode Island—ban or restrict the purchase of polystyrene (styrofoam) products. Massachusetts filed the nation's first lawsuit to stop the excessive emissions of CFCs.

States could also take the lead in using regulatory measures or economic incentives to promote CFC recovery and recycling, especially from refrigerators and automobile air conditioners. Recycling centers could be set up in cooperation with industry. (9) (Chlorofluorocarbons/Methane Matrix, p. 24)

Methane — Landfills, Cows, and Rice Paddies

Methane is generated mainly by the bacterial decomposition of organic matter, particularly in flooded rice fields, wetlands, the digestive systems of certain animals, and landfills. Wood and agricultural waste-burning, pipeline leaks, and coal mining also contribute. Methane emissions are not well-documented, but are linked to population growth and agricultural and economic development.

Landfill gas consists of about 50 percent methane and is produced by the decomposition of solid waste. Recovering methane from landfills can reduce emissions, but not all landfills are suited for methane recovery, and further research is needed to document methane emissions. EPA lists 7,608 municipal waste landfills in the United States. Currently, 20 states have a total of 65 privately operated landfill recovery projects. (Chlorofluorocarbons/Methane Matrix, p. 24)