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United States General Accounting Office

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Briefing Report to the Chairman, Committee on Natural Resources, House of Representatives

August 1993

NATURAL RESOURCES RESTORATION

Use of *Exxon Valdez* Oil Spill Settlement Funds

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United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-254199

August 20, 1993

The Honorable George Miller
Chairman, Committee on
Natural Resources
House of Representatives

Dear Mr. Chairman:

The March 1989 grounding of the supertanker Exxon Valdez in Alaska's Prince William Sound spilled 11 million gallons of crude oil--the largest oil spill in U.S. history. The spilled oil affected more than 1,200 miles of Alaskan shoreline, killed or injured large numbers of wildlife, and touched off massive cleanup and restoration efforts by Exxon[1] and federal and state of Alaska agencies.

In October 1991, the U.S. District Court for the District of Alaska approved settlements between Exxon and the federal government and the state of Alaska to resolve civil claims and criminal charges for damages caused by the oil spill. Under the civil settlement, Exxon agreed to pay a total of $900 million in 11 annual payments. Under the criminal settlement, Exxon was fined $150 million ($125 million of which was forgiven because of, among other things, Exxon's cooperation during the cleanup) and required to pay $50 million each to the federal government and to the state of Alaska as remedial and compensatory payments to be used exclusively for restoring natural resources damaged by the oil spill.

Oil from the Exxon Valdez affected the natural resources managed by the state of Alaska and three federal agencies --the Departments of Agriculture; Commerce, through the National Oceanic and Atmospheric Administration (NOAA); and the Interior. Federal and state trustees have been designated to assess the damage to the natural resources

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[1]As used in this report, the name Exxon includes the Exxon Corporation and its subsidiaries: the Exxon Pipeline Company and the Exxon Shipping Company, which owned the Exxon Valdez.

caused by the oil spill and to restore these resources. Currently, the federal trustees are the Secretary of the Interior; the Secretary of Agriculture; and the Administrator, NOAA.[2] The state of Alaska trustees are the Commissioner, Department of Environmental Conservation; the Commissioner, Department of Fish and Game; and the Alaska Attorney General, Department of Law.

In May 1989, the federal government and the state of Alaska established a trustee council to (1) coordinate damage assessment activities and (2) provide the framework to seek funds from responsible parties to restore or replace natural resources damaged by the oil spill. In August 1991, the federal government and the state of Alaska converted the original trustee council into the Exxon Valdez Oil Spill Trustee Council (Trustee Council)[3] to jointly direct the restoration. After the civil claims and criminal charges were settled in October 1991, the Trustee Council became responsible for jointly managing the distribution of the civil settlement funds. (See sec. 1 for additional background information.)

In response to your request and subsequent agreements with your office, this briefing report provides information on

-- the amount of money that Exxon has paid through December 1992 under the settlements and the distribution of this money and

-- issues surrounding the functioning of the Trustee Council.

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[2]In 1989, the then Secretary of Commerce recused himself of his duties as a trustee in matters related to the Exxon Valdez oil spill because of a potential conflict of interest. Since then, the Administrator, NOAA, has served as Commerce's trustee instead.

[3]The Trustee Council comprises three federal and three state members. The federal members are the Alaska-based representatives of the federal trustees--the Alaska Regional Forester, U.S. Forest Service, Department of Agriculture; a Special Assistant to the Secretary of the Interior; and the Director, Alaska Region of the National Marine Fisheries Service, NOAA. The state members are the state of Alaska trustees.

On March 19, 1993, we briefed your office on the preliminary results of our review. Following that briefing, we provided--at your office's request--two similar briefings: one on May 12, 1993, to senior officials from the Departments of Agriculture, Commerce, and the Interior in Washington, D.C.; and a second, on May 26, 1993, to federal and state members of the Trustee Council in Alaska. As subsequently agreed with your office, this letter and the following sections summarize and update the information provided at these briefings.

EXXON PAYMENTS AND DISTRIBUTION OF SETTLEMENT FUNDS

Through December 1992, Exxon paid two annual installments --totaling $240 million--on the $900 million to be paid under the civil settlement. As of February 1993, the $240 million was distributed as follows:

-- $107 million was returned to federal and state agencies as reimbursement for presettlement cleanup and damage assessment costs,

-- $40 million was offset against Exxon's payments, as provided in the settlement, for cleanup costs that Exxon incurred in 1991,

-- $19 million was approved by the Trustee Council for expenditure on damage assessment and restoration projects and administrative costs, and

-- $74 million remained in a joint federal/state trust fund for future use.

Both an August 1991 Memorandum of Agreement between the federal government and the state of Alaska and the civil settlement placed a limit of $142 million on the amount of presettlement cleanup and damage assessment costs that can be reimbursed--$67 million for federal agencies and $75 million for state agencies. Trustee Council members believe that reimbursements will not exceed the $142 million limit.

About 40 percent of the $19 million for projects approved by the Trustee Council through February 1993 was used for damage assessment. The remainder was split almost evenly between restoration projects and administrative costs. Furthermore, the $19 million was divided almost evenly between federal and state agencies. The Trustee Council has approved a resolution to use $21.1 million of the $74 million remaining in the joint trust fund for damage assessment and restoration projects, habitat protection, and administrative costs for 1993. Of the $21.1 million, about $7.5 million was allocated for restoration work and habitat protection each.

In accordance with the criminal settlement, Exxon has paid $25 million of the $150 million fine, which was deposited into the North American Wetlands Conservation Fund (16 U.S.C. sec. 4401-4413) and the Victim Compensation and Assistance Act (42 U.S.C. 10601-10605) account. Under the terms of the settlement, the $125 million balance of the fine was forgiven because of Exxon's cooperation during the cleanup. Exxon has also paid $100 million in remedial and compensatory (restitution) payments--$50 million each to the federal government and to the state of Alaska. Plans have been proposed or are under way to use these funds for such measures as acquiring land for habitat protection, building a marine mammal rehabilitation center, and restoring subsistence resources or services lost or damaged in rural communities. (See sec. 2.)

ISSUES SURROUNDING THE FUNCTIONING OF THE TRUSTEE COUNCIL

Issues surrounding the functioning of the Trustee Council fall into three categories: restoration planning, habitat protection, and overall organization and administration.

Restoration Planning

A key ingredient--which the Trustee Council does not yet have--in the transition from the Trustee Council's role of assessing damage to taking action to restore the natural resources affected by the oil spill is an approved restoration plan. The plan is scheduled to be issued in December 1993. At present, however, the Trustee Council's annual work plans are not tied to a comprehensive restoration plan, and some projects do not appear to have a direct link to the oil spill or else appear to duplicate existing agency responsibilities. In addition, some participants in and observers of the Trustee Council's activities believe that the damage assessment and restoration work carried out to date has been dominated by federal and state agencies and that, as a consequence, few nongovernmental organizations have been able to participate in the process. For example, almost all of the 1992 and 1993 work projects were not open for competitive bid and were carried out by federal and state agency personnel. The Trustee Council's chief scientist believes that open competition would encourage more timely completion of projects at reduced costs. According to Trustee Council members, there was a need for federal and state agencies to do most of the damage assessment work; however, as more restoration projects are undertaken, less use will be made of federal and state agencies and more projects will be subject to bid proposals from nongovernment sources. (See sec. 3.)

Habitat Protection

The Trustee Council is facing increasing public pressure to acquire land to protect habitat. However, land acquisition is expensive, as is illustrated by the Trustee Council's estimates to acquire land for habitat protection that run as high as $3 billion. Currently, land acquisition activities are not yet tied to an approved land acquisition plan that is linked to an approved restoration plan. Meanwhile, using interim evaluation criteria approved by the Trustee Council, a habitat protection/acquisition work group classified about 42,000 acres as critical habitat to help the recovery of injured wildlife species. This land was identified as "imminently threatened" because of its vulnerability to activities, such as logging, that would significantly lessen the land's ability to provide habitat protection for wildlife species injured by the oil spill. The Trustee Council has approved over $60 million to acquire 24,500 acres, which includes the work group's two top-ranked imminently threatened parcels totaling 22,500 acres. The work group classified another 338,000 acres as "opportunity-to-buy" parcels--land that is important as habitat protection but not imminently threatened. (See sec. 4.)

Overall Organization and Administration

The Trustee Council's current procedures and practices lead many to view the Trustee Council's objectivity with some skepticism. Among other things, the individuals making up the Trustee Council and its organization, which includes a restoration team and several work groups, are, for the most part, employees of the various federal and state trustee agencies. The same agencies--and sometimes the same individuals--that recommend a project for funding also approve and carry out the project. Moreover, financial reviews or audits have not been conducted of the federal and state agencies' reimbursement claims or of the use of civil settlement funds.

In addition, required project reports on damage assessment and restoration efforts are frequently submitted late and often require extensive revision because of such problems as incomplete analyses, overreaching conclusions, and imbalanced presentations. Consequently, the Trustee Council has often made decisions on follow-on projects without the knowledge of the final conclusions of earlier, related studies. Also, there are some who believe that the Trustee Council organization has not sufficiently sought meaningful public participation or independent scientific viewpoints in deciding which studies and restoration activities should be undertaken. Because of the importance placed on the public's views, the Trustee Council has held numerous public meetings and has established a 17-member public advisory group to facilitate the gathering of the views of individuals and various interest groups throughout Alaska. (See sec. 5.)

CONCLUSIONS

Our review raised a number of issues surrounding the functioning of the Trustee Council. These issues require attention before adequate assurance can be provided that the $1 billion being received as a result of the Exxon Valdez oil spill civil and criminal settlements are expended as intended. Several of the issues relate to the completion of a comprehensive restoration plan to guide such things as annual work plans and land acquisitions, more timely and better quality project reports, and more open competition for restoration projects. Other issues involve the adequacy of internal controls, including (1) financial reviews and program audits to ensure the propriety of reimbursements and subsequent expenditures of settlement funds and (2) a separation of duties among agency personnel involved in recommending, approving, and carrying out the projects.

RECOMMENDATIONS

We recommend that the three federal trustees proactively work with the three state of Alaska trustees to better ensure that the $1 billion being received as a result of the Exxon Valdez oil spill settlements is expended as intended. Among other things, attention should be given to (1) completing restoration and land acquisition plans, (2) requiring more timely and better quality project reports, (3) providing for more open competition for restoration projects, and (4) improving internal controls.

AGENCY COMMENTS

At your office's request, we did not obtain written agency comments on a draft of this report. We did, however, discuss the information in the report with members of the Trustee Council. They generally agreed with the information in the report and provided comments and suggestions, which we incorporated where appropriate.

More specifically, the Trustee Council members suggested that we more clearly distinguish between the role and makeup of the presettlement and postsettlement trustee councils, which we did. They also commented that we had understated the extent of public participation actively sought and used for the Trustee Council's decisions. We revised the report as necessary to more clearly reflect the extent and form of public participation.

The Trustee Council members expressed concern that we had not fully reflected the magnitude of the challenge they faced in establishing a joint federal/state organization, process, and plan for addressing the restoration of resources damaged and services affected by the largest oil spill on record. We believe that the report does recognize the magnitude and complexity of the challenges faced by the trustees and the Trustee Council, and that this is all the more reason for the trustees to address the issues identified in the report to ensure that settlement funds are expended efficiently, effectively, and as intended.

Finally, the Trustee Council members believe that we should have addressed the multiplicity of federal and state procedures and requirements that must be met in developing a restoration plan. Although the scope of our review did not include an in-depth analysis of all the statutes, laws, and regulations affecting the Trustee Council's operations, we believe that the report does provide a fairly comprehensive overview of its operations, including the restoration planning process.

SCOPE AND METHODOLOGY

To determine how much Exxon has paid to date under the settlement and how the money has been distributed, we obtained documents and interviewed officials from federal agencies in Washington, D.C., and their regional offices in Alaska, as well as state of Alaska agencies. The federal agencies we contacted were the Departments of Agriculture, Commerce (NOAA), the Interior, Justice, and Transportation (U.S. Coast Guard). The state of Alaska agencies included the Departments of Environmental Conservation, Fish and Game, and Law.

To identify issues surrounding the functioning of the Trustee Council, we interviewed the six federal and state members of the Trustee Council and various other officials of the Trustee Council organization, including members of the Trustee Council's restoration team, work groups, the public advisory group, and the chief scientist. We also reviewed the Trustee Council's documents, including transcripts of the Trustee Council's monthly meetings; annual budgets and work plans; and analyses prepared by the chief scientist.

We conducted our review between February and July 1993 in accordance with generally accepted government auditing standards. As agreed, however, we did not verify the accuracy or reliability of the annual budgets or actual distributions of funds.

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As requested, unless you publicly announce its contents earlier, we plan no distribution of this briefing report until 30 days from the date of this letter. At that time, we will make copies available to the Secretary of Agriculture; the Secretary of Commerce and the Administrator, NOAA; the Secretary of the Interior; designated federal and state members of the Trustee Council at Anchorage, Alaska; and other interested parties. Copies will also be made available to others on request.

This work was performed under the direction of James Duffus III, Director, Natural Resources Management Issues, who can be reached at (202) 512-7756 if you or your staff have any questions. Other major contributors to this briefing report are listed in appendix I.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

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ABBREVIATIONS

GAO	General Accounting Office
NOAA	National Oceanic and Atmospheric Administration
NRDA&R	Natural Resources Damage Assessment and Restoration Fund

SECTION 1

BACKGROUND

Shortly after midnight on March 29, 1989, the supertanker Exxon Valdez struck a reef and ran aground in Prince William Sound, off the coast of Alaska, spilling 11 million gallons of crude oil, the largest oil spill in U.S. history. The spilled oil spread to more than 1,200 miles of Alaska's coastline, including portions of one national forest, four national wildlife refuges, three national parks, five state parks, four state critical habitat areas, and one state game sanctuary. This coastline is rich in fish and wildlife, such as herring, salmon, sea otters, whales, bald eagles, and seabirds. The spill killed and injured large numbers of many of these wildlife species. Services dependent upon these natural resources--such as native subsistence, commercial and sport fishing, sport hunting, camping, boating, and tourism--were also reduced or lost.

Oil from the Exxon Valdez affected the natural resources managed by the state of Alaska and three federal agencies--the Departments of Agriculture; Commerce, through the National Oceanic and Atmospheric Administration (NOAA); and the Interior. The Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. sec. 9607); the Clean Water Act (33 U.S.C. sec. 1321); and implementing regulations provide for the designation of federal and state officials to act as trustees to ensure that responsible parties pay to restore, rehabilitate, or replace natural resources damaged or destroyed by an oil spill. The federal trustees were the Secretary of the Interior; the Secretary of Agriculture; and the Administrator, NOAA. The state of Alaska trustee was the Commissioner, Department of Fish and Game.

Although the response of the state of Alaska and of the various federal agencies to the oil spill was swift, a need soon emerged for a formal interagency structure to coordinate response and damage assessment activities. In May 1989, the trustees established a trustee council to coordinate activities. The council was composed of three Alaska-based representatives of the federal trustees--the Alaska Regional Forester, U.S. Forest Service, Department of Agriculture; the Director, Alaska Region of the U.S. Fish and Wildlife Service, Department of the Interior; and the Director, Alaska Region of the National Marine Fisheries Service, NOAA--and the state's Commissioner, Department of Fish and Game. The U.S. Environmental Protection Agency participated in the council's activities as an adviser on the long-term revival of Prince William Sound.

During 1989, state and federal agency efforts focused on containing and cleaning up the spill and rescuing oiled wildlife. Although winter storms helped in cleaning many beaches, additional cleanup work was needed in 1990 and 1991. Along with the cleanup effort, the state and federal trustee agencies--under the coordination of the trustee council--also planned and directed natural resources damage assessment studies to determine the nature and extent of injuries sustained in the oil spill area. The results of these studies were to be used as evidence in pending civil and criminal claims against Exxon and to help in the restoration of the damaged resources.

Both the state of Alaska and the federal government filed claims against Exxon seeking to recover damages for injuries to and the restoration and replacement of natural resources affected by the oil spill. In October 1991, the U.S. District Court for the District of Alaska approved agreements that settled the claims of the United States and the state of Alaska against Exxon for civil damages and criminal charges. Under the major terms of the civil settlement, Exxon (1) agreed to pay the federal government and the state of Alaska a total of $900 million in 11 annual payments (see table 1.1) beginning in December 1991 and ending in September 2001 and (2) might be liable for up to an additional $100 million between 2002 and 2006 for projects to restore populations, habitats, or species that had suffered a substantial loss or decline not anticipated on the effective date of the settlement.

Table 1.1: Schedule of Exxon's Civil Settlement Payments

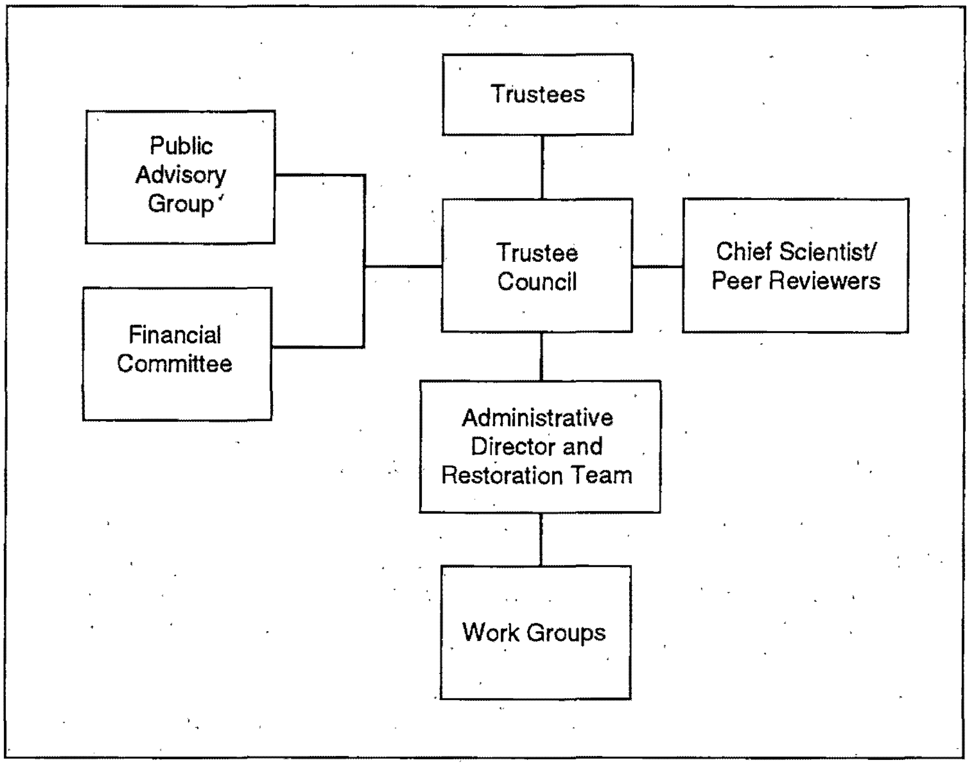
Dollars in millions

Scheduled payment date	Amount
Dec. 1991	$90
Dec. 1992	150
Sept. 1993	100
Sept. 1994	70
Sept. 1995	70
Sept. 1996	70
Sept. 1997	70
Sept. 1998	70
Sept. 1999	70
Sept. 2000	70
Sept. 2001	70
Total	$900

Under the criminal settlement, Exxon agreed to plead guilty to four criminal charges arising from the oil spill and be fined $150 million. The $150 million fine was the largest fine ever imposed for an environmental crime. Of this amount, $125 million was forgiven because of Exxon's cooperation during the cleanup, timely payment of many small claims, and environmental precautions taken since the spill. The remaining $25 million was paid into the North American Wetlands Conservation Fund (16 U.S.C. sec. 4401-4413) and the Victim Compensation and Assistance Act (42 U.S.C. sec. 10601-10605) account. In addition, Exxon agreed to pay $100 million ($50 million to the federal government and $50 million to the state of Alaska) as remedial and compensatory (restitution) payments to be used exclusively for the restoration of natural resources damaged by the oil spill.

Guidelines for the use of the $900 million civil settlement funds are set forth in a Memorandum of Agreement between the federal government and the state of Alaska, which was approved by the U.S. District Court in August 1991. The agreement established a federal/state trusteeship--known as the Exxon Valdez Oil Spill Trustee Council (Trustee Council)--to review and approve the expenditure of civil settlement funds for such things as damage assessment and restoration projects. The federal members of the Trustee Council are the same as those on the earlier trustee council, except that a Special Assistant to the Secretary of the Interior replaced the Director, Alaska Region of the U.S. Fish and Wildlife Service. The Memorandum of Agreement also designated as state of Alaska trustees and as members of the Trustee Council the Commissioner, Department of Environmental Conservation; the Commissioner, Department of Fish and Game; and the Alaska Attorney General, Department of Law. Figure 1.1 shows the postsettlement Trustee Council organization.

Figure 1.1: Exxon Valdez Oil Spill Trustee Council Organization



Under the Memorandum of Agreement, civil settlement funds must be used to restore, replace, rehabilitate, enhance, or acquire the equivalent of the natural resources injured, lost, or destroyed as a result of the oil spill and the reduced or lost services provided by such resources. The funds must be spent on the restoration of natural resources in Alaska unless the trustees unanimously agree that spending funds outside of the state is necessary for effective restoration. The agreement also established a joint trust fund, within the jurisdiction of the U.S. District Court, as a depository for Exxon's payments. The use of the $100 million restitution funds from the criminal settlement was not covered by the Memorandum of Agreement; however, these funds must be used by the federal government and the state of Alaska for restoration activities, within the state, relating to the Exxon Valdez oil spill.

The six-member Trustee Council receives input and advice from a contracted chief scientist and a peer review group of scientists, a financial committee, a public advisory group, and the public at large. The primary day-to-day activities of the Trustee Council organization are performed by an interim administrative director, a six-member restoration team, and various work groups. The restoration team reviews and recommends proposed actions to the Trustee Council, and the work groups prepare plans and documents as directed by the restoration team, including annual work plans and a long-term habitat-protection plan. The work groups are staffed by officials from state and federal agencies represented on the Trustee Council or restoration team. The Trustee Council's first of generally monthly meetings occurred in December 1991. All Trustee Council meetings are open to the public under Alaska's open-meeting laws. Teleconferencing is used in many of these meetings as a means of involving individuals from up to 10 communities throughout the state who, otherwise, would be unable to participate. A significant part of each meeting is devoted to the public comments received on the issues being considered by the Trustee Council.

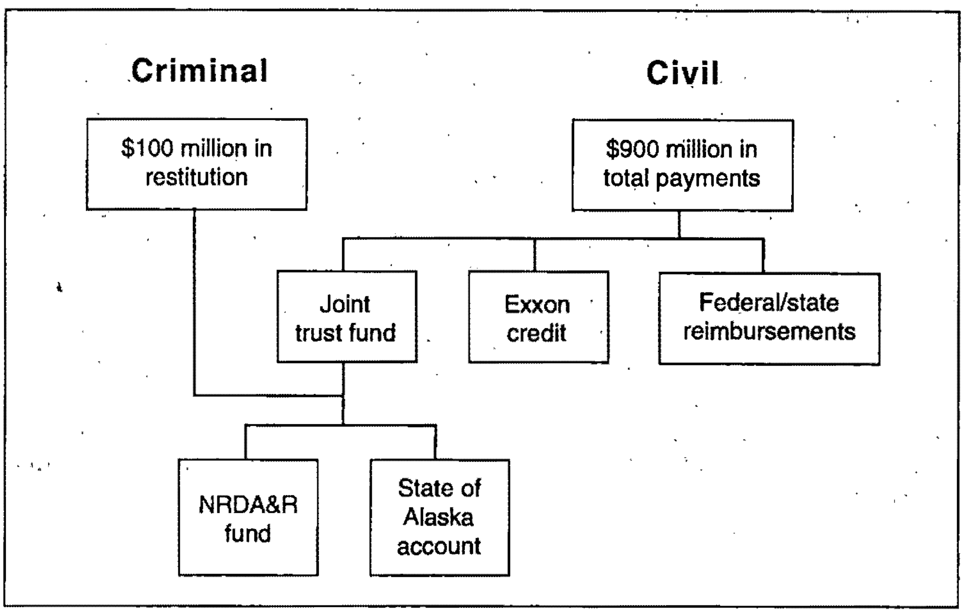
According to Trustee Council members, settlement fund expenditure decisions are made in the following manner. The annual work plan group initially develops a proposed list of damage assessment and restoration projects, including projects proposed by the public. The group then forwards the recommended list of proposed projects to the restoration team. At least five of the six members of the restoration team must approve a proposed project before it is recommended to the Trustee Council. The Trustee Council may also consider projects in addition to those recommended by the restoration team. The chief scientist reviews the proposed projects and provides comments to the Trustee Council. The list of proposed projects is also available for public review and comment. A unanimous vote is required by all six members of the Trustee Council to approve a project's funding. After a project begins, periodic progress reports and a final completion report for the project must be submitted to the chief scientist for review and approval.

SECTION 2

EXXON PAYMENTS AND SETTLEMENT FUND DISTRIBUTIONS

Figure 2.1 shows the flow of dollars resulting from the criminal and civil settlements. As mentioned earlier, Exxon owed $100 million in criminal restitution payments--half to the federal government and half to the state of Alaska. The $50 million payment to the federal government was deposited into the Department of the Interior's Natural Resource Damage Assessment and Restoration (NRDA&R) Fund and the state of Alaska's $50 million was deposited into a state account.

Figure 2.1: Exxon Payments and Settlement Fund Distributions



Exxon's payments from the $900 million civil settlement flow to three areas:

-- reimbursements to federal and state agencies of up to $142 million for past spill-related work,

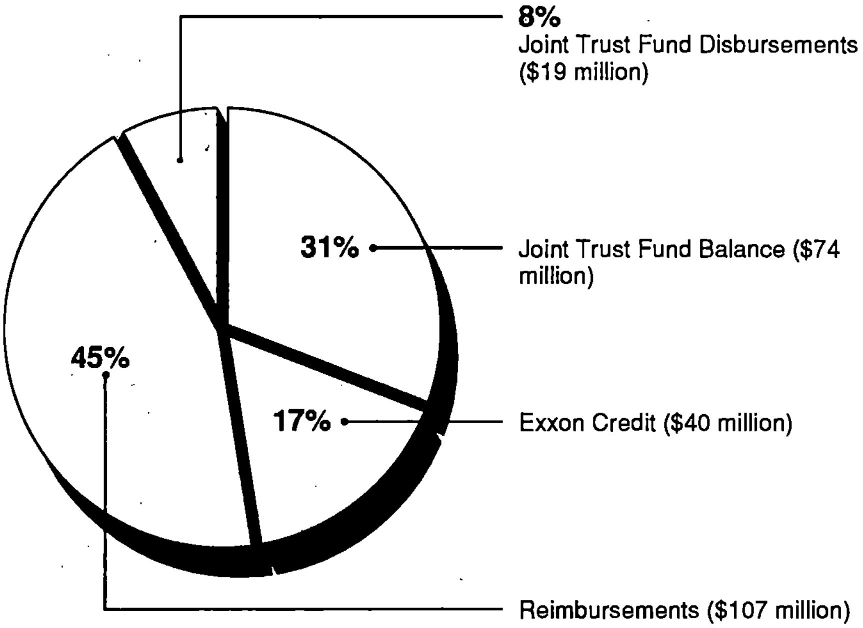
-- a credit of $40 million to Exxon for the reimbursement of certain agreed-upon cleanup work performed at the direction of a federal on-scene coordinator, and

-- deposits of the remaining funds from 11 annual payments from Exxon into the joint federal/state trust fund held in a depository under the jurisdiction of the U.S. District Court.

After the Trustee Council approves damage assessment and restoration projects and the administrative costs of the Trustee Council organization, the U.S. District Court is petitioned to release funds from the joint trust fund to cover these activities. For projects carried out by federal agencies, the funds are transferred from the joint trust fund to the NRDA&R fund. Interior then transfers funds from the NRDA&R fund to the federal agency carrying out the activity. For Alaska agencies' projects, the funds are transferred from the joint trust fund to the state's general fund for subsequent distribution to the various state agencies.

Through December 1992, two civil settlement payments totaling $240 million were made by Exxon. The next Exxon payment, in the amount of $100 million, is scheduled for September 1993. Prior to each of Exxon's annual civil settlement payments, the respective federal and state agencies reach agreement on the amount of the payment that will apply toward reimbursements and the amount that will be deposited into the joint trust fund for activities authorized by the federal and state trustees. Figure 2.2 shows the distribution of the $240 million in Exxon payments through February 1993.

Figure 2.2: Distribution of $240 Million in Exxon Payments Through February 1993



Most of the funds distributed to date have been used to reimburse various government agencies and Exxon for past cleanup costs; some have been used for the Trustee Council's activities such as administration, damage assessment and restoration projects, and restoration planning; and the remainder resides in the joint trust fund. The $40 million Exxon credit was provided for in the settlement. The credit was to reimburse Exxon for expenditures it made for cleanup costs incurred at the direction of a federal on-scene coordinator in early 1991 as well as specified cleanup costs performed at a later date. The Coast Guard performed a financial review of Exxon's claims and allowed the $40 million credit. Additional credits against future Exxon payments may result if federal/state on-scene coordinators direct Exxon to perform additional cleanup work. According to the Trustee Council, cleanup work that met federal and state standards was completed as of August 1992.

Both the Memorandum of Agreement and the civil settlement place a limit of $142 million on the amount of presettlement cleanup and damage assessment costs that can be reimbursed. The limit is divided into maximums of $67 million for federal agencies and $75 million for state agencies. Trustee Council members believe that reimbursements will not exceed the $142 million limit. Through December 1992, approximately $107 million was used to reimburse federal and state agencies for presettlement response, cleanup, and damage assessment costs incurred before January 1991. Certain additional reimbursements, including litigation costs, incurred since then may also be claimed but must be jointly agreed to by the federal and state trustees. Of this $107 million, federal agencies have been reimbursed $49 million and state agencies $58 million. Table 2.1 shows a summary of reimbursements to federal agencies through December 1992. A detailed breakdown of the reimbursements to state agencies was not available at the time of our review.

Table 2.1: Reimbursements to Federal Agencies Through December 1992

Dollars in millions unless otherwise noted

Federal agency	Amount
Department of Army: Corps of Engineers	$5.5
Department of Agriculture: Forest Service	10.4
Department of Commerce: NOAA	11.7
Department of the Interior	10.2
Department of Transportation: Coast Guard Federal Aviation Administration	7.2 [a]
Environmental Protection Agency	4.2
Total[b]	$49.2

[a]Less than $10,000.

[b]Reimbursements do not include about $226,000 in interest paid by Exxon between the scheduled and actual dates of the first payment under the civil settlement. This amount was distributed proportionately among the federal agencies being reimbursed from the first payment.

Of the $240 million paid by Exxon through December 1992, about $93 million was deposited into the joint trust fund to fund activities approved by the Trustee Council. Of this amount, about $19 million was authorized by the Trustee Council to fund damage assessment and restoration projects included in the restoration work plan approved by the Trustee Council for 1992. Table 2.2 shows how these funds were distributed among damage assessment projects, restoration projects, and administration through February 1993. The $19 million was about equally divided between federal and state agencies. On the federal side, the Forest Service received the most funds--about 20 percent--and for the state of Alaska, the Department of Fish and Game received the most--about 40 percent. The balance--about $74 million--remains in the joint trust fund and is earning interest.

Table 2.2: Distribution of Funds From the Joint Trust Fund Through February 1993

Dollars in millions

Category	Amount
Damage assessment	$7.5
Restoration	6.6
Administration	5.1
Total	$19.2

In April 1993, the Trustee Council approved a resolution to draw $21.1 million from the joint trust fund to finance damage assessment projects, restoration projects, the Trustee Council's administrative costs, and other activities included in the 1993 work plan. (See table 2.3.) The 1993 work plan reflects a phasing out of damage assessment studies and an increase in restoration projects. Overall, about 25 percent of the $21.1 million will fund federal agencies' work, and 75 percent will fund state agencies' work.

Table 2.3: Planned 1993 Distribution of Funds From the Joint Trust Fund

Dollars in millions

Category	Amount
Damage assessment	$1.5
Restoration	7.5
Administration	2.8
Other	9.3
Total	$21.1

Note: Distribution of these funds is for the period March 1, 1993, to September 30, 1993.

Included in the $9.3 million "other" category is $1.5 million to fund an archaeological repository on Kodiak Island. The repository will preserve and protect artifacts from about 17 sites on Kodiak Island that were destroyed or discovered as a result of the cleanup following the spill. Also, the Trustee Council approved $7.5 million to be used by the state, along with about $14 million from the state's restitution funds from the criminal settlement and another source of state funds, to purchase 7,500 acres of privately owned land within the boundaries of Kachemak Bay State Park on the Kenai Peninsula across from Homer, Alaska. The purchase is intended to provide additional lands to protect habitat from further degradation and to allow recovery of various species. Following the drawdown to fund the 1993 work plan, a balance of about $52.9 million will remain in the joint trust fund. This balance will increase when Exxon makes its third annual civil settlement payment--in the amount of $100 million--in September 1993. The actual amount to be deposited into the joint trust fund will depend on how much of Exxon's payment is used for reimbursements.

As of June 1993, none of the $100 million in criminal restitution funds had been expended. However, as shown in table 2.4, several projects have been proposed by the federal and state governments. In March 1993, the federal trustees proposed that $25 million be used to acquire private land concentrated within the boundaries of the Chugach National Forest, Kenai Fjords National Park, Kodiak National Wildlife Refuge, and the Maritime Wildlife Refuge Islands. Although the precise use of the remaining $25 million has yet to be determined, agencies are considering the funds for various habitat acquisition, restoration, and monitoring projects.

Table 2.4: Proposed Use of Criminal Restitution Funds

Dollars in millions

Federal share	$50.0
Proposed uses:	
Habitat acquisition	25.0
Other (habitat acquisition, restoration, and monitoring)	25.0
State share	$50.0
Proposed uses:	
Build marine center	12.5
Buy land for habitat protection	7.0
Restore subsistence areas	5.0
Oil spill research programs	5.0
Restore recreation sites	4.8
Enhance hatchery system	4.0
Other smaller projects	11.7

Using its share of the restitution funds, the Alaska state legislature, in May 1993, approved funding for a variety of projects, the larger of which include the following:

-- the design and construction of a recreation and marine mammal rehabilitation center for education and research;

-- the partial funding of the acquisition of private land within the Kachemak Bay State Park to add habitat for recovering wildlife species;

-- the restoration, replacement, or enhancement of subsistence resources or services lost or damaged in rural communities; and

-- the development of research programs directed at the prevention, containment, cleanup, and amelioration of oil spills.

SECTION 3

RESTORATION PLAN AND ANNUAL WORK PLAN ISSUES

We identified several issues relating to the development of the Trustee Council's restoration plan for damaged resources and services and its annual work plans.

RESTORATION PLAN

Table 3.1 shows issues relating to the Trustee Council's development of a restoration plan.

Table 3.1: Issues Related to the Restoration Plan

• No restoration plan in place • Plan scheduled to be issued in December 1993, but issuance date may slip

An approved restoration plan is a key ingredient in the transition from the Trustee Council's role of assessing damage to taking action--as provided for in the August 1991 Memorandum of Agreement--to restore, replace, rehabilitate, enhance, or acquire the equivalent of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources. Moreover, according to the Trustee Council, the restoration plan is a primary means for the public to help the Trustee Council prioritize restoration activities. However, an overall restoration plan is not yet in place to provide direction to restoration planning for Prince William Sound. Restoration planning began in late 1989. In April 1992, a restoration framework document was published that proposed a process to guide the trustees in restoration efforts, discussed possible action alternatives, and invited public comment.

A year later, in April 1993, a brochure providing an advance description of a draft restoration plan was distributed for public comment. Five potential restoration alternatives were presented:

1. Natural recovery: No action.

2. Habitat protection: Over 90 percent of the settlement funds would be used for habitat protection and acquisition. Restoration activities would be limited to the spill area.

3. Limited restoration: About 75 percent of the settlement funds would be used for habitat protection and acquisition. Some effort would be directed at restoring only the most severely injured species with declining populations within the spill area.

4. Moderate restoration: About 50 percent of the settlement funds would be used for habitat protection and acquisition. An additional one-third of the funds would be used to restore all injured species, including those whose populations did not decline and are located outside of the spill area.

5. Comprehensive restoration: About one-third of the settlement funds would be used for habitat protection and acquisition. About one-half of the settlement funds would be used to restore all injured species, including those whose populations did not decline and are located outside of the spill area.

The public was asked to comment on the plan and the five restoration alternatives by August 6, 1993. In addition, the Trustee Council scheduled public meetings in 21 communities throughout the state to solicit input. Trustee Council members told us that about 1,200 responses from the public were received and will be considered in further development of the plan. A draft environmental impact statement analyzing the impacts of the alternatives on the physical, biological, social, and economic aspects of the environment was due to be released for public comment in June 1993, but it had not been released as of the end of July 1993. The final restoration plan is scheduled to be issued in December 1993, but according to Trustee Council members, this too may slip.

ANNUAL WORK PLANS

Table 3.2 shows three issues relating to the Trustee Council's development of annual work plans.

Table 3.2: Issues Related to Annual Work Plans

- Not tied to restoration plan
- Some projects may not be directly linked to the oil spill or appear to duplicate agencies' responsibilities
- Few projects competitively bid

First, the Trustee Council's 1992 and 1993 annual work plans were not linked to an approved restoration plan. About 90 projects totaling nearly $40 million were approved during this time. Although not directly linked to a restoration plan, Trustee Council members have reported that they have strived to work within the restoration framework by approving projects measuring damage or monitoring injured resources that either were time-critical or represented a lost opportunity if not conducted. Some Trustee Council members claimed that if action had been postponed until a restoration plan were developed, work projects would not have been approved until 1995 or 1996. Because of the lead time needed to implement approved work projects, the Trustee Council will approve the 1994 work plan before issuing the final restoration plan. Trustee Council members advised us that the 1994 work plan decisions will be based on a synopsis of public comments related to the restoration plan, scientific data available from past studies, and input from the public and the chief scientist on the merits of the proposed projects.

Second, certain projects either do not appear to be directly linked to the oil spill, as required in the settlement, or appear to duplicate existing responsibilities of federal and state agencies, particularly several sockeye salmon and killer whale projects. According to Trustee Council members, where linkage or contribution of the spill to an injured resource is unclear, Trustee Council members have been inclined to approve data collection projects so that members are put in a better position to evaluate the causes and extent of damage to the resource resulting from the oil spill.

To illustrate, the management of the sockeye salmon fishery has historically been a responsibility of the Alaska Department of Fish and Game, including the development and maintenance of a state plan for the rehabilitation, enhancement, and development of the state's salmon fisheries. One particular problem that the Alaska Department of Fish and Game has been dealing with for several years--both before and after the oil spill--is the overescapement of sockeye salmon into the Kenai River during migration to their spawning areas upstream. Overescapement occurs when too many migrating adult fish reach the spawning areas and produce too many juvenile fish that deplete the available food supplies needed to sustain them until they are ready to migrate downstream and out to sea. The depletion of the food supplies causes reduced growth and high mortality of current and future generations.

The overescapement of sockeye salmon occurred on the Kenai River system in 1987 and 1988--before the oil spill occurred--and again in 1989 when the sockeye salmon fishery was closed because of the presence of oil in the fishing areas from the Exxon Valdez oil spill. Consequently, the problems associated with the overescapement of sockeye salmon entering the Kenai River probably are only partially due to the closure of the salmon fishery following the oil spill. Thus far, the Trustee Council has approved five projects totaling about $3 million to study the Kenai River sockeye salmon fishery. According to Trustee Council officials, although there may not be a direct link between the situation with the sockeye salmon and the oil spill, there is enough of an indirect link to justify the spending of settlement funds to study the problem.

Several killer whale studies also illustrate projects which do not appear to have a direct link to the oil spill or appear to duplicate existing agency responsibilities. Between 1989 and 1992, the Trustee Council approved four studies totaling about $700,000 to examine the mortality rate of the approximately 245 killer whales in Prince William Sound. However, the chief scientist believes that the disappearance of some killer whales has not been convincingly linked to the oil spill. Nevertheless, in 1993, the Trustee Council approved an additional $127,000 to further assess the disappearance of 13 out of a group of 36 killer whales since the oil spill occurred. NOAA's National Marine Mammal Laboratory is responsible for the general monitoring of killer whales off Alaska, and it has been studying these whales for several years both before and after the oil spill. For example, from 1989 through 1993, the laboratory's budget--in addition to the oil spill funds provided through the Trustee Council--for killer whale studies totaled about $665,000. Trustee Council officials stated that the chief scientist is not an expert on all issues and that public comments received on the work plans indicated a very high interest in determining whether the whales' disappearance was linked to the oil spill.

Last, some participants in and observers of the Trustee Council organization believe that the carrying out of damage assessment and restoration work to date has been dominated by federal and state agency personnel and that, as a consequence, few nongovernment organizations have been able to competitively bid for these projects. For example, almost all of the 1992 and 1993 work projects were not open for competitive bid and were carried out by federal and state agency personnel. The Trustee Council's chief scientist believes that open competition would encourage more timely completion of projects at reduced costs. According to Trustee Council members, as more restoration projects are undertaken, less use will be made of federal and state agencies and more projects will be subject to bid proposals from nongovernment sources.

SECTION 4

HABITAT PROTECTION AND ACQUISITION ISSUES

We identified several issues relating to the Trustee Council's activities to protect and acquire habitat to aid in the restoration of the natural resources damaged by the oil spill. These issues are shown in table 4.1.

Table 4.1: Issues Related to Habitat Protection and Acquisition

- Acquisition plan not approved or tied to restoration plan
- Interim criteria used to identify acquisition parcels
  - 42,000 acres identified as imminent threat
  - 338,000 acres identified as opportunity parcels
- Pressure is building for Trustee Council to acquire land and protect habitat
- Much of the remaining $660 million may be used for land purchase

An acquisition plan has neither been approved by the Trustee Council nor tied to an approved restoration plan. The Trustee Council, however, has approved interim evaluation criteria for use by its habitat protection/acquisition work group. Using these criteria, in February 1993 the work group classified 42,000 acres as being "imminently threatened." The group concluded that various parcels of land were significant ecologically and that they were threatened by actions--such as imminent logging--which would significantly lessen the land's ability to provide habitat protection for wildlife species injured by the oil spill. The two top-ranked imminently threatened parcels were 7,500 acres within Kachemak Bay State Park near Homer, Alaska, and 15,000 acres near Seal Bay on Afognak Island north of Kodiak Island. Both of these parcels of land were described in the Trustee Council's ranking analysis as essential habitat sites for injured species, such as bald eagles and marbled murrelet, and were located within the area affected by the oil spill. These wildlife species are considered vulnerable or threatened by human activity. The Trustee Council has approved, subject to appraisal, the purchase of these two parcels--the 7,500 acres of private land in Kachemak Bay State Park for $21.5 million and

42,000 acres (25,000 acres of which are to be donated by the land owner) near Seal Bay, which includes the 15,000 acres classified as imminently threatened, for $38.7 million. The work group classified an additional 338,000 acres as "opportunity-to-buy" parcels--land important as habitat protection, but not imminently threatened.

Public pressure is building for the Trustee Council to acquire more land to protect habitat because many consider land acquisition to be an effective restoration activity. The Trustee Council's habitat protection/acquisition work group received comments from various public interest groups encouraging the Trustee Council to protect habitat. Comments included the following:

-- ". . . habitat acquisition is the most meaningful form of restoration . . . ."

-- ". . . habitat protection is [the] best means of protecting natural and cultural resources . . . ."

-- ". . . the acquisition process [is] taking too much time; no more talk--start using funds to buy land."

With the pressure building for the Trustee Council to approve the acquisition of land to protect habitat, some Trustee Council officials believe that much of the remaining Exxon payments--about $660 million--may be used for land acquisitions rather than for other restoration purposes. The Trustee Council's estimate of the cost to acquire parcels of land classified as "imminently threatened" and "opportunity to buy," and additional parcels of land that may eventually be classified as such, runs as high as $3 billion. Because Exxon's settlement payments will continue until 2001, it appears that difficult land acquisition choices will have to be made throughout the period.

SECTION 5

TRUSTEE COUNCIL ORGANIZATION AND ADMINISTRATION ISSUES

We identified several issues relating to the Trustee Council organization and its day-to-day administration.

TRUSTEE COUNCIL ORGANIZATION

Table 5.1 shows four issues relating to the Trustee Council organization.

Table 5.1: Issues Related to the Trustee Council Organization

- Agencies propose, review, approve, and carry out projects
- No executive director to lead efforts
- Meaningful public participation and independent scientific viewpoints not always sought
- Financial audits and program reviews not conducted

First, the current makeup and process of the Trustee Council organization leads many to view the objectivity of the organization with some skepticism. The federal and state agencies that propose damage assessment and restoration projects are the same agencies that review, approve, and carry out the projects. This organization has the same general makeup as the presettlement organization responsible for measuring the nature and extent of the injuries, losses, and destruction of resources as part of the litigation process leading up to criminal and civil law suits against Exxon. Trustee Council members believe the organization has provided the best source of expertise for cleanup and damage assessment, and foresee a gradual lessening of dependence on federal and state agency personnel to conduct projects as damage assessment is completed and the restoration plan is implemented.

Second, no executive director or chief executive officer is in place to lead and direct day-to-day operations. The Trustee Council currently employs an interim administrative director who mainly functions as a coordinator of Trustee Council organization activities. In March 1993, the Trustee Council advertised nationally for an executive director position. Eighty-eight applications were received, and the Trustee Council is in the process of selecting a director, who it hopes will be in place by the fall of 1993.

Third, some participants in and observers of the Trustee Council organization have faulted the state and federal agencies represented on the Trustee Council for not seeking meaningful public participation or independent scientific viewpoints in deciding which studies and restoration activities should be undertaken. To date, expert assessments of the merits of various proposed projects have been predominantly those of the chief scientist, who is under contract to the Trustee Council, or the agencies' personnel proposing the projects. In 1992, many of the 58 approved projects in the 1992 work plan were started and partially funded before the public review process was completed. Although the Trustee Council members pointed out that all of the Trustee Council's meetings have been open to the public and public comment is encouraged on issues facing the Trustee Council, the time available to both solicit and analyze the comments is generally insufficient, according to critics. A review of some of the transcripts of the Trustee Council's meetings indicates that the public would like more time to review and comment on the draft plans being considered by the Trustee Council. Because of the importance placed upon the public's views, the Trustee Council has held numerous public meetings separate from the Trustee Council's meetings and has made available to the public, for review and comment, transcripts of Trustee Council meetings as well as drafts of annual work plans and restoration plans. In addition, the Trustee Council has established a 17-member public advisory group to facilitate the gathering of the views of various interest groups throughout Alaska. This group has met five times since its establishment and is in the process of developing and clarifying its role.

And fourth, although almost $150 million either has been used to reimburse federal and state agencies for presettlement response, cleanup, and damage assessment costs or has been approved to fund Trustee Council activities, no financial audits or program reviews have been conducted to ensure the propriety of reimbursements and subsequent expenditures of civil settlement funds. Furthermore, at the time of our review, there were no federal or state plans to conduct such audits or reviews of past or future expenditures, in spite of their magnitude.

TRUSTEE COUNCIL'S ADMINISTRATION

Table 5.2 shows three issues relating to the Trustee Council's day-to-day administration.

Table 5.2: Issues Related to the Trustee Council's Administration

• Few project reports approved by the chief scientist
• Some planning meetings lacked procedures and focus
• High travel costs incurred (Juneau/Anchorage)

First, only 8 of about 91 scheduled project reports have been approved by the Trustee Council's chief scientist. Many reports have been returned by the chief scientist to the projects' principal investigators for needed revision because of his belief that they were poorly organized and contained unclear messages, incomplete analyses, overreaching conclusions, and imbalanced presentations. For example, the chief scientist returned for revision 10 of the 20 reports due in 1992. Of the remaining 10, 4 were approved, 3 were still under review, and 3 had not been received for review by the chief scientist as of May 1993. Because of these types of delays, the Trustee Council is forced to make decisions on follow-on projects without the knowledge of the final conclusions of earlier, related studies. Trustee Council members stated that they are aware of reporting problems and that they would like reports to be (1) completed on time and (2) of acceptable quality. We were told that the Trustee Council has directed that all project reports be submitted before the Trustee Council deliberates the 1994 annual work plan this fall.

Second, although the restoration team and the work groups have held frequent meetings to develop proposed plans and approaches that need to be acted upon by the Trustee Council, the work groups did not have final operating procedures until November 1992. Many products resulting from this process have been late, required substantial rework, and have not reflected the consensus of the restoration team. This, in turn, often caused the public to comment on plans and the Trustee Council to make decisions without sufficient time to thoroughly review the plans and supporting material.

And third, many of the federal and state officials on the Trustee Council's restoration team and various work groups live in Juneau but must travel to Anchorage to attend frequent work sessions and meetings. This travel increases administrative costs for the Trustee Council organization. For example, the round-trip airfare between Juneau and Anchorage is about $450.

Trustee Council members anticipate that travel costs will diminish in the future as the restoration plan is implemented and the number of restoration team and various work group meetings is reduced.

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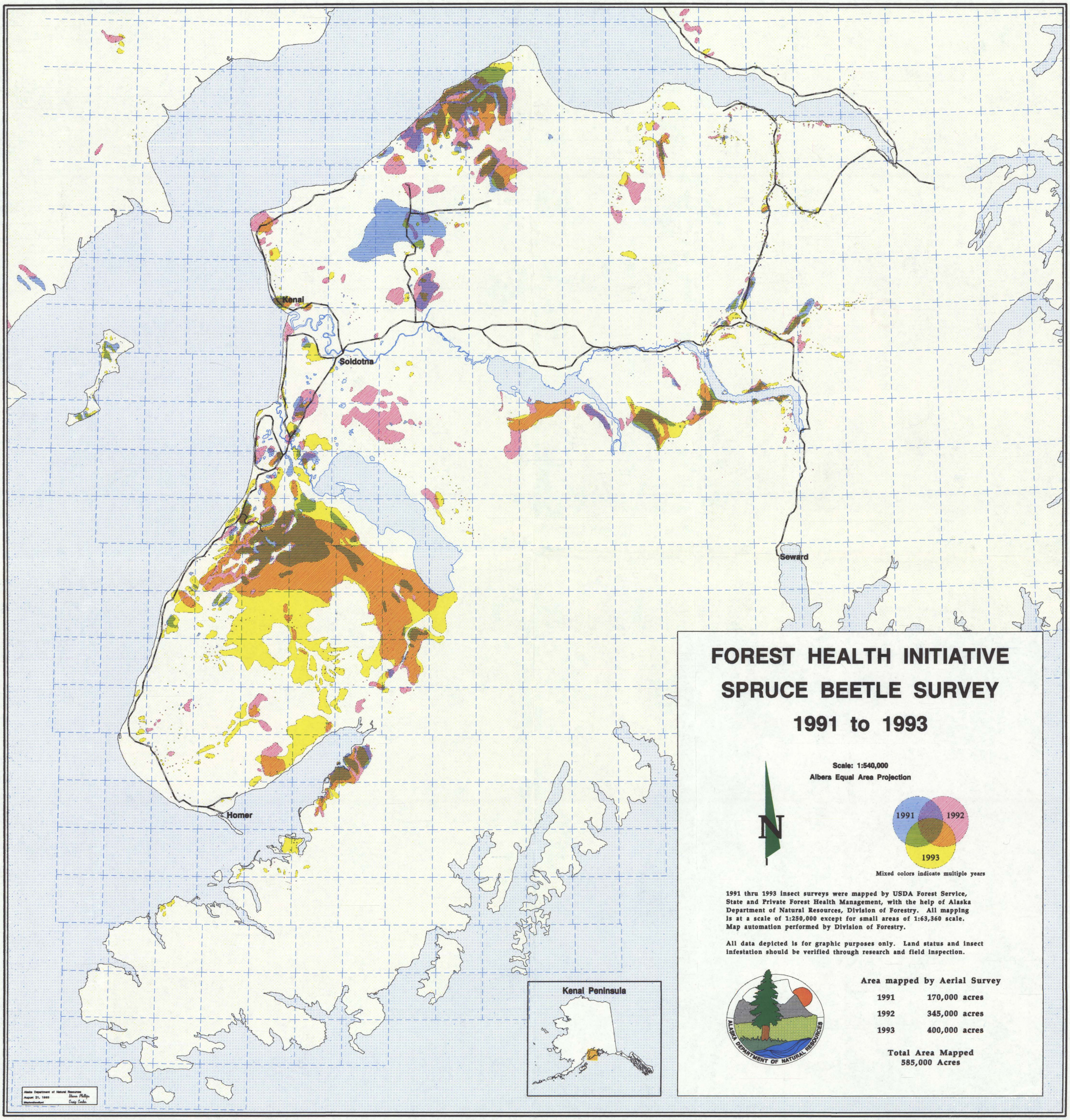
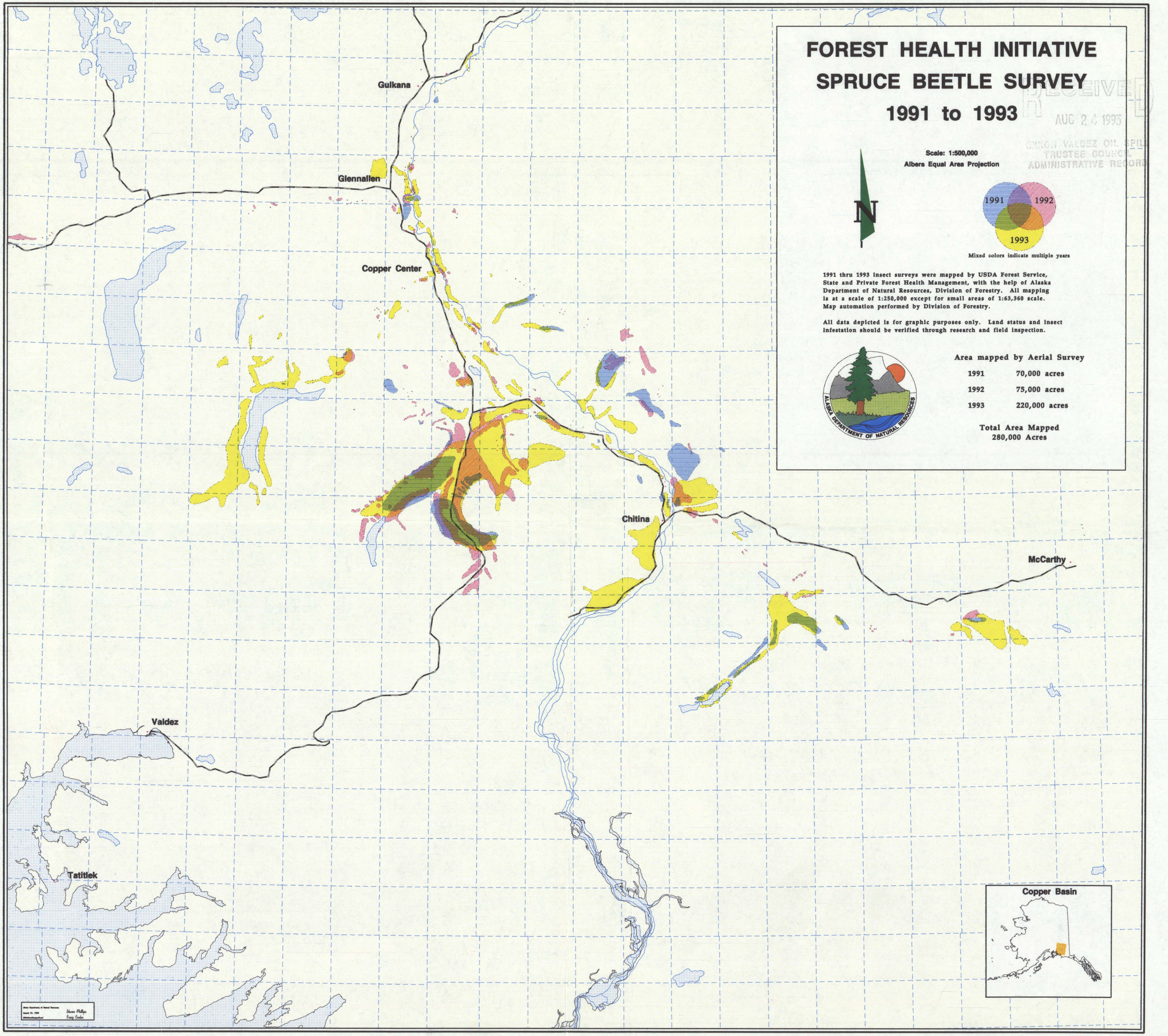

FOREST HEALTH INITIATIVE
SPRUCE BEETLE SURVEY
1991 to 1993
Scale: 1:540,000
Albers Equal Area Projection
N
1991
1992
1993
Mixed colors indicate multiple years
1991 thru 1993 insect surveys were mapped by USDA Forest Service, State and Private Forest Health Management, with the help of Alaska Department of Natural Resources, Division of Forestry. All mapping is at a scale of 1:250,000 except for small areas of 1:63,360 scale. Map automation performed by Division of Forestry.
All data depicted is for graphic purposes only. Land status and insect infestation should be verified through research and field inspection.
Area mapped by Aerial Survey
1991 170,000 acres
1992 345,000 acres
1993 400,000 acres
Total Area Mapped
585,000 Acres
ALASKA DEPARTMENT OF NATURAL RESOURCES
Kenai Peninsula
Kenai
Soldotna
Seward
Homer
Alaska Department of Natural Resources
August 21, 1993


FOREST HEALTH INITIATIVE
SPRUCE BEETLE SURVEY
1991 to 1993
Scale: 1:500,000
Albers Equal Area Projection
N
1991
1992
1993
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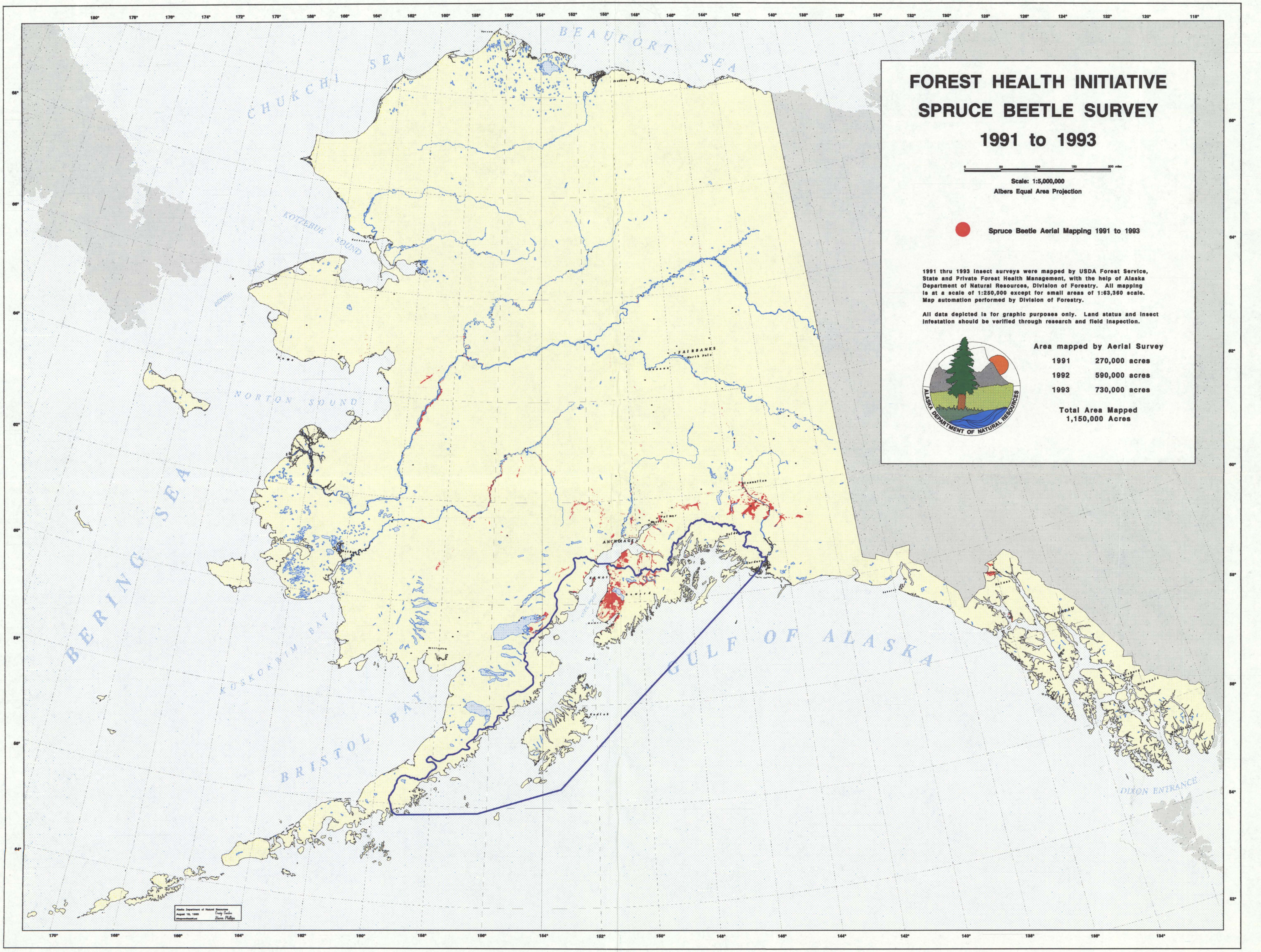
All data depicted is for graphic purposes only. Land status and insect infestation should be verified through research and field inspection.
ALASKA DEPARTMENT OF NATURAL RESOURCES
Area mapped by Aerial Survey
1991 70,000 acres
1992 75,000 acres
1993 220,000 acres
Total Area Mapped
280,000 Acres
Gulkana
Glennallen
Copper Center
Chitina
McCarthy
Valdez
Tatitlek
Copper Basin


FOREST HEALTH INITIATIVE
SPRUCE BEETLE SURVEY
1991 to 1993
0 50 100 150 200 miles
Scale: 1:5,000,000
Albers Equal Area Projection
Spruce Beetle Aerial Mapping 1991 to 1993
1991 thru 1993 insect surveys were mapped by USDA Forest Service, State and Private Forest Health Management, with the help of Alaska Department of Natural Resources, Division of Forestry. All mapping is at a scale of 1:250,000 except for small areas of 1:63,360 scale. Map automation performed by Division of Forestry.
All data depicted is for graphic purposes only. Land status and insect infestation should be verified through research and field inspection.
ALASKA DEPARTMENT OF NATURAL RESOURCES
Area mapped by Aerial Survey
1991 270,000 acres
1992 590,000 acres
1993 730,000 acres
Total Area Mapped
1,150,000 Acres
BEAUFORT SEA
CHUKCHI SEA
KOTZEBUE SOUND
NORTON SOUND
BERING SEA
KUSKOKWIM BAY
BRISTOL BAY
GULF OF ALASKA
DIXON ENTRANCE
FAIRBANKS
ANCHORAGE

11.4.8

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EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL
ADMINISTRATIVE RECORD

FOREST HEALTH

Alaska Department of
NATURAL
RESOURCES

11.4.8 I

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Spruce Beetle Leaflet #127 (USDA/Forest Service)

Forest Insect
& Disease
Leaflet 127

U.S. Department
of Agriculture
Forest Service

The Spruce Beetle

Edward H. Holsten,[1] R.W. Thier,[2] and J.M. Schmid[3]

Figure 1—*Yellowish orange and reddish colors in the tops of trees are evidence of spruce beetle infestation in Arizona.*

The spruce beetle, *Dendroctonus rufipennis* (Kirby), is the most significant natural mortality agent of mature spruce. Outbreaks of this beetle have caused extensive spruce mortality from Alaska to Arizona and have occurred in every forest with substantial spruce stands. Spruce beetle damage results in the loss of 333 to 500 million board feet of spruce sawtimber annually. In the past 25 years, outbreaks have resulted in estimated losses of more than 25 million board feet in Montana, 31 million in Idaho, over 100 million in Arizona, 2 billion in Alaska, and 3 billion in British Columbia (fig. 1).

Spruce beetle outbreaks cause extensive tree mortality and modify stand structure by reducing the aver-

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age tree diameter, height, and stand density, leaving small, slow-growing trees and intermediate-sized trees to become dominant.

As mature spruce are killed, forage may increase, benefiting some wildlife species. But species that depend on the mature spruce for habitat may be adversely affected.

Indirectly, extensive spruce mortality can also affect water yields and result in water gains in rivers, lakes, and streams because of reduced transpiration from dead and dying trees.

Hosts

The spruce beetle infests all species of spruce within its geographical range (fig. 2). The more important commercial tree species attacked include white, Lutz, Sitka, and Engelmann spruce.

Evidence of Infestation

On standing trees, the first sign of spruce beetle infestation is reddish-brown boring dust accumulating at the beetle's entrance holes, in bark crevices, and on the ground around the trunk of infested trees. Masses of pitch may accumulate around the en-

Figure 2—*The geographic range of the spruce beetle.*

trance sites. These signs are most visible the summer following infestation and become less noticeable months later.

On windthrown trees and logging residuals, spruce beetle attacks are readily detected on the lower surfaces of the material and should not be confused with *Ips* beetle attacks more commonly found on the upper surfaces.

Some standing trees may be attacked on only one side of the bole, creating a "strip attack." The infested area may die, but the tree usually remains alive, so the foliage does not discolor. Trees with "strip attacks" frequently are infested by subsequent spruce beetle generations and may host two or more generations simultaneously.

During the first fall and winter following spruce beetle infestation, one should look for trees "debarked" by woodpeckers (fig. 3). Partially debarked, green trees are easily noticed. However, on trees without significant debarking, one must be relatively close to see sawdust in bark crevices and around the tree base.

The needles of infested trees do not usually fade or discolor within the first year following attack. However, during the second summer following attack most needles turn yellowish. Some needles even remain green until the third summer, or up to 2 years after the initial infestation. The needles on separate branches of the same tree discolor at different times. Needles are removed periodically from the trees by wind or thunderstorms, leaving the upper crowns of exposed twigs with a yellowish-orange to reddish hue.

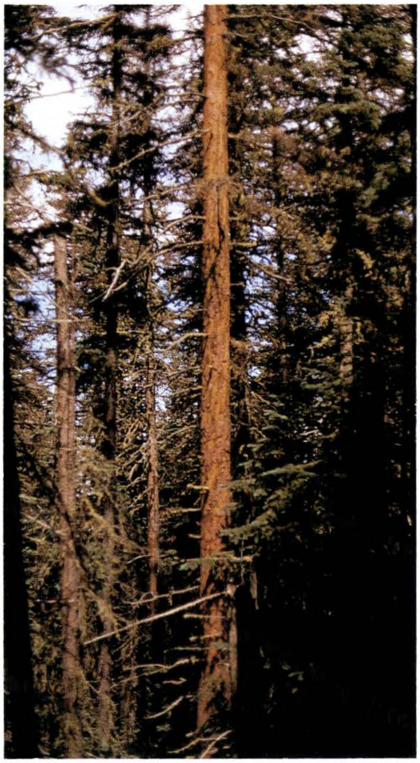

Figure 3—*Infested spruce debarked by woodpeckers.*

Identification of the Life Stages

Adult beetles are blackish brown to black with reddish-brown or black wing covers. The beetles are cylindrical, approximately 1/4 inch (6 mm) long and 1/8 inch (3 mm) wide (fig. 4).

Spruce beetles look similar to other *Dendroctonus* beetles and, if no host material is present, can be distinguished from them only by microscopic examination. At first glance, spruce beetles may also be confused with *Ips* beetles in spruce. It is important to remember that the posterior margins of the wing covers on spruce beetles are evenly rounded, while *Ips* beetles have wing covers with concave margins and teethlike projections.

Figure 4—*An adult spruce beetle.*

The eggs of the spruce beetle are oblong, pearly white, and 1/16-inch (1.5 mm) long. The larvae are stout, cylindrical, legless grubs that pass through 4 larval stages (instars) and reach a length of 1/4 inch (6 mm) at maturity (fig. 5). The pupae are opaque white, inactive, and somewhat similar in size and shape to adults.

Life Cycle

Spruce beetles may complete their life cycle in 1 year on warm sites at lower elevations or take up to 3 years on cool, well-shaded locations on north slopes.

However, it generally requires 2 years for the spruce beetle to complete its life cycle. Adults may emerge any time from May to October, depending on temperature. The beetles attack host material soon after emerging. Adults that appear in August to October may represent a reemergence of parent adults or a movement of maturing brood adults to hibernation sites.

Figure 5—*Spruce beetle larvae.*

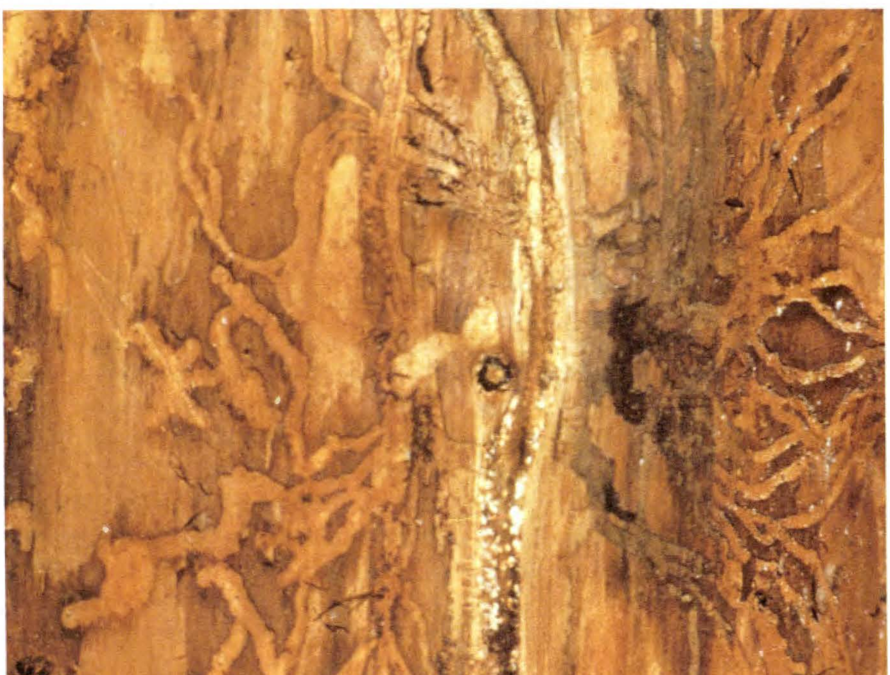

Figure 6—*Spruce beetle egg gallery and larval mines.*

To deposit eggs, female beetles bore through the outer bark of the host tree and create egg galleries in the underlying phloem tissue. Eggs are laid on either side of the egg gallery (fig. 6). Egg galleries are slightly wider than the beetle and, except for the terminal portion, are packed with frass and boring dust. Egg gallery length ranges from about 2.5 to 12 inches (6 to 30 cm). Eggs are usually deposited in short rows along alternate sides of the gallery in numbers ranging from 4 to 14 eggs per centimeter of gallery.

Most of the eggs hatch by August. The larvae bore outward from the egg gallery and feed as a group for the first and second instars. Third and fourth instars construct individual feeding galleries. The larval stage predominates during the first winter, although adults and eggs may also be present. During the 2-year life cycle, most larvae pupate approximately 1 year after attack. Pupation lasts 10 to 15 days and usually takes place in pupal chambers at the end of the larval galleries.

During the second winter of the 2-year cycle in standing trees, some beetles overwinter in their pupal sites. Other beetles—from 5 to 88 percent—emerge, move to the base of the tree, and bore into the bark near the litter line to hibernate. In windthrown trees, most adults overwinter in place. Approximately 2 years after attack, adults emerge from overwintering sites and attack new host material.

Stand Conditions Conducive to Infestations

Endemic spruce beetle populations usually live in windthrown trees (fig. 7). When beetle populations increase to high levels in downed trees, beetles may enter susceptible, large-diameter, standing timber. Most outbreaks in standing timber originate in windthrown trees.

In mature stands, large-diameter trees ($\geq 18''$) usually are attacked first, an obvious characteristic denoting susceptibility to spruce beetle attack. If an infestation persists in a stand, smaller diameter trees are attacked. Recent evidence from Alaska indicates that tree diameter is important in determining susceptibility only when coupled with less-than-average radial growth in the preceding 5 years. The proximity of uninfested standing spruce trees to infested hosts also denotes vulnerability to attack.

In the Rocky Mountain area, susceptibility of a stand to spruce beetle attack is based on the physiographic location, tree diameter, basal area, and percentage of spruce in the canopy. Spruce stands are highly susceptible if they grow on well-drained sites in creek bottoms, have an average diameter (d.b.h.) of 16 inches or more, have a basal area greater than 150 square feet per acre, and have more than 65 percent spruce in the canopy.

In Alaska, the susceptibility of a spruce stand is based on average tree

Figure 7—*Windthrown trees and logging residuals—prime habitat for beetle populations.*

diameter, age of the stand, condition of the stand, and proportion of white spruce in the canopy. A spruce stand of old-growth or damaged sawtimber is very susceptible to spruce beetle attack if the larger diameter spruce trees have a slower-than-average growth rate, have an average diameter (d.b.h.) greater than 12 inches, and if the stand has more than 70 percent white spruce.

Susceptibility of a spruce stand to spruce beetle attack in British Columbia and the Northeastern United States is based on criteria similar to that used in the Rocky Mountains and Alaska.

Hazard rating systems based on the stand and site conditions discussed above have been developed so that managers can identify stand susceptibility to spruce beetle attack.

Management Strategies

Forest managers can develop various strategies to avoid or reduce resource losses to spruce beetles. Before developing a strategy, the forest manager must evaluate the resource values and economics of management actions for each stand in light of management objectives. The beetle population level must also be considered because population levels will determine the priority of management actions and the type of strategy to be invoked.

The primary strategy should be silvicultural treatments of potentially susceptible stands in order to maintain their health with a moderate growth rate. The first step in this strategy is to hazard-rate spruce stands, which will indicate the most susceptible stands. The stands can then be treated with harvesting directed at the most susceptible stands. Infested logging residuals need never become a significant contributor to spruce beetle populations if stump height is kept below 18 inches (45 cm) and cull logs and tops are limbed, cut into short lengths, and left unshaded, unpiled, and exposed to sunlight. Silvicultural treatments have greater long-term effectiveness, because these treatments modify stand conditions.

The primary strategy assumes, in general, beetle populations are not immediately threatening resource values. If beetle populations are threatening, then strategies involving suppression methods are more appropriate. Suppression methods including silvicultural, physical, and chemical measures are available to forest managers for reducing spruce beetle populations. Some methods are suitable only for populations in windthrown host material; other methods are better suited for infestations in standing trees. Most suppression methods are short-term responses to existing beetle populations and, therefore, correct only the immediate situation.

Figure 8—*Green trees felled to capture emerging spruce beetles.*

Silvicultural Methods:

- *Sanitation overstory removal* involves the removal of all infested and susceptible spruce to encourage regeneration of a new vigorous stand.

- *Sanitation partial* cut involves the removal of infested and susceptible spruce to improve the growth of the residual stand. Sanitation partial cut removes most of the larger trees but may leave a residual stand that is below the recommended level of basal area. This residual stand may be more susceptible to windthrow.

- *Trap trees* are green trees with a diameter greater than 18 inches (d.b.h.) that are felled before beetle flight. Trap trees can absorb up to 10 times the number of spruce beetles that a standing tree will absorb. Once infested, trap trees should be removed from the forest.

Trap trees shaded from direct sunlight attract the most beetles. Spruce beetles attack cool, shaded portions of the trap tree boles (fig. 8). Felled trees should not be delimbed because limbs on the upper side of the bole provide shade while limbs on the underside permit the beetles to colonize the underside of the bole by keeping it off the ground.

Past ratios of trap trees to infested standing trees have ranged from 1:2 to 1:10. Current ratios vary with the size of the green trees to be felled as traps, with the number and size of infested trees in a stand, and with the existing beetle population.

- *Lethal trap trees* are green trees injected with a silvicide and felled before beetle flight. They are effective in areas where traps cannot be removed.

Physical Methods:

- *Solar heat* involves exposing infested logging residuals or windthrow to direct sunlight to kill inhabiting larvae. To maximize brood mortality, residuals should be cut into 5-foot lengths. All branches and debris shading the host material should be removed. The infested material should be rotated at 2-week intervals during the summer to expose all surfaces. While using solar heat is effective in the Rocky Mountains, it is not effective in Alaska, because summer temperatures are not warm enough.

- *Fire* involves piling and burning infested logging residuals and windthrow to destroy inhabiting broods. The infested material is usually green and difficult to burn, but only the bark has to be scorched to destroy the inhabiting brood.

Chemical Methods:

- ***Pheromones*** are chemical substances that influence insect behavior. Synthetic aggregating and anti-aggregating pheromones increase the attractiveness of trap trees, attract beetles into the trees to be cut, or discourage infestation of high-value trees. Aggregating pheromones are most efficient when used with trap trees. Methylcyclohexenone (MCH), an anti-aggregating pheromone, shows promise in discouraging spruce beetles from attacking trees; however, it has not yet been registered by the U.S. Environmental Protection Agency (EPA).
- ***Insecticides***, such as Lindane and carbaryl, can be applied to the boles of uninfested trees to kill attacking adults. In Alaska, carbaryl applied as a 2-percent spray has provided 100-percent protection from attacking beetles for at least 2 years. Cacodylic acid and MSMA (monosodium methanearsonate) are silvicides that can be injected into standing trees, which become lethal trap trees when they are felled.

Assistance

More information about the management of the spruce beetle may be obtained from the State Forester's office or the U.S. Department of Agriculture, Forest Service, Forest Pest Management.

The publications listed in the references provide more information on the biology, ecology, and management of the spruce beetle.

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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

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Alaska
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R10-TP-32

Forest Health Management Report

Forest Insect and Disease Conditions in Alaska - 1992

FOREST INSECT AND DISEASE CONDITIONS IN ALASKA -- 1992

General Technical Report R10-TP-32

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FOREST INSECT AND DISEASE CONDITIONS IN ALASKA - 1992

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FOREST INSECT AND DISEASE CONDITIONS IN ALASKA - 1992

CONDITIONS IN BRIEF

Forest insect and disease populations and related damage increased throughout Alaskan forests in 1992. This was the fourth consecutive year with warm dry weather in spring and early summer, which allowed insect populations to explode, especially in South-Central and Interior Alaska. Spruce bark beetle activity increased for the fourth consecutive year. New and ongoing infestations of spruce bark beetle, as determined by 1992 aerial surveys, now affect more than 600,000 acres. This is the greatest known acreage affected by spruce bark beetle in Alaska. Increased bark beetle activity occurred in the Copper River area near Chitina; the Clam Gulch-Tustumena Lake areas on the Kenai Peninsula, and portions of the west side of Cook Inlet near the Skwentna River. The Yukon River outbreak decreased significantly in 1992. Spruce bark beetle levels increased in Sitka spruce stands along Turnagain Arm; 585 acres of infested spruce were detected from Ingrahm Creek to Hope. This increase is of concern as this is the first increase recorded in this area.

Hardwood defoliator activity increased for the third consecutive year throughout most of south-central and interior Alaska with willow defoliation accounting for the majority of the increase. Assorted leaf miners, noctuid, and rusty-tussock moth larvae were responsible for the defoliation of more than 150,000 acres of willow. Spruce budworm populations exploded near Fairbanks and Delta Junction and along the Yukon River in interior Alaska where more than 160,000 acres of white spruce were defoliated. Black-headed budworm defoliation in Prince William Sound decreased in 1992. However, black-headed budworm populations increased for the first time along Turnagain Arm in the Portage/Turnagain Pass areas.

In southeast Alaska, three different defoliating insects caused substantial defoliation of western hemlock and Sitka spruce. The black-headed budworm, spruce needle aphid and hemlock sawfly caused notable defoliation at various locations across southeast Alaska. Black-headed budworm defoliated over 87,000 acres of mature western hemlock and Sitka spruce in areas located primarily north of Frederick Sound. Budworm defoliation of this magnitude has not been noted in southeast Alaska since the early 1960's. Spruce needle aphid defoliated approximately 25,000 acres of Sitka spruce and caused significant damage to ornamental spruce in several communities. Hemlock sawflies defoliated approximately 6500 acres of mature western hemlock on Prince of Wales Island and within Misty Fjords National Monument. Spruce budworm caused heavy defoliation of Sitka spruce and western hemlock for the third consecutive year along the Chilkat River near Haines. Spruce beetle activity increased slightly within Glacier Bay National Park and increased substantially on state lands near Haines. Spruce beetle activity in these two areas now encompasses approximately 25,000 acres.

The most significant diseases of Alaskan forests are those that persist chronically on sites from year-to-year: yellow cedar decline, wood decay of live trees, and hemlock dwarf mistletoe. More than 526,000 acres of cedar decline occur in Southeast Alaska in a broad band from western Chichagof Island through the Ketchikan area (Appendix A). Heartrot and buttrot fungi caused significant cull in all tree species in Alaska. Hemlock dwarf mistletoe continued to cause growth loss and mortality in old-growth forests of Southeast Alaska; its impact in young-growth stands appears to depend on the presence of large infected residuals left after harvesting of the previous stands. An outbreak of hemlock canker, caused by the fungus *Xenomeris abietis* and possibly aggravated by dust, killed small hemlocks and the lower branches of large hemlock trees along more than 60 miles of unpaved roads on Prince of Wales Island for the third consecutive year. The disease also developed for the first recorded time along roads near Rowan Bay on Kuiu Island, Corner Bay on Chichagof Island, and Caroll Inlet on Revillagigedo Island. Spruce needle rust was present at relatively high levels throughout Alaska, but most other foliar pathogens occurred at low to moderate levels in 1992. *Rhizosphaera* needle cast, however, was quite visible on Sitka spruce throughout the Girdwood, Twenty-mile, and Portage Valleys south of Anchorage. Porcupines continued to damage spruce and hemlock in valuable young-growth stands in southeast Alaska. Decay, canker, and foliar fungi caused a large, but unmeasured damage to hardwood species in interior Alaska.

Table 1 summarizes insect and disease activity by land ownership.

Table 1. 1992 Forest insect and disease infestation in Alaska by land ownership and pest.[a]

Pest	National Forest	Other Federal	Native	State & Private
	Acres			
Spruce beetle	28,816	225,343	118,794	231,856
Larch Beetle	-----	2,000	-----	----
Engravers	182	----	1,237	811
Spruce budworm	----	----	47,089	133,430
Black-headed budworm	70,431	4,826	5,137	15,879
Hemlock sawfly	6,539	----	----	----
Spruce needle aphid	14,945	778	2,180	7,317
Large aspen tortrix	----	935	2,510	16,076
Birch defoliation	----	----	----	1,713
Cottonwood defoliation	5,060	934	----	311
Willow defoliation	1,090	55,712	39,621	57,256
Yellow-cedar decline[b]	541,349	-----	17,667	10,430
Totals	668,412	290,528	234,235	475,079
GRAND TOTAL	1,668,254 acres			

[a]Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) because these losses are not detectable in aerial surveys.

[b] Value of yellow-cedar decline is not restricted to the acreage with a high concentrations of dying trees for this year; it represents stands that generally have long-dead trees, recently-dead trees, dying trees, and some healthy trees. See Appendix for a detailed listing by island and Ranger District.

Figure 1. Heavy mortality of Lutz spruce (>50 killed trees/acre) caused by spruce bark beetle on the Kenai Peninsula.

Figure 2. Black-headed budworm defoliation of mature Sitka spruce and western hemlock, Lemon Creek drainage, Juneau, AK.

Figure 3. Willow defoliation, Nushagak River, Alaska.

Figure 4. Dwarf mistletoe on western hemlock on Etolin Island in southeast Alaska.

STATUS OF INSECTS

SPRUCE BEETLE
Dendroctonus rufipennis Kirby

Alaska spruce bark beetle populations increased dramatically for the third consecutive year in 1992. Newly detected infestations as well as active on-going infestations now cover more than 600,000 acres of Alaska's spruce forests. This is an increase of more than 200,000 acres over levels infested in 1991. More than 90% of spruce bark beetle activity is occurring in the Lutz and white spruce stands of south-central and interior Alaska. Unusually warm spring and early summer weather conditions throughout south-central and interior Alaska for four consecutive years have helped increase bark beetle populations by decreasing spruce beetle developmental times from two to one year. Likewise, warm dry spring and summer weather conditions may have increased spruce susceptibility to spruce beetle attack by decreasing host defense mechanisms; mainly resin exudation.

White, Lutz, and Sitka spruce mortality continues on 28,658 acres of the Chugach National Forest and is an increase (9,000 ac.) over the acreage infested in 1991. The majority of the spruce beetle activity on the Chugach National Forest is located from the Russian Lakes (5,000 ac.) to and along the Sterling Highway between Broadview Guard Station and Gwin's Lodge near Summit Lake (2,024 ac.). Likewise, spruce bark beetle activity has increased near Hope on the Kenai Peninsula where more than 1,000 acres of maritime Sitka spruce have been infested. Spruce beetle activity has increased for the second year on State and private lands near Moose Pass; 5,527 acres of spruce were infested along the north shore of Upper Trail Lake.

Spruce beetle activity increased dramatically further south on the Kenai Peninsula on Kenai National Wildlife Refuge lands and adjoining State and private lands. Spruce bark beetle activity was detected on more than 300,000 acres from Pt. Possession in the northern Kenai Peninsula to Kachemak Bay to the south. This represents a substantial increase over levels (187,842 acres) detected in 1991. It appears that most forested areas of the Kenai Peninsula are experiencing increased spruce beetle activity especially in the Lutz spruce forests north of Homer. For example, 184,799 acres of infested Lutz spruce were detected this year from Skilak Lake south to Ninilchick, from Cook Inlet east to the Harding Ice Field vs. 101,543 acres detected in 1991 vs. 39,033 acres detected in 1990 in the same areas. With respect to the Kachemak Bay area, there appears to be a slight increase in spruce beetle activity over levels detected in 1991: 12,454 acres vs. 6,820 acres. The majority of this increase has occurred in the Aurora Spit (10,975 ac.) and Halibut Cove (1,245 ac.) areas.

Spruce beetle activity on the west side of Cook Inlet decreased by half in 1992; approximately 17,000 acres of infested spruce were aerially detected. Areas of significant spruce beetle activity include: Beluga Lake to the Skwentna River (2,958 ac.); the

Skwentna River, from Shell Lake to its headwaters (10,976 ac.); and along the McArthur River (1,168 ac.)

Spruce beetle levels increased in the Sitka spruce stands along Turnagain Arm; 585 acres of infested spruce were detected from Ingrahm Creek to Hope. Spruce beetle populations showed a slight increase in the Indian Creek Valley where 35 acres of scattered tree mortality were observed. This increase in beetle activity in spruce stands bordering Turnagain Arm is of concern as this is the first increase recorded in this area. The Turnagain Arm area is extremely important for its aesthetic values. The Seward Highway National Scenic By-Way passes through this area. Spruce beetle activity will be carefully monitored in subsequent years.

Bark beetle activity in the Anchorage Bowl area, however, did not increase over 1991 levels of approximately 2,000 acres. The largest area of spruce beetle activity (1,335 acres) was once again in the Potter/Rabbit Creek areas of the Hillside. Small, isolated pockets of spruce beetle activity were also detected on Fire Island (415 ac.) and throughout the lower Hillside area.

Further north, spruce beetle activity was apparent from Ship Creek to Eagle River along the Chugach Mountains (1,070 ac.); 2,335 acres throughout the Ship Creek drainage; and 780 acres of scattered spruce beetle caused tree mortality in the Eagle River valley. Likewise, scattered spruce beetle activity was noted along the Richardson Highway from Palmer to Kings Mountain (545 ac.) and from Sutton to Sheep Mountain Lodge (5,994 ac.). Spruce bark beetle activity continues further west near Lake Clark and Lake Iliamna. 11,241 ac. of scattered infested spruce were detected along the entire east end of Lake Iliamna. Another 2,335 acres of scattered spruce beetle infested trees were detected on the south-west side of Lake Clark Pass.

Spruce bark beetle activity in the Tiekel River area and north and east to Gulkana and McCarthy was high for the second consecutive year; more than 77,426 acres of infested spruce were aerially detected. The areas of heaviest and most intensive spruce beetle activity include: 59,706 acres from Copper Center to the Tiekel River, west of the Copper River; 10,431 acres along the east side of the Copper River from Copper Center to Chitina and 5,343 acres scattered around Gulkana/Glennallen areas. This current spruce beetle activity has the potential of becoming one of Alaska's largest infestations.

Spruce beetle activity along the Yukon River significantly decreased in 1992. It appears that the outbreak, after more than five years of activity, is declining. 52,314 acres of scattered infested spruce were detected in 1992 vs. 80,000 acres in 1991. Most are areas of continuing, not new, infestations and include: 30,362 acres along the Yukon River from Fox Pt. Island to Quail Island and 17,126 acres along the Yukon River from Quail Island to Galena. Bark beetle activity increased, however, along the South Fork of the Nulatto River in 1992: 11,365 acres vs 4,359 acres in 1991.

Spruce beetle activity was detected along the Kuskokwim River on more than 15,000 acres this year; almost double the amount detected in 1991. Areas of heaviest infestations include: 7,000 acres 15 miles east of Aniak; 2,500 acres scattered along the Kuskokwim River 18 miles NE of Stony River Village; and an additional 4,500 acres scattered throughout the white spruce stands bordering the Kuskokwim River downstream from McGrath. Spruce beetle activity also increased along the Stony River (2,000 ac.), a tributary of the Kuskokwim River.

In Southeast Alaska, two major spruce beetle outbreaks continued to expand. The spruce beetle outbreak within Glacier Bay National Park increased slightly, following several years of declining activity. Approximately 29,000 acres of mature Sitka spruce have been affected since spruce beetle was first detected there in the late 1970's. Current beetle activity was noted on over 11,000 acres located primarily within the Beardsley Islands and on the mainland between the park's visitor center and Point Gustavus. Barring a large catastrophic windthrow event, spruce beetle activity within Glacier Bay should decline over the next few years. In the 12 years since spruce beetle activity was first detected at Glacier Bay, many of the trees killed in the initial attacks have blown over or broken off. In areas of heaviest initial mortality, where stands are most open, regeneration (primarily hemlock) is abundant.

The spruce beetle outbreak on state lands near Haines continued to expand rapidly. Spruce beetle activity totalling 4200 acres was first noted in the Klehini, Chilkat, and Kelsall River drainages in 1990. The current area of infestation encompasses over 14,000 acres.

During the winter of 1990-91, strong winds blew down large patches of timber near the confluence of the Wright and Taku Rivers (state, private and National Forest land). Investigations during 1991 and 1992 indicated a significant spruce beetle buildup in windthrown trees. Infestation of adjacent stands is likely in 1993.

In 1992, spruce beetle infestations throughout Alaska by ownership are as follows; National Forest land -28,816 acres; State and Private - 231,856 acres, Native land - 118,794 acres and other Federal lands (e.g. Kenai National Wildlife Refuge, National Parks, etc.) -225,343 acres.

ENGRAVERS
Ips perturbatus Eichh.

Engraver activity decreased in 1992 with 1,892 acres of infested white spruce aerially detected this year versus more than 5,000 acres detected last year. The majority of the infested areas were scattered along the Yukon, Chandalar, and Porcupine Rivers in interior Alaska. The expected increase in *Ips* caused tree mortality in the Fairbanks area did not occur.

EASTERN LARCH BEETLE
Dendroctonus simplex (LeC.)

The 3,000 acres of eastern larch beetle activity detected last year near Delta Junction was not apparent this year. However, approximately 2,000 acres of larch beetle activity was observed in northwest Alaska near Norutuk Lake. Larch beetle activity will continue to be scattered and low as most of the susceptible host material was killed in the large infestations of the early 1970's.

SPRUCE BUDWORM
Choristoneura sp.

Spruce budworm populations increased dramatically in interior Alaska's white spruce stands for the third consecutive year. 1992 aerial surveys detected more than 160,000 acres of defoliated spruce; more than eight times the amount noted in 1991. Largest areas of defoliation included: 56,203 acres scattered along the middle portion of the Yukon River from Galena upstream to the Kokrine Hills; 29,425 acres along the Tanana River near Manley Hot Springs; and 28,646 acres 26 miles NNW of Delta Junction. The largest expanse of budworm defoliation continues to occur along the Nenana Ridge and throughout the Goldstream Valley near Fairbanks. Impact studies conducted by research scientists at the Institute of Northern Forestry have shown significant decreases in diameter growth of defoliated spruce. There is concern that these budworm defoliated trees are stressed and as such are increasingly more susceptible to *Ips* attack and subsequent tree mortality.

In Southeast Alaska, spruce budworm caused over 11,500 acres of heavy defoliation on western hemlock and Sitka spruce along the Chilkat River north of Klukwan. 1992 marked the third consecutive year of budworm activity in this vicinity. Defoliated areas are immediately adjacent to areas of ongoing spruce beetle activity. Mature spruce weaken by repeated defoliation may be subject to future spruce beetle attack. Defoliation along the Chilkat River (above Mosquito Lake) is again likely in 1993.

WESTERN BLACK-HEADED BUDWORM
Acleris gloverana Walsingham

Black-headed budworm defoliation of western hemlock and Sitka spruce in Prince William Sound declined in 1992 for the second consecutive year. Aerial detection surveys noted 4,990 acres of infested hemlock and spruce vs. 7,500 acres in 1991 and 40,000 acres in 1990. Areas most seriously infested include: 256 acres on Knight Island; 200 acres along Bainbridge Island; 467 acres ESE of Cordova; 467 acres on Hawkins Island; 700 acres on Hinchinbrook Island; and 623 acres in the Port Gravina area.

Black-headed budworm populations increased for the first time along Turnagain Arm in the Portage Valley/Turnagain Pass areas where more than 3,600 acres of Sitka spruce, western, and mountain hemlock were defoliated. The most extensive areas of defoliation occurred along the Seward Highway from Ingrahm Creek to Turnagain Pass. Budworm populations are expected to remain high next year with minimal damage resulting from larval defoliation.

The black-headed budworm was the most significant forest defoliator in southeast Alaska in 1992. Approximately 87,666 acres of mature western hemlock and Sitka spruce were defoliated. Budworm activity of this magnitude has not been noted in southeast Alaska since the early 1960's. Population explosions were evident at numerous locations throughout southeast Alaska, but were concentrated primarily north of Frederick Sound.

The heaviest black-headed budworm defoliation was noted on Admiralty Island and in the Juneau vicinity. Areas of heavy defoliation on Admiralty Island included: Mole Harbor (1556 acres), Gambier Bay (10,281 acres), White Water Bay (2650 acres), Hood Bay (8417 acres), and Kootznahoo Inlet (3425 acres). Areas of heavy defoliation in the Juneau vicinity included Lemon Creek, Mendenhall Peninsula, Sunny Point, southeast Mendenhall Valley, Auke Bay and Lena Point. Defoliation of ornamental hemlock and spruce, common around the Auke Bay and Mendenhall Peninsula areas, caused some concern among property owners. Light defoliation was also noted on North Douglas Island. Budworm defoliation in the Juneau vicinity totalled 10,431 acres.

Areas of light to moderate defoliation (north of Frederick Sound) included: approximately 2600 acres along the Katzehin River (mainland, east of Chilkoot Inlet), approximately 5000 acres in the Seymour Canal area (Admiralty Island), approximately 1000 acres along the Herbert and Eagle Rivers north of Juneau, approximately 1000 acres on Moser and Baranof Islands (Hoonah Sound and Peril Strait), and approximately 3200 acres near Whitestone Harbor and 1700 acres north of Hoonah (Chichagof Island).

All budworm defoliation noted south of Frederick Sound was light to moderate in intensity. Concentrations of defoliation included: approximately 300 acres on Big Castle Island (Duncan Canal), approximately 600 acres along Southeast Cove (Wrangell Island), approximately 2600 acres on Etolin Island (Mosman Inlet and Steamer Bay), approximately 150 acres on Bushy Island, approximately 450 acres on Shrubby Island, almost 1600 acres adjacent to Anan Bay, approximately 600 acres near Edna Bay (Kosciusko Island) and approximately 2800 acres north of Naha Bay (Revillagigedo Island).

Numbers of black-headed budworm larvae sampled from defoliator plots varied greatly north and south of Frederick Sound. Numbers of larvae (and acres of defoliation) were consistently higher north of Frederick Sound. North of Frederick Sound, the largest numbers of larvae were collected at Taku Harbor (mainland, southeast of Juneau) and the North Arm of Hood Bay (Admiralty Island, south of Angoon). South of Frederick Sound, the largest numbers of larvae were collected at High Island (between Kuiu and Kupreanof Islands) and Duncan Canal (Kupreanof Island).

Without unforeseen impact on overwintering eggs or young larvae next spring, black-headed budworm populations (and subsequent defoliation) will increase in 1993. Quantity and severity of defoliation will again be greatest within forests north of Frederick Sound.

HEMLOCK SAWFLY
Neodiprion tsugae Middleton

In southeast Alaska, defoliation of mature western hemlock by hemlock sawfly increased significantly from 1991 to 1992. In 1992, sawflies defoliated approximately 6539 acres (900 acres in 1991) of mature western hemlock on the Tongass National Forest south of Sumner Strait. Defoliation was evident near the head of the North Arm of Moira Sound and adjacent to Sunny Cove (Cholmondeley Sound) on Prince of Wales Island, on the north side of Neets Bay (Revillagigedo Is.), and on Smeaton Island and near Winstanley Lakes within Misty Fjords National Monument.

The highest sawfly larvae counts of the 1992 survey were collected at High Island (between Kupreanof and Kuiu Islands, Petersburg Ranger District) and at Princess Bay (Revillagigedo Is., Misty Fjords National Monument). Sawfly activity is expected to continue to increase on the southern Tongass National Forest in 1993.

SPRUCE NEEDLE APHID
Elatobium abietinum Walker

Following the mild winter of 1991-92, large spruce needle aphid populations caused defoliation of Sitka spruce throughout southeast Alaska. Defoliation was noted on a total of 25,220 acres. As with past aphid activity, impact was most severe in urban settings and along marine shorelines.

Aphid defoliation of mature Sitka spruce was evident along many miles of shoreline from Excursion Inlet (mainland), south to Prince of Wales Island. Aphid activity was noted at several locations on Admiralty, Baranof, Chichagof, Douglas, Krestof, Kuiu, Kupreanof, Mitkof, Partofshikof, Prince of Wales, and Wrangell Islands.

Aphid-caused defoliation of ornamental spruce occurred in Sitka, Ketchikan, Wrangell, Petersburg, Juneau, Craig, Klawock, Thorne Bay, and Elfin Cove. Needle aphid damage appeared to be most severe in and around Sitka. Tree mortality is likely among the most heavily defoliated individuals.

If southeast Alaska experiences a mild winter in 1992-93, spruce needle aphid activity can be expected to continue in 1993. Repeated years of aphid activity could cause significant damage and some mortality of ornamental spruce in urban settings.

SPRUCE BUD MOTH
Zeiraphera **sp.**

Populations of the spruce bud moth rebounded southeast of Yakutat in 1992. Defoliation was visible on approximately 5138 acres of Sitka spruce between Dry Bay and the Akwe River. Though 8600 acres of defoliation were noted northwest of this area in 1990, defoliation was not apparent in 1991.

LARGE ASPEN TORTRIX
Choristoneura conflictana **Wlkr.**

Tortrix populations increased slightly in 1992. 19,521 acres of defoliated aspen were detected this year vs. 4,120 acres in 1991. Areas of concentrated tortrix activity include: 5,760 acres along the Parks Highway near Cantwell; 3,036 acres along the Richardson Highway near Sutton; 4,126 acres of defoliated aspen from Glenallen to Copper Center along the Old Edgerton Highway. Some growth loss and top-kill can be expected from heavily defoliated hosts. Tree mortality, however, is rare. Tortrix populations normally increase rapidly for two to three years with defoliation covering hundreds of thousands of acres followed by an equally rapid decline.

WILLOW DEFOLIATION

The amount of willow defoliation increased slightly throughout south-central and interior Alaska in 1992 as a result of three consecutive warm, dry springs and early summers. 1992 aerial surveys detected more than 150,000 acres of defoliated willow; 20,000 acres more than last year. The most heavily defoliated areas continue to be the riparian zones along the Yukon, Kuskokwim, Mulchatna, and Nushagak Rivers as well as in the Lake Clark/Iliamna areas; Seward and Kenai Peninsulas. There is no single causal agent involved in this expansive defoliation but rather a varied group of defoliators. For example, many thousands of acres of willow near Fairbanks and along the Yukon River were defoliated by a willow blotch miner (Gracillariidae: *Micrurapteryx salicifoliella*) whereas Rusty Tussock Moth larvae (Lymantriidae: *Orgyia antigua*) were responsible for much of the willow defoliation along the Kuskokwim River and throughout the Seward Peninsula. Leaf beetles (Chrysomelidae: *Chrysomela* spp.) were the most commonly encountered willow defoliators on the Kenai Peninsula.

COTTONWOOD DEFOLIATION
Chrysomela **sp. and** ***Lyonetia*** **sp.**

Approximately 13,736 acres of defoliated cottonwood were detected in 1991 with approximately 50% occurring in Prince William Sound. 1992 defoliation levels, however, decreased as only 234 acres of cottonwood defoliation were observed near Sheridon Glacier in Prince William Sound.

Cottonwood defoliation by leaf beetles totalled approximately 6,000 acres in southeast Alaska in 1992. Defoliation was noted along the Dangerous, Katzehin, Stikine, Skagway and Taiya Rivers. Leaf beetle defoliation of willow was noted during field activities at several locations, but was not detectable during the aerial survey.

BIRCH DEFOLIATION

A few hundred acres of birch were heavily defoliated on Ft. Richardson Military land along the southside of the Glenn Highway near Ship Creek in 1991. The causal agents were identified as *Sunira verberata* (Smith) and *Parastichtis discivaria* (Wlkr). Both noctuids are transcontinental in distribution and are not noted as important defoliators. Populations did not increase this year as expected; no visible defoliation was noted.

In 1992, leaf miners caused noticeable birch defoliation along the Haines highway for the fourth consecutive year.

STRIPED ALDER SAWFLY
Hemichroa crocea (Fourcroy)

In Southeast Alaska, defoliation of alder was noted along the Stikine River for the second consecutive year. Defoliation in and around Guerin Slough area totalled 623 acres.

In early July around Juneau, alder sawfly larvae were found to be infected by the fungus, *Entomophthora* sp. The fungus was effective in reducing numbers of larvae, however, most of the larvae did not die before causing significant alder defoliation.

GALL MIDGE

A newly detected gall midge was noted on yellow-cedar saplings at Anita Bay (Etolin Island). The midge causes galls on yellow-cedar foliage and its potential impact is not yet known. The midge has been tentatively identified as *Chamaediplosis* sp.

GYPSY MOTH
Lymantria dispar **(L.)**

The European Gypsy Moth was accidently introduced into Massachusetts from Europe in 1869 and the rest is history! Since then, the gypsy moth has been responsible for considerable damage to the hardwood forests of the eastern United States. Millions of dollars are spent annually attempting to reduce the amount of damage and restrict the distribution of this important forest pest. However, the european gypsy moth arrived in the western U.S. in the early 1980's.

Historically, there has been little european gypsy moth activity in Alaska. In 1985, several larvae were detected by moving company employees on lawn furniture which had been shipped to Juneau from the East Coast. Every summer since 1986, USDA Forest Health Management in cooperation with the Cooperative Extension Service and the USDA Animal and Plant Health Inspection Service, has placed pheromone monitoring traps throughout Alaska, especially in locations frequented by out-of-state vehicles, including campgrounds and port areas. To date, only two male european gypsy moths have been trapped: one in a campground near Anchorage in 1987 and the other in a campground near Fairbanks in 1992. Due to the recent detection of the Asian Gypsy Moth, a much more damaging race of the european gypsy moth, in the Pacific Northwest, the Alaskan pheromone trapping program was expanded in 1992; more than 300 traps were placed throughout Alaska from Petersburg to Nome, including Dutch Harbor. No asian gypsy moths were encountered. If the asian gypsy moth becomes established in the western U.S., including Alaska, the potential impacts to forests and riparian areas could be tremendous. The extensive trapping program will be carried out again next year.

STATUS OF DISEASES

HEMLOCK DWARF MISTLETOE
Arceuthobium tsugense (Rosendhal) G.N. Jones

Dwarf mistletoe is abundant in unmanaged, old-growth stands throughout southeast Alaska as far north as Haines. Within the range of western hemlock, dwarf mistletoe is absent from Cross Sound to the northwest along the Gulf of Alaska; thus, managers need not be concerned about the disease in these areas.

Old-growth hemlock stands in southeast Alaska vary in their level of infestation from stands in which almost every western hemlock tree is infected to other stands in which the parasite is absent. Sitka spruce and mountain hemlock are only rarely infected. Most old-growth stands below about 500 feet elevation have some level of infestation. The disease is uncommon at higher elevations.

Heavily infected western hemlock trees have branch proliferations (witches-brooms), bole deformities, reduced radial growth, or may die -- all potential problems in stands managed for wood production. On the other hand, witches-brooms, wood decay associated with bole infections, and scattered tree mortality can result in greater diversity of forest structure and increased animal habitat. For example, witches-brooms may provide hiding or nesting habitat for birds or small mammals. Heavily infested hemlock stands can begin to decline and collapse to the extent that diversity and animal habitat are diminished, however. When mixed-species stands are heavily infected, growth of resistant species such as Sitka spruce and the cedars may be enhanced.

Spread of the parasite into young-growth stands is typically by: 1) infected non-merchantable hemlock trees (residuals) which are sometimes left standing in cut-over areas, 2) infected old-growth hemlocks on the perimeters of cut-over areas, and 3) infected advanced reproduction. Residuals may play the most important role in the initial spread to young stands. Managers who use new techniques of forest management (e.g., Ecological Management, New Perspectives) where large residuals are left standing in clearcuts, on the edges of small harvest units, or in partial harvests should recognize the probable increased impact of dwarf mistletoe in hemlock overstory trees and in regeneration.

A demonstration area near Thorne Bay on Prince of Wales Island, Alaska was developed to provide information on the recognition, biology, impact, and recommended silvicultural techniques for managing hemlock dwarf mistletoe in young-growth stands. Killing infected residual hemlocks (by girdling or felling) and discrimination against advanced reproduction during precommercial thinning can help reduce initial spread to young stands. Care in laying out cutting boundaries to avoid infected old-growth hemlock on clearcut perimeters is also suggested. Recent extensive surveys in young-growth stands up to rotation age in southeast Alaska indicate that the disease occurs at low frequency and low impact as long as large infected residual trees are not present. Current studies are examining the incidence and impact of hemlock dwarf mistletoe in mixed-storied stands.

HEMLOCK CANKER
Xenomeris abietis Barr.

Hemlock canker continued to develop at outbreak levels for the third consecutive year on Prince of Wales Island in 1992. Small hemlocks and the lower crowns of large hemlock trees were killed along more than 60 miles of road. The disease had been inconspicuous since 1985, the year of its last outbreak. In the 1985 outbreak, the disease was confined to old-growth stands along about 30 miles of roads on Prince of Wales Island. This year, the disease had a similar, although larger distribution and also extended further from roads than in previous outbreaks. In the current outbreak the disease was present in both old-growth and young-growth stands. As it killed more hemlock in managed young-growth stands, the disease became more of a management problem.

In 1992, new outbreaks were reported and investigated along unpaved roads near Rowan Bay (Kuiu Island) and Corner Bay (Chichagof Island). The disease has also been reported but not examined along a small section of road near Carroll Inlet (Revillagigedo Island).

The causal agent is the fungus *Xenomeris abietis*, but it appears to be unable to damage trees far from roads. Apparently, road dust is necessary for the fungus to invade hemlock tissues successfully. The previous outbreak of the disease began before 1985 and before some roads were paved on Prince of Wales Island. None of the hemlock canker disease was found this year along paved roads, even though the disease was conspicuous in these locations during the previous outbreak (before paving). Thus, road dust may contribute to development of the disease.

SPRUCE NEEDLE BLIGHT
Lirula macrospora (Hartig) Darker
Rhizosphaera kalkhoffii Bubák
Lophodermium picea (Fuckel) Höhn.

Spruce needle blight, caused by the fungus *L. macrospora*, is the most important needle disease of Sitka spruce in coastal Alaska. The disease occurred at low to moderate infection levels in 1992. It was common on young Sitka spruce and the lower crowns of larger trees throughout coastal Alaska. The disease was especially visible in cutover areas and in urban areas. It was found killing needles along with the more destructive spruce needle aphid this year in southeast Alaska. The life cycle of the fungus has recently been elucidated. The timing of sporulation coincides with bud break in the spring and ceases at about the time of full shoot elongation. Using this information, a study recently demonstrated that fungicides applied soon after spruce bud break successfully controls the disease.

Spruce needle blight caused by *Rhizosphaera* was visible on Sitka spruce throughout the Girdwood, Twenty-mile, and Portage Valleys south of Anchorage. This fungus causes premature death, and casting of needles but damage in natural forests is negligible. The fungal disease can cause significant defoliation of spruce in nurseries, plantations, and landscapes outside the native range of the trees.

The fungus *Lophodermium picea* was found killing the needles of ornamental white spruce in the Anchorage area in 1992.

SIROCOCCUS SHOOT BLIGHT
Sirococcus strobilinus Pruess.

The shoots of young-growth western hemlock were killed in moderate levels by the blight fungus *Sirococcus* in southeast Alaska. Sitka spruce and mountain hemlock are sometimes also attacked. Thinning may be of some assistance in reducing damage by the fungus as thinned stands have fewer infections than in unthinned stands.

SHOOT BLIGHT OF YELLOW-CEDAR
Apostrasseria sp.

Regenerating yellow-cedar (*Chamaecyparis nootkatensis*) suffered substantial infection and shoot blight by the fungus *Apostrasseria* sp. in southeast Alaska in 1992. The disease does not affect mature cedar trees, however. The incidence of shoot blight has not changed appreciably over the past several years. Attack by the fungus causes terminal and lateral shoots to be killed back 5 inches or so on seedlings and saplings during winter or early spring. Entire seedlings up to 18 inches tall are sometimes killed. The newly discovered fungus that causes the disease, *Apostrasseria* sp., is closely related to other fungi that cause disease to plants under snow. The fungus *Herpotrichia juniperi* is often found as a secondary invader on seedlings after they die. A recent study at Anita Bay on Etolin Island indicates that yellow-cedar seedlings planted near naturally regenerating yellow-cedar are more likely to become infected with *Apostrasseria*, but the disease is present and building in seedlings planted away from inoculum sources. An inoculation study is planned in 1993 to confirm the pathogenicity of *Apostrasseria* sp.

SPRUCE NEEDLE RUST
Chrysomyxa ledicola Lagerh.

The incidence of spruce needle rust returned to low and moderate levels in 1992 after several years of abundance. The outbreaks on white spruce around Dillingham have apparently subsided as only 390 acres were detected this year; those on Sitka spruce around Juneau returned to average levels. The spores that infect spruce needles are produced on the alternate host, Labrador-tea (*Ledum* spp.), a plant that is common in boggy, poorly drained areas; thus the disease on spruce is most pronounced in these boggy (muskeg) areas. Although the disease can give spruce trees the appearance of being nearly dead, trees rarely, if ever, die from this disease even in years of intense infection.

SPRUCE BROOM RUST
Chrysomyxa arctostaphyli **Diet.**

Perennial infections result in dense clusters of branches (witches brooms) on white, Lutz, Sitka, and black spruce when infected by this rust fungus. The incidence of spruce broom rust changes little from year to year. It is common wherever spruce grows near the alternate host, bearberry or kinnikinnik (*Arctostaphylus uva-ursi*) in Alaska. The disease is common in interior and south-central Alaska, where scattered individual trees are infected, but only occurs in localized areas of Southeast Alaska where the alternate host is common (e.g., Halleck Harbor area of Kuiu Island and Glacier Bay). The disease may cause slow growth on spruce, although this has not been determined by research. The dense clusters of branches and needles (brooms) are known to provide nesting and hiding habitat for many birds and perhaps for small mammals.

HEMLOCK NEEDLE RUST
Pucciniastrum vaccinii **(Rab.) Joerst.**

This year, hemlock needle rust once again occurred at low, endemic levels on needles of western hemlock. The disease has not been found at outbreak levels since the late 1970's. The blueberry alternate hosts for this rust fungus (*Vaccinium alaskensis* and *V. ovalafolium*) are very common understory plants in hemlock-spruce forests. With the great abundance of both hemlock and blueberry hosts, reasons for the low incidence of this disease are not known.

WESTERN GALL RUST
Endocronartium harknessii **(J.P. Moore) Hirat.**

Gall rust was common throughout the distribution of pine in Alaska. Infection by the rust fungus *E. harknessii* causes spherical galls on branches and main boles of shore pine. Typically, infected pine tissues are swollen but are not killed by the rust fungus. Another fungus, *Nectria macrospora*, colonized and killed many of the pine branches with these galls this year. In cases where galls were located on the main bole, the combination of the rust fungus and *N. macrospora* commonly caused top-kill.

FOLIAGE DISEASES OF CEDARS
Gymnosporangium nootkatense **Arth.**
Didymascella thujina **(Durand) Maire**

Two fungi that infect the foliage of cedar, *Gymnosporangium* on yellow-cedar and *Didymascella* on western redcedar, occurred at endemic levels this year. *Didymascella* was the more damaging of the two and was common wherever its host was found. Infection by neither fungus resulted in severely defoliated nor death of cedar trees.

YELLOW-CEDAR DECLINE

Decline and mortality of yellow-cedar persists as the most spectacular and important forest diseases in southeast Alaska. About 570,000 acres of decline have been mapped during aerial detection surveys. Concentrated mortality occurs in a wide band from western Chichagof and Baranof Islands to the Ketchikan Area. Ground surveys indicate that 65% of the basal area of yellow-cedar is dead on this acreage. Other tree species are relatively unaffected, although they show increased growth on some sites due to less competition from cedars and slowed growth and mortality elsewhere because of site deterioration (poor drainage). Succession to western hemlock and mountain hemlock appears to be occurring in some stands suffering from decline.

All research suggests that no contagious organism is the primary cause for this intensive and extensive mortality. Some abiotic (non-living) site factor, probably associated with the poorly-drained anaerobic soils where decline occurs, appears to be responsible for initiating and continuing cedar decline. Two hypotheses have been proposed to explain the primary cause of cedar decline -- death could result from (1) toxins produced by anaerobic decomposition in the wet soils or (2) freezing damage to the shallow fine roots in wet soils associated with climatic warming and reduced snowpacks in the last century.

A detailed list of acreage affected by Alaska-yellow cedar decline has been determined from a composite map developed by mapping dead and dying cedar during annual aerial detection surveys conducted over the previous 23 years (Appendix A). Recent research suggests that the total acreage of cedar decline has been increasing very slowly; the slow increase in area of cedar decline is a result of the expansion of existing decline-affected areas (less than 3 feet per year) of decline to adjacent stands. Contained within most declining stands are trees that died up to 100 years ago (snags still standing), more recently killed cedars, dying cedars (with yellow, red, or thinning crowns), healthy cedars, and other tree species.

HEMLOCK FLUTING

Deeply incised grooves and ridges extending vertically along boles of western hemlock characterize hemlock fluting. The problem is common on western hemlock throughout southeast Alaska. This condition reduces the value of hemlock logs because they yield less sawlog volume and bark is contained in some of the wood. The cause of fluting is not completely known, but associated factors include increased wind-firmness of fluted trees, common occurrence on sites with shallow soils, triggering of fluting by growth release, and fluting on boles corresponding with patterns of translocation. Researchers have recently documented the development of fluting in young hemlock stands.

WOOD DECAYS

Conifers. Decay fungi (including heart rot, sap rot, and butt rot fungi) cause substantial loss of wood volume in Alaskan forests. A comprehensive list of wood decay fungi found in Alaska would be quite extensive. Appendix B lists the more common species, and indicates, for each species, its known conifer hosts, type of decay, and mode of attack.

Decay problems are substantial in southeast Alaska where long-lived tree species predominate in old-growth forests, and the slow-growing decay fungi have ample time to cause significant losses. Decay fungi play an important role in the structure and function of coastal old-growth forests where fire and other forms of catastrophic disturbance are uncommon. By predisposing large old trees to bole breakage, these fungi serve as important disturbing factors that cause small scale canopy gaps. Heartrot fungi enhance wildlife habitat -- indirectly by increasing forest diversity through gap formation or more directly by creating hollows in logs or live trees for species such as cavity nesting birds.

The importance of decay fungi in managed young-growth conifer stands is less certain. Wounds on live trees caused by logging activities allow decay fungi to cause appreciable losses. Studies in progress are investigating how frequently fungi enter wounds of different sizes and the rate of subsequent decay in these wounded trees.

In southeast Alaska, the following fungi are the most important causes of wood decay in live trees:

Sitka spruce
Fomitopsis pinicola
Phellinus pini
Armillaria sp.
Phaeolus schweinitzii
Laetiporus sulphureus

Western hemlock
Fomitopsis pinicola
Armillaria sp.
Heterobasidion annosum
Laetiporus sulphureus
Phaeolus schweinitzii
Phellinus hartigii
Phellinus pini

Western redcedar
Poria albipellucida
Phellinus weirii

With the exception of *Armillaria* sp., all decay fungi important on Sitka spruce are also important in decay of white spruce in south-central and interior Alaska (and on Lutz spruce on the Kenai Peninsula). In addition, significant volume loss occurs in white and Lutz spruce from butt rot caused by *Coniophora puteana* and *Pholiota alnicola*.

Saprot fungi typically decay dead branches and large woody debris and therefore play an essential role in recycling wood in unmanaged forests. However, saprot decay also routinely becomes established in spruce trees attacked by spruce bark beetles. Large volumes of potentially recoverable timber volume are currently being lost annually on the Kenai Peninsula, where salvage logging has not kept pace with tree mortality from the continuing spruce beetle outbreak. Significant volume loss from saprot appears to begin about 4-5 years following tree death. Several species of saprot fungi (Appendix B) are associated with spruce beetle-caused mortality, but *Fomitopsis pinicola* occurs most commonly.

Hardwoods. Heart rots are the most important cause of volume loss in Alaskan hardwood species. Incidence of heartrot in hardwood species of interior and south-central Alaska is generally high by the time a stand has reached maturity (about 50 years old). Substantial volume loss can be expected in stands 80 years old or older. Detailed data on volume losses by stand age class and forest type are currently lacking; studies are needed to better characterize these relationships.

Pleurotus sp. and *Pholiota* sp., which produce annual sporophores, commonly occur on trembling aspen, black cottonwood, and paper birch, but are not as common as heartrot fungi that form perennial sporophores on these tree species. *Phellinus igniarius* (L. ex Fr.) Quel. and *Fomes fomentarius* (Fr.) Kichx. account for the majority of decay in paper birch, with the former stem decay fungus being the most important in terms of both incidence and decay volume. *Phellinus tremulae* (Bord.) Bond & Boriss. accounts for the majority of stem decay in both trembling aspen and black cottonwood.

STATUS OF ANIMAL DAMAGE

PORCUPINE
Erethizon dorsatum

Porcupines cause severe damage to Sitka spruce and western hemlock in numerous local areas of southeast Alaska. An extensive survey has been completed that documents the level of porcupine damage in young-growth stands. Damage is confined to the known distribution of porcupine; thus, trees are not damaged where the porcupine is absent such as Prince of Wales, Kuiu, Baranof, Chichagof, and Admiralty Islands. Damage is especially serious on Mitkof Island in southeast Alaska. Other damage has been noted at Thomas Bay, Cleveland Peninsula, Bradfield Canal, Anita Bay, Douglas Island, and the Juneau area. Shore pine near Haines has been damaged the last few years. Feeding behavior of porcupines changes as forests age and trees become larger and older. Porcupines climb smaller trees and kill or cause topkill by removing bark along the entire bole, or the bole near the top of the tree. As trees become larger, around 40-50 years old, porcupines climb fewer trees and most of the damage is in the form of basal wounding. Most of these larger trees are not killed, but the large basal scars allow fungi to enter the bole and begin to cause wood decay.

Porcupines also damage trees throughout interior Alaska. Bark beetles, including *Ips* spp., have been found infesting damaged trees.

BROWN BEAR
Ursus arctos

Yellow-cedar trees were wounded by brown bears in spring on Baranof and Chichagof Islands. Brown bears rip the bark away from the lower boles of these trees, apparently to taste the sweet cambium. Other tree species are unaffected. Trees with old scars have associated columns of wood decay that will limit the value of their butt logs.

INTEGRATED PEST MANAGEMENT ACTIVITIES

Integrated pest management has been described as a "systems approach to alter pest damage to acceptable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical pesticides." Current FHM activities in Region 10 include:

(1) Participation in a cooperative effort with the Alaska Agricultural Research Station and the Cooperative Extension Service to provide pest management information to Alaska residents. The program, which includes education, research and survey activities, and provides integrated pest management information concerning urban forestry and garden and greenhouse pests. This program includes an IPM Newsletter that is published monthly throughout the summer. In 1992, there were nine pest scouts (7 full-time, 2 part-time) in seven communities in Alaska: Fairbanks, Delta Junction, Palmer, Anchorage, Soldotna, Juneau, and Kodiak. The 1992 IPM Pest Scouts had a very full summer season. The end of the season records indicate that there were over 2,100 telephone contacts, over 400 specimens diagnosed, and over 400 site visits made statewide.

(2) A ground application of methylcyclohexenone (MCH) for the prevention of spruce beetle attacks and population build-up in standing, uninfested spruce in a popular Kenai Peninsula campground was undertaken in the spring of 1992. MCH is the naturally occurring antiaggregating pheromone of the spruce beetle. That is, it functions as a repellent. The study was undertaken in a campground that had come under heavy attack by the spruce bark beetle the last three years. The objective of the study was to see if the application of MCH in a Bubble-cap formulation would significantly reduce the number of spruce beetle attacks on large diameter campground spruce. There was no significant protection afforded by the application of the MCH bubble caps. The spruce beetle dispersal flight and subsequent tree attacks were once again, extremely high; approximately 150 trees were successfully attacked in the "treated" campground. It appears that MCH is not an effective tool when populations are in epidemic conditions as the antiaggregant pheromone released from the bubble caps is "overwhelmed" by the large amounts of naturally occurring aggregant pheromone.

(3) Airborne video technology is currently being used to monitor spruce beetle outbreaks in southeast and south-central Alaska. This work is being done to enhance current spruce beetle detection and monitoring capabilities. This airborne video project is being completed in cooperation with the Chatham Area (Tongass National Forest), Glacier Bay National Park and the State of Alaska (Department of Natural Resources, Division of Forestry).

SUBMITTING INSECTS AND DISEASES FOR IDENTIFICATION

The following procedures for the collection and shipment of specimens should be used for submitting samples to specialists:

I. Specimen collection:

1. Adequate material should be collected
2. Adequate information should be noted, including the following:

a. Location of collection
b. When collected
c. Who collected the specimen
d. Host description (species, age, condition, # of affected plants)
e. Description of area (e.g., old or young forest, bog, urban);
f. Unusual conditions (e.g., frost, poor soil drainage, misapplication of fertilizers or pesticides?).

3. Personal opinion of the cause of the problem is very helpful

II. Shipment of specimens:

1. General: Pack specimens in such a manner to protect against breakage.
2. Insects: If sent through the mail, pack so that they withstand rough treatment.

a. Larvae and other soft-bodied insects should be shipped in small screw-top vials or bottles containing at least 70% isopropyl (rubbing) alcohol. Make certain the bottles are sealed well. Include in each vial adequate information, or a code, relating the sample to the written description and information. Labels inserted in the vial should be written on with pencil or India ink. Do not use a ballpoint pen, as the ink is not permanent.

b. Pupae and hard-bodied insects may be shipped either in alcohol or in small boxes. Specimens should be placed between layers of tissue paper in the shipping boxes. Pack carefully and make certain that there is very little movement of material within the box. Do not pack insects in cotton.

3. Needle or foliage diseases: Do not ship in plastic bags. Sprinkle lightly with water before wrapping in newspaper. Pack carefully and make sure that there is very little movement of material within the box. Include the above collection information. For spruce and other conifers, include a description of whether current year's-needles, last-year's needles, or old-needles are attacked.
4. Mushrooms and conks (bracket fungi): Do not ship in plastic bags. Either pack and ship immediately, or first air dry and then pack. To pack, wrap specimens in dry newspaper and pack into a shipping box with more newspaper. If on wood, include some of the decayed wood. Be sure to include all collection information.

III. Shipping:

1. Ship as quickly as possible, especially if specimens are fresh and not air-dried. If samples cannot be shipped rapidly, then store in a refrigerator.
2. Include address inside shipping box.
3. Mark on outside: "Fragile: Insect-disease specimens enclosed; For scientific purposes only; No commercial value."

FOREST INSECT AND DISEASE BIOLOGICAL EVALUATIONS, TECHNICAL REPORTS, AND MISCELLANEOUS PUBLICATIONS

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MAILING LIST UPDATE AND REVISION

At this time, we wish to update our mailing list of all cooperators. Only those persons or agencies returning this form by June 15, 1993 will receive subsequent mailings of reports. Please complete this form and return to:

Forest Health Management
USDA Forest Service
201 E. Ninth Ave., Suite 201
Anchorage, Alaska 99501

Your current address:

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I would like to receive the following publications:
(please check one or more)

- ☐ Insect biological evaluations
- ☐ Disease biological evaluations
- ☐ Insect technical reports
- ☐ Disease technical reports
- ☐ Annual Reports on insect and disease conditions in Alaska

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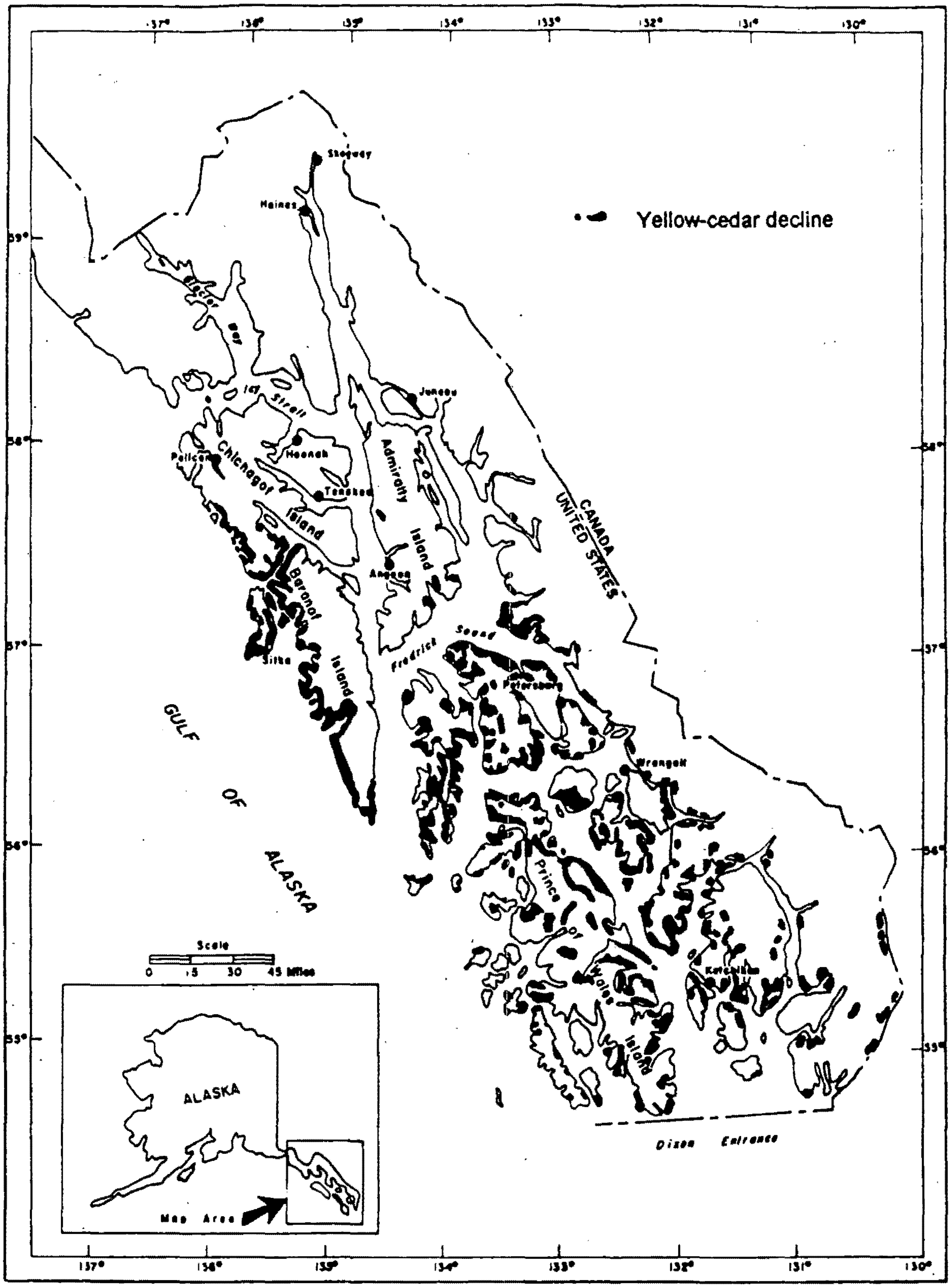

Distribution of yellow-cedar decline in southeast Alaska

Appendix A

ACREAGE AFFECTED BY YELLOW-CEDAR IN SOUTHEAST ALASKA AS OF 1992

	Acres
NATIONAL FOREST LAND	541,349
Chatham Area	132,590
Juneau Ranger District	1,167
Hoonah Ranger District	2,179
Sitka Ranger District	
Chichagof I	36,897
Baronof I	58,564
Kruzof I	27,971
Total	123,432
Admiralty Island Nat'l Mon. Wilderness	5,812
Stikine Area	233,870
Petersburg Ranger District	
Kupreanof I	79,913
Kuiu I	66,653
Mitkof I	8,602
Woewodski I	2,258
Mainland	7,707
Total	165,133
Wrangell Ranger District	
Etolin I	26,077
Wrangell I	16,648
Zarembo I	9,496
Woronofski I	622
Mainland	15,894
Total	68,737
Ketchikan Area	174,889
Thorne Bay Ranger District	
Prince of Wales I	29,204
Kosciusko I	12,027
Heceta I	1,463
Total	42,694

	Acres
Ketchikan Area (continued)	
Craig Ranger District	
Prince of Wales I	41,152
Dall I. and Long I	1,323
Total	42,475
Ketchikan Ranger District	
Revillagigedo I	24,208
Gravina I	6,780
Mainland	22,028
Total	53,016
Misty Fjords Nat'l Mon. Wilderness	
Revillagigedo I	13,623
Mainland	23,081
Total	36,704
NATIVE LAND	17,667
Prince of Wales I	10,196
Kupreanof I	312
Sukkwan I	156
Ketchikan area	5,058
Annette I	1,945
STATE AND PRIVATE LAND	10,430
Sitka area	1,246
Mitkof I	1,362
Kupreanof I	234
Prince of Wales I	943
Wrangell area	311
Pelican area	156
Ketchikan area	2,131
Gravina I	2,958
Koscusko I	1089
TOTAL LAND AFFECTED	**569,446**

Appendix B

DECAY FUNGI ASSOCIATED WITH SPRUCE AND HEMLOCK IN ALASKA.

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Antrodia albobrunnea (Rommell) Ryvarden	WS	BC	S-HR
Antrodia carbonica (Overh.) Ryv. & Gilbn.	SS, WH	BC	S-HR
Antrodia crassa (Karst.) Ryvarden	WS	BR	S-HR,SR
Antrodia heteromorpha (Fr.) Donk	WS	BC	S-HR,SR
Antrodia serialis (Fr.) Donk	WS, SS	BC	S-HR
Antrodia xantha (Fr.) Ryv.	WS	BC	S-HR,SR
Armillaria ostoyae (Romagn.) Herink	WS, SS, WH, MH?	YS	P,S-R&B
Bjerkandera adusta (Willd.:Fr.) Karst.	WS	WR	P-SR
Botryobasidium vagum (Berk. & Curt.) Rogers	WS	WR	?
Ceriporiopsis rivulosa (Berk. & Curt.) Gilbn. & Ryv.	WS, SS, WH	WSR	P-HR
Chondrostereum purpureum (Fr.) Pouz.	WS	WR	S-SR
Climacocystis borealis (Fr.) Kotl. & Pouz.	SS	WMR	P-HR
Coniophora puteana (Schum. ex Fr.) Karst.	WS, WH	BC	P,S-R&B,HR,SR
Crustoderma dryinum (Berk. & Curt. in Berk.) Parm.	WS	WR	P-SR?
Dichomitus squalens (Karst.) Reid	WS	WPR	P-HR
Diplomitoporus crustulinus (Bres.) Dom.	WS	WR	S-SR
Diplomitoporus lindbladii (Berk.) Gilbn. & Ryv.	WS	WR	S-HR,SR
Echinodontium tinctorium (Ell. & Ev.) Ell. & Ev.	MH, WH?	YS	HR
Fomitopsis officinalis (Vill.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-HR,SR
Fomitopsis pinicola (Swartz.:Fr.) Karst.	WS, SS, WH, MH	BC	P,S-HR,SR
Fomitopsis cajanderi	WS, WH	BC	P,S-HR
Ganoderma applanatum (Pers.:Wallr.) Pat.	WS, SS, WH	WSR	S-HR,SR
Ganoderma oregonense Murr.	SS, WH	WSR	S-HR,SR
Gloeophyllum odoratum (Wulf.:Fr.) Imazeki	WS	BR	S-HR,SR
Gloeophyllum saepiarium (Wulf.:Fr.) Karst.	WS	BR	S-HR,SR
Hericium abietis (Weir in Hubert) Harrington	SS, WH, MH	WPR	P-HR,SR
Heterobasidion annosum (Fr.) Bref.	SS, WH	WPR	P-R&B,HR
Inonotus tomentosus (Fr.) Gilb.	WS, SS, MH	WPR	P-R&B
Laetiporus sulphureus (Bull.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-R&B
Laurilia sulcata (Burt) Pouz.	WS	WR	P-R&B
Lentinus kauffmanii Smith	SS	BPR	P-R&B
Perenniporia subacida (Peck) Donk	WS	WSR	P-R&B
Phaeolus schweinitzii (Fr.) Pat.	WS, SS, WH	BC	P-R&B
Phanerochaete gigantea (Fr.:Fr.) Rattan	WS	WR	P-SR

See footnotes at end of table.

Decay fungi associated with spruce and hemlock in Alaska (continued).

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Phanerochaete laevis (Pers.:Fr.) Fr.	WS	WR	S-HR?
Phellinus pini (Thore ex Fr.) Pil.	WS, SS, WH, MH	WPR	P-HR
Phellinus punctatus (Fr.) Pilat	WH	WR	S-HR,SR
Phellinus robustus (Karst.) Bourd. & Galz.	WH, MH	WR	P-HR,SR
Phellinus viticola (Schw.:Fr.) Donk	WS	WR	S-HR,SR
Pholiota alnicola (Fr.) Sing.	WS	YS	P-R&B
Pholiota aurivella (Bat. ex Fr.) Kumm.	WS, SS, WH	BMR	P-HR
Postia (Oligoporia) balsamea (Peck) Julich	WS, SS, WH	BC	P-R&B,SR
Postia (Oligoporia) guttulata (Peck) Julich	WS	BC	P-R&B
Postia (Oligoporia) placenta (Fr.) M.J. Larsen & Lombard	SS, WH	BC	S-HR,SR
Postia (Oligoporia) sericeomollis (Rommell) Julich	WS, SS, WH	BC	P,S-HR
Pycnoporellus alboluteus (Ell. & Ev.) Kotl. & Pouz.	WS	BC	S-SR
Scytinostroma galactina (Fr.) Donk	WS, WH	YS	P-R&B
Stereum sanguinolentum (Alb. & Schw.:Fr.) Fr.	WS, SS, WH, MH	YS	P,S-HR,SR
Trametes versicolor Fr.	SS, WH	WSR	S-SR
Trichaptum abietinus (Dicks.:Fr.) Ryvarden	WS, SS, WH	WPR	S-SR
Veluticeps abietina (Pers.:Fr.) Hjort. & Telleria	SS, WH	BC	S-HR

[a]Host species are: SS, Sitka spruce; WS, white spruce; MH, mountain hemlock; WH, western hemlock.

[b]Types of decay are: WR, white rot; YS, yellow stringy or yellow spongy rot; WMR, white mottled rot; WSR, white stringy or white spongy rot; WPR, white pocket rot; BR, brown rot; BC, brown cubical rot; BPR, brown pocket rot; BMR, brown mottled rot.

[b]Mode of attack is defined in a two-part code given as A-B. Before the hyphen, P and S are used to indicate primary and secondary attack, respectively. Primary attack means the decay typically occurs in living trees. After the hyphen, the codes R&B, HR, and SR are used to refer to root & butt rot, heart rot, and sap rot, respectively.

United States
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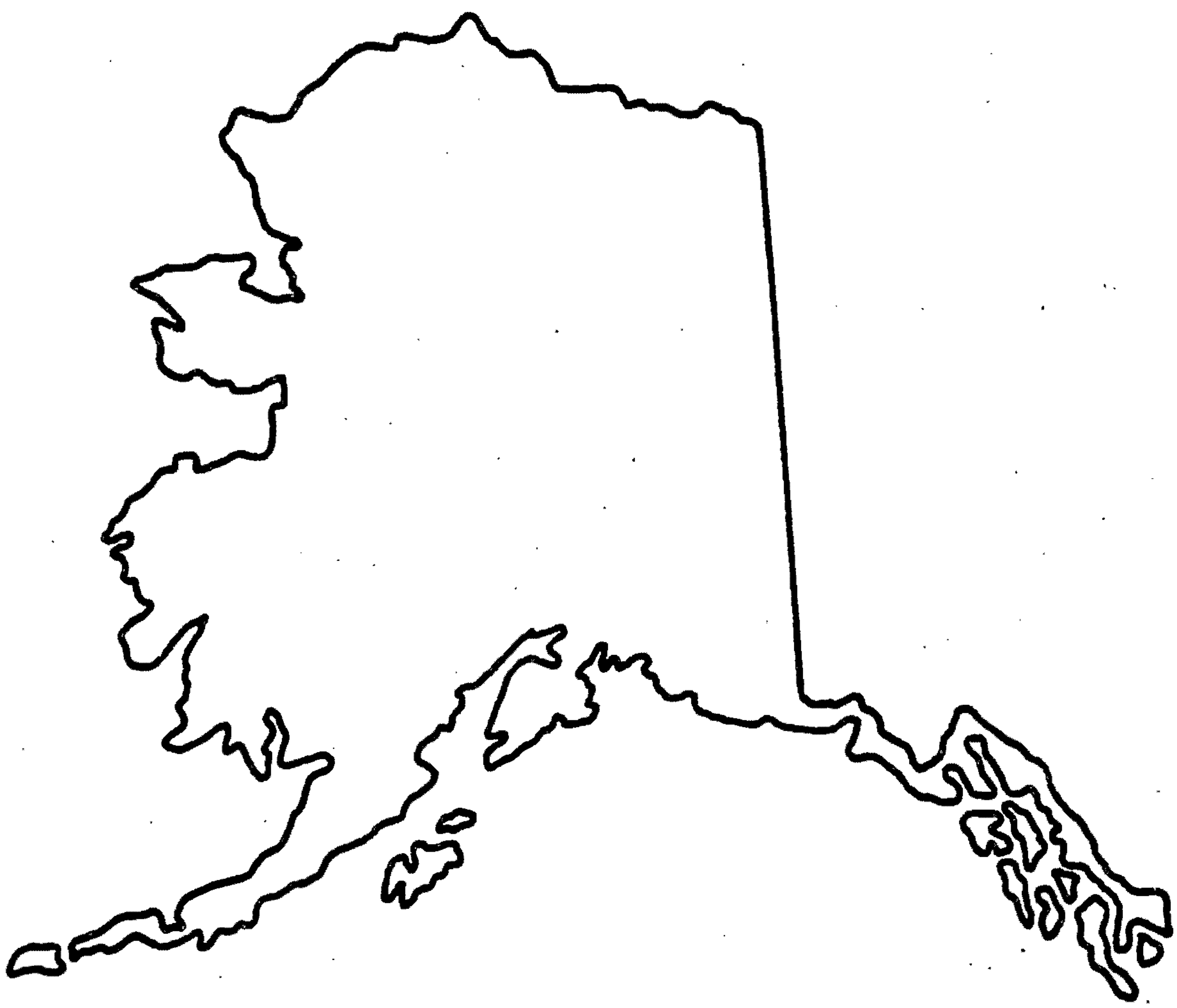
Agriculture

Forest Service

Alaska
Region
R10-TP-22

Forest Health Management Report

Forest Insect and Disease Conditions in Alaska - 1991



FOREST PEST CONDITIONS IN ALASKA - 1991

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FOREST PEST CONDITIONS IN ALASKA - 1991

CONDITIONS IN BRIEF

Forest insect and disease populations and related damage increased throughout Alaskan forests in 1991. 1991 was the third consecutive year with warm, dry springs and early summers which allowed insect populations to explode, especially in South-Central and Interior Alaska. Spruce bark beetle activity increased for the third consecutive year, as on-going and new infestations as determined by 1991 aerial surveys now affect more than 375,000 acres. Increased bark beetle activity occurred in the Copper River area near Chitina; the Clam Gulch-Tustemena Lake area on the Kenai Peninsula, and portions of the west side of Cook Inlet near the Skwenta River. The Yukon River outbreak increased slightly in 1991. The outbreak adjacent to Russell Fiord, near Yakutat, has subsided. In Southeast Alaska, spruce beetle outbreaks continued within Glacier Bay National Park and near Haines. Hardwood defoliator activity increased for the second consecutive year throughout most of South-Central and Interior Alaska with willow defoliation accounting for the majority of the increase. Assorted leaf miners, Noctuid, and Rusty-tussock moth larvae were responsible for the defoliation of more than 130,000 acres of willow vs. 30,000 defoliated acres noted in 1990. Spruce budworm populations exploded near Fairbanks and Delta Junction in Interior Alaska where more than 20,000 acres of white spruce were defoliated. In Southeast Alaska, spruce budworm activity along the Ferebee and Kelsall Rivers was significantly less than that of 1990. Black-headed budworm defoliation in Prince William Sound decreased in 1991. 7,000 acres of western hemlock and Sitka spruce were defoliated this year vs. 40,000 acres in 1990. Light defoliation from black-headed budworm was noted on approximately 6000 acres of western hemlock on the Tongass National Forest. Hemlock sawfly defoliated approximately 900 acres of western hemlock on Dall Island in 1991.

The most significant diseases of Alaskan forests are those that persist on sites from year-to-year: yellow cedar decline, wood decay of live trees, and hemlock dwarf mistletoe. More than 526,000 acres of cedar decline occur in Southeast Alaska in a broad band from western Chichigof Island through the Ketchikan area (Table 1). Heartrot and buttrot fungi cause significant cull in all tree species in Alaska. Hemlock dwarf mistletoe continue to cause growth loss and mortality in old-growth forests of Southeast Alaska; its impact in young-growth stands appears to depend on the presence of large infected residuals left after harvesting of the previous stands. An outbreak of hemlock canker, caused by the fungus *Xenomeris abietis* and possibly aggravated by dust, killed small hemlocks and the lower branches of large hemlock trees along roads along more than 60 miles on Prince of Wales Island for the second consecutive year. Spruce needle rust was present at relatively high levels throughout Alaska, but most other foliar pathogens occurred at low to moderate levels in 1991. Aspen leaf blight was conspicuous for the second consecutive year on portions of the Kenai Peninsula. Porcupines continued to damage spruce and hemlock in valuable young-growth stands in southeast Alaska.

Table 1 summarizes insect and disease activity by land ownership.

Table 1. 1991 Forest insect and disease infestation in Alaska by land ownership and pest.[a]

Pest	National Forest	Other Federal	Native	State & Private
	- - - - - - - - - -	Acres	- - - - - - - - - - - - -	
Spruce beetle	19,526	142,228	23,315	191,748
Larch Beetle	-----	156	-----	3,425
Engravers	----	2,572	1,414	1,902
Spruce budworm	----	----	1,791	25,143
Black-headed budworm	11,064	-----	2,107	234
Hemlock sawfly	934	----	----	----
Large aspen tortrix	----	3,176	267	677
Spear-marked black moth	----	4,223	----	----
Birch defoliation	----	215	251	716
Cottonwood defoliation	2,955	4,617	----	9,119
Willow defoliation	----	53,538	75,081	3,098
Alaska yellow-cedar[b] decline	500,406	-----	17,511	8,718
Totals	534,885	210,725	121,737	244,780
GRAND TOTAL		1,112,127 acres		

[a]Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) because these losses are not detectable in aerial surveys.

[b]Acreage of Alaska yellow-cedar decline reported is the cumulative total up to 1990, and not an annual figure.

STATUS OF INSECTS

SPRUCE BEETLE
Dendroctonus rufipennis Kirby

Alaska spruce bark beetle populations increased dramatically for the second consecutive year in 1991 (see Figure 1). Newly detected infestations as well as active on-going infestations affected more than 375,000 acres of Alaska's spruce forests. This is an increase of more than 130,000 acres over levels infested in 1990. More than 90% of spruce bark beetle activity is occurring in the Lutz and white spruce stands of South-Central and Interior Alaska. Unusually warm spring and early summer weather conditions throughout South-Central and Interior Alaska for three consecutive years have helped increase bark beetle populations by decreasing spruce beetle developmental times from two to one year. Likewise, warm, dry spring and summer weather conditions may have increased spruce susceptibility to spruce beetle attack by decreasing host defense mechanisms; mainly resin exudation.

White, Lutz, and Sitka spruce mortality continues on 19,000 acres of the Chugach National Forest and is a slight decline (3,000 acres) over the acreage infested in 1990. This decline is the result of more than ten years of heavy spruce beetle activity on the Chugach National Forest which has depleted most of the available host material. Populations are expected to decline even further in 1992. The majority of the spruce beetle activity on the Chugach National Forest is located from Russian Lakes to and along the Sterling Highway between Broadview Guard Station and Gwin's Lodge (6,772 ac.). Spruce beetle activity dramatically increased on State and private lands near Moose Pass; 3,114 acres of spruce were infested along the north shore of Upper Trail Lake. Spruce beetle activity increased dramatically further south on the Kenai Peninsula on Kenai National Wildlife Refuge lands and adjoining State and private lands. Areas of the largest increase were detected from Pt. Possession south to Skilak Lake on Wildlife Refuge lands; approximately 75,000 acres of scattered spruce beetle activity were aerially detected. Further south on the Kenai Peninsula, the 35,000 acre outbreak detected in 1990 between Clam Gulch and Tustumena Lake increased to 55,346 acres. Light scattered spruce beetle activity was again apparent along the Fox River (2,024 acres) and 16 miles NNE of Anchor Point where more than 1,000 acres of infested spruce were detected. Spruce beetle populations in the Kachemak Bay area have declined in 1991. Approximately 7,000 acres of infested Sitka spruce were aerially detected this year versus 10,000 acres in 1990. The areas most heavily infested (6,695 ac.) are from Aurora Lagoon to Battle Creek. Expansions outside this area were not detected. Very little (less than 25 acres) of scattered spruce beetle activity was detected further south and west along Kachemak Bay towards Seldovia. Spruce beetle activity on the west side of Cook Inlet dramatically increased in 1991. Approximately 45,000 acres of infested spruce were aerially detected versus 12,721 acres in 1990. Areas of increased activity occurred 8 miles NW of Beluga where 17,437 acres of spruce have been infested. Likewise, 15,000 acres of infested spruce were noted near the confluence of the Talachulitna and Skwenta Rivers; an increase of 2,000 acres over 1990 levels. Approximately 2,000 acres of scattered spruce beetle activity were noted within the Nancy Lake State Recreation Area north of Wasilla. An additional 1,090 acres of beetle activity were noted 14 miles south of Talkeetna. Spruce bark beetle activity appeared to have decreased in 1991 in the Anchorage Bowl as only 2,000 acres of scattered infested spruce were detected along the Hillside from the foot of Flat Top Mountain to McHugh Peak. Small, isolated beetle activity was detected in the following areas: 5 acres near the mouth of Campbell Creek; 10 acres near end of Klatt Road; 415 acres on Fire Island, and 150 acres in Ship Creek Valley. Further north, 156 acres of spruce beetle infestations were detected above Eagle River; 701 acres bordering Eklutna Lake; and 311 acres along the slopes of Bodenburg Butte near Palmer. Spruce bark beetle activity continues further west near Lake Clark and Lake Iliamna. 1,245 acres of infested spruce were detected 4 miles NW of Pile Bay Village. Another 2,335 acres of scattered spruce beetle infested trees were detected on the south-west side of Lake Clark Pass.

The Tiekel River outbreak maintained its 25,000 acres of activity along the Tiekel River north to Pump Station 12. Last year approximately 11,000 acres of spruce beetle activity were noted due south of the confluence of the Chitina and Copper Rivers. This activity greatly expanded in 1991 as more than 45,000 acres of spruce beetle activity were noted from Pump Station 12 northeast to McCarthy and northwest to Gulkana. The first spruce beetle outbreak (200,000) recorded in Alaska in 1922 was located near this area. It appears that after 70 years the live residual stand has become susceptible to spruce beetle activity. There is a large quantity of unattacked but susceptible host material in this area. This current spruce beetle activity has the potential of becoming one of Alaska's largest infestations. The areas of heaviest and most intensive spruce beetle activity include: 15,257 acres from Tonsina to Pump Station 12; 3,425 acres near Tebay Lakes; 3,581 acres near Nelson Mtn. 34 miles west SW of McCarthy, 6,900 acres 8 miles NE of Chitina, 3,036 acres 16 miles N of Chitina; and 5,683 acres 21 miles NNW of Chitina. An additional 1,323 acres of spruce beetle activity were noted 4 miles SE of Glennallen.

Spruce beetle activity along the Yukon River increased in 1991 after a significant decrease in 1990. More than 100,000 acres were infested in 1987, decreasing to 41,000 acres in 1989 then increasing to more than 80,000 acres in 1991. Some of this apparent increase may be the result of the more intensive 1991 aerial survey. Ground checks of infested areas have indicated that *Ips* beetles may be as important as spruce beetles as mortality agents. The areas containing heavy spruce beetle activity include; 34,499 acres along the Yukon River from Fox Point Island north to Quail Island; 31,373 acres from Big Eightmile Island to Galena, and 4,359 acres along the Nulato River approximately 18 miles west of Nulato. Scattered spruce beetle activity continues along the Kuskokwim River where approximately 7,800 acres are currently infested; 4,000 acres approximately 75 miles SW of Sleetmute and 3,736 acres of infested white spruce scattered along the Kuskokwim River from 37 to 66 miles

SSW of McGrath.

In Southeast Alaska, active spruce beetle infestations totalled almost 16,000 acres. Approximately 9200 acres of Sitka spruce are infested within Glacier Bay National Park. Approximately 27,000 acres have been affected since spruce beetle was first detected there in the late 1970's. Glacier Bay's spruce beetle activity is ongoing on the Beardsley Islands and on the mainland west of Gustavus, AK. Spruce beetle infestations along the Klehini and Kelsall Rivers near Haines, AK, total approximately 6500 acres. Favorable weather the past three years appears to favor the expansion of these infestations.

The spruce beetle outbreak near Russell Fiord (Yakutat Ranger District) has subsided. In addition, no new blowdown was observed in the area in 1991. Salvage of previous beetle-killed Sitka spruce is ongoing. During the winter of 1990-91, strong winds blew down large patches of timber in the vicinity of the Wright and Taku Rivers. Investigations during 1991 indicate potential spruce and *Ips* beetle buildup there.

In 1991 spruce beetle infestations throughout Alaska by ownership are as follows; National Forest land - 19,526 acres; State and Private - 191,748 acres, Native land - 23,315 acres and other Federal lands (e.g. Kenai National Wildlife Refuge, National Parks, etc.) - 142,228 acres.

ENGRAVERS
Ips perturbatus Eichh.

Engraver activity increased in 1991 with 5,800 acres of infested spruce aerially detected this year versus 326 acres detected last year. The majority of the infested areas occurred along the shores of the Noatak River near Noatak. However, as previously mentioned, it is quite possible that much of the Yukon River spruce beetle infestation is caused by engraver beetles. Substantial top breakage of white spruce occurred near Fairbanks as a result of a late, heavy snowfall. This material was available as breeding habitat for the 1991 emerging *Ips* populations. It is quite possible that increased mortality of standing spruce will occur next summer as a direct result of this *Ips* population increase.

In Southeast Alaska, windthrown Sitka spruce near the confluence of the Wright and Taku Rivers was attacked by *Ips* beetles. Beetles emerging in 1992 may attack adjacent standing spruce.

EASTERN LARCH BEETLE
Dendroctonus simplex (LeC.)

Eastern larch beetle, activity increased after more than three years of inactivity in Interior Alaska. More than 3,000 acres of scattered larch mortality were aerially detected. The majority of the activity was detected 16 miles ENE of Delta Junction. Larch beetle activity will continue to be scattered and low as most of the susceptible host material was killed in the large infestations of the early 1970's.

SPRUCE BUDWORM
Choristoneura sp.

In 1990 *C. fumiferana* populations increased in interior Alaska's white spruce stands. Budworm populations were high enough to cause severe defoliation of 2-4 year old planted stock but not high enough for signs of defoliation to be aerially detected. Populations increased once again in 1991. Heavy budworm defoliation was detected on 7,551 acres of white spruce from Black Rapids to Donnelly south of Delta Junction and on 12,610 acres of white spruce in the Bonanza Creek and Gold Stream Valley areas near Fairbanks (see Figure 2). As previously mentioned, *Ips* populations are building in the Fairbanks area. Many of the budworm defoliated trees are now stressed and occur in areas of potentially high *Ips* populations, thus increasing the probability of an *Ips* outbreak next year. 623 acres of apparent budworm activity were detected along the Resurrection River 8 miles NW of Seward.

In Southeast Alaska, budworm activity declined significantly along the Kelsall and Ferebee Rivers west of Haines. However, approximately 5000 acres of Sitka spruce did receive moderate defoliation. Though budworm populations will likely decline, defoliation is expected there again in 1992.

WESTERN BLACK-HEADED BUDWORM
Acleris gloverana Walsingham

Black-headed budworm defoliation of western hemlock and Sitka spruce in Prince William Sound significantly declined in 1991. Aerial detection surveys noted 7,491 acres of infested hemlock and spruce vs. 40,000 acres in 1990 and 145,000 acres in 1988. Areas most seriously affected include: 4,126 acres along coast between Tatitlek and Cordova and on 623 acres along shore of Ester Island 22 miles ENE of Whittier. Most of the budworm activity has been limited to forested areas along the shoreline.

In Southeast Alaska, light budworm defoliation was noted on approximately 6000 acres of mature western hemlock. Defoliation was apparent on the west side of Shelter Island, on the mainland north of the Taku River, and on southwest Admiralty Island. South of Frederick Sound, defoliation occurred on Baker Island and on Prince of Wales Island near San Christoval Channel and along the South Arm of Moira Sound. The highest budworm larvae counts of 1991 were obtained near the North Arm of Hood Bay on southwest Admiralty Island and at Calder Bay on northwest Prince of Wales Island.

HEMLOCK SAWFLY
Neodiprion tsugae Middleton

Hemlock sawflies defoliated approximately 900 acres of mature western hemlock on Dall Island near Camp Cove. The highest sawfly larvae counts of the 1991 survey occurred at Calder Bay (northwest Prince of Wales Island) and at Thorne Island (northeast side of Prince of Wales Island). Sawfly populations will likely increase south of Frederick Sound in 1992.

SPRUCE BUD MOTH
Zeiraphera sp.

Populations of the spruce bud moth collapsed in Sitka spruce stands south of Yakutat. In 1990, approximately 8,600 acres were defoliated. No new defoliation was detected in 1991. Barring any unforeseen bud moth buildup in 1992, host recovery is expected.

LARGE ASPEN TORTRIX
Choristoneura conflictana Wlkr.

Tortrix populations decreased in 1991. Only 4,120 acres of defoliated aspen were detected this year versus 63,234 acres in 1990. The majority of the 1991 defoliation (2,414 acres) occurred on the Kenai National Wildlife Refuge near Skilak Lake and Skilak River.

SPEAR-MARKED BLACK MOTH
Rheumaptera hastata L.

Black moth populations increased slightly in Interior Alaska from 867 acres of defoliated birch in 1990 to 4,223 acres in 1991. Areas of concentrated defoliation occurred on 1,343 acres 12 miles south of Ruby along the Yukon River and on 1,500 acres near the confluence of the Kandik and Yukon Rivers. Further west along the Yukon River, 1,401 acres of defoliated birch were aerially detected 11 miles east of the Yukon River bridge. The 13,000 acres of defoliated birch in 1990 on the Kenai National Wildlife Refuge was not apparent during the 1991 aerial surveys.

WILLOW DEFOLIATION

The amount of willow defoliation increased dramatically throughout South-Central and Interior Alaska in 1991 as a direct result of two consecutive unseasonably warm, dry springs and early summers. 1991 aerial surveys detected more than 130,000 acres of defoliated willow; four times the area defoliated in 1990. The most heavily defoliated areas occurred throughout the riparian zones along the Yukon, Kuskokwim, Mulchatna, and Nusagak Rivers as well as in the Lake Clark/Iliamna area and portions of the Seward Peninsula. Areas along the Seward Highway near Moose Pass on the Kenai Peninsula were also defoliated. Willow defoliation was also evident along the highway west of Haines. Although larval numbers were high and defoliation heavy in these areas, many impacted willow had refoliated by August. Hardwood shrubs are resilent species capable of withstanding several years of heavy defoliation with minimal impact. In some cases heavy defoliation may kill back the older shoots resulting in a spurt of new growth the following spring. There is no specific single causal agent involved in this defoliation but rather a varied group of defoliators. Willow along the Yukon river was primarily defoliated by leaf and blotch miners (Cosmopterygidae, Gelechiidae, and Gracilariidae). These are very small caterpillars which feed between the upper and lower leaf epidermis. Leaves which have been fed upon have a brownish-papery appearance. External defoliators such as noctuid and tortricid caterpillars were responsible for the majority of defoliation in the Anchorage Bowl and Lake Clark/Iliamna areas. Leaf beetles (*Chrysomela* sp.) were the most commonly encountered willow defoliator on the Kenai Peninsula.

Rusty tussock moth populations (*Orgyia antiqua* (L)) increased to epidemic proportions throughout areas of the Kuskokwim River drainage and portions of the Seward Peninsula. This tussock moth has a wide distribution including Europe, southern Canada, and the northern United States. In the west, it is distributed from California to Alaska and common hosts include alder, blueberry, willow, birch, and western hemlock and some spruces.

In Alaska, most rusty tussock moth populations are found on willow. There is probably only one generation per year in Alaska overwintering in the egg stage.

COTTONWOOD DEFOLIATION
***Chrysomela* sp. and *Lyonetia* sp.**

Approximately 13,736 acres of defoliated cottonwood were detected in 1991. Sixty percent of this defoliation occurred in Interior Alaska, most near Holy Cross and Unalakleet, and was probably a result of river flooding and not insect damage. The remaining 5,448 acres of defoliated cottonwood occurred in Prince William Sound near Cape Yakataga and was brought about by the combined feeding of leaf miners and leaf beetles.

Leaf beetles defoliated approximately 1,500 acres of cottonwood and willow along the Dangerous River near Yakutat. Cottonwood defoliation by leaf beetles, totalling approximately 3,500 acres, was noted in Southeast Alaska along the Antler, Stikine, Taku and Unuk Rivers. Consecutive years of heavy defoliation may result in a limited growth reduction and some top kill.

BIRCH DEFOLIATION

A few hundred acres of birch were heavily defoliated on Ft. Richardson Military land along the southside of the Glenn Highway near Ship Creek. Defoliation was heavy and apparent throughout July and August. The causal agents appear to be Noctuid caterpillars belonging to the genera, *Sunira* and *Parastichtis*. Final identification is pending. Damage appears to be more cosmetic than harmful. If 1992 spring weather conditions are once again unseasonably warm and dry, we can expect continued heavy defoliation. Leaf miners defoliated birch along the highway near Haines for the third consecutive year, but host damage seemed insignificant.

STRIPED ALDER SAWFLY
Hemichroa crocea (Fourcroy)

Riparian zone alder in various localities in the Mat-Su Valley was heavily defoliated by large populations of the striped alder sawfly. No defoliation acreage figures are available. One of the heaviest areas of defoliation occurred along the banks of the Little Susitna River from Houston to the Burma Landing.

Previous alder sawfly activity has been more commonly encountered in coastal Southeast Alaska. In 1971 and 1972 the alder sawfly heavily infested young alder stands near Juneau. During 1991 in Southeast Alaska, alder sawflies defoliated approximately 300 acres of alder along the Stikine River. Heavy defoliation presumably slows the growth rate of affected trees, but no impact data are available.

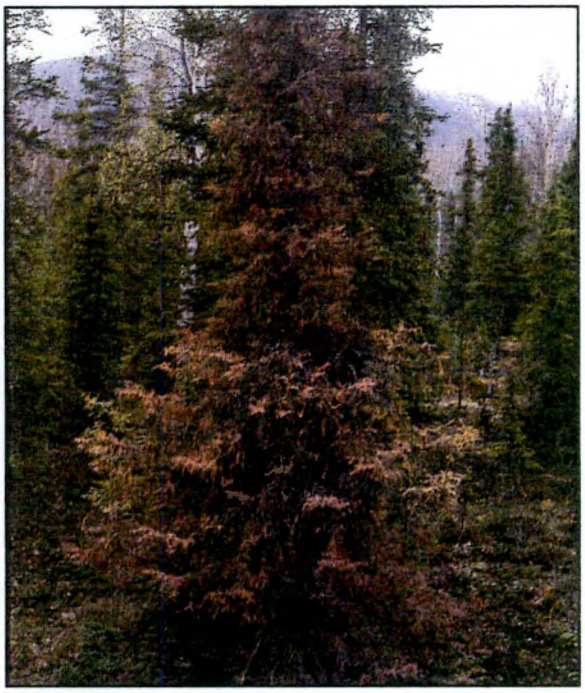

Figure 1. Black spruce on the Kenai Peninsula killed by spruce beetle. This rare occurrence is indicative of extremely high beetle populations.

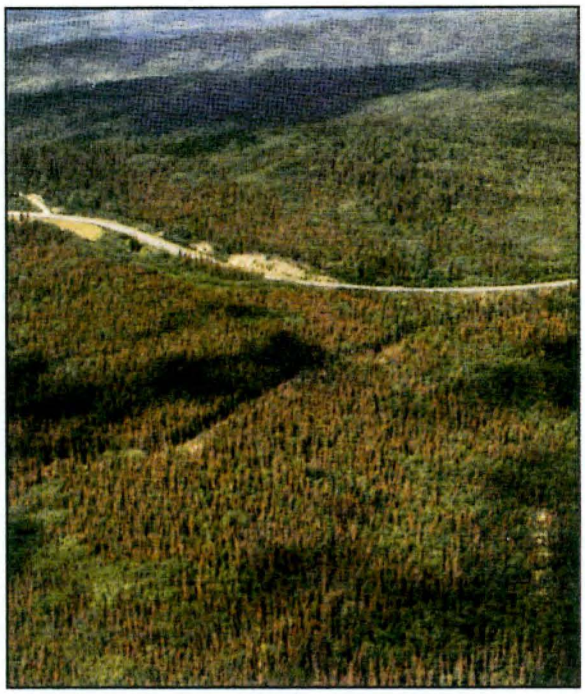

Figure 2. Eastern spruce budworm defoliation of white spruce near Fairbanks.

Figure 3. Spruce needle rust on Sitka Spruce.

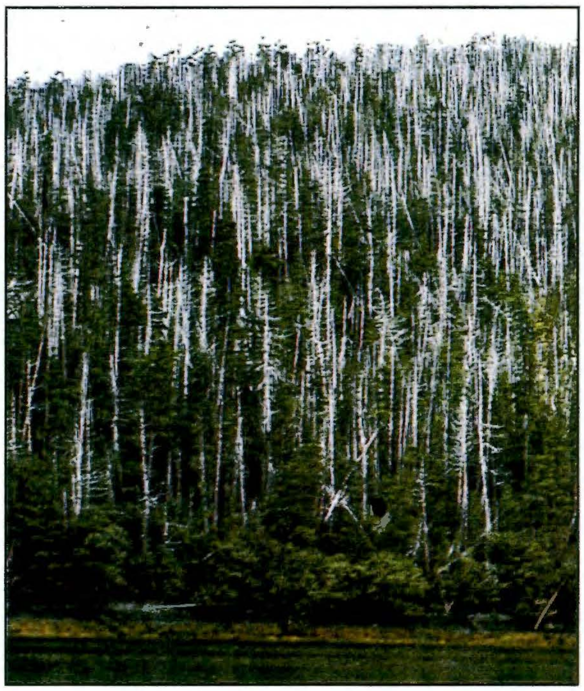

Figure 4. Decline and mortality of yellow-cedar now exceeds 500,000 acres in Southeast Alaska

STATUS OF DISEASES

HEMLOCK DWARF MISTLETOE

Arceuthobium tsugense (Rosendhal) G.N. Jones

Hemlock dwarf mistletoe is common in unmanaged, old-growth stands throughout southeast Alaska as far north as Haines. Within the range of western hemlock, dwarf mistletoe is absent from Cross Sound to the northwest along the Gulf of Alaska; thus, managers need not be concerned about the disease in these areas.

In southeast Alaska, old-growth hemlock stands vary in their level of infestation from stands in which almost every hemlock is infected to other stands in which the parasite is absent. Most old-growth stands at lower elevation have some level of infestation. Sitka spruce and mountain hemlock are only rarely infected. Heavily infected western hemlock trees have branch proliferations (witches-brooms), bole deformities, reduced radial growth, or may die--all potential problems in stands managed for wood production. The disease affects stand structure in unmanaged stands by causing mortality or by slowing growth of infected trees. When mixed-species stands are heavily infected, growth of resistant species such as Sitka spruce and the cedars may be enhanced. Witches-brooms may provide hiding or nesting habitat for birds or small mammals.

The principle forms of introduction of the parasite into young-growth stands are 1) infected non-merchantable hemlock trees (residuals) which are sometimes left standing in cut-over areas, 2) infected old-growth hemlocks on the perimeters of cut-over areas, and 3) infected advanced reproduction. Residuals may play the biggest role in the initial spread to young stands. Managers who use new techniques of forest management (New Perspectives, New Forestry) where large residuals are left standing in clearcuts or where harvest units are very small should consider the probable increased impact of dwarf mistletoe in hemlock regeneration.

A demonstration area near Thorne Bay on Prince of Wales Island, Alaska was developed to provide information on the recognition, biology, impact, and recommended silvicultural techniques for managing hemlock dwarf mistletoe in young-growth stands. Killing infected residual hemlocks (by girdling or felling) and discrimination against advanced reproduction during precommercial thinning can help reduce initial spread to young stands. Care in laying out cutting boundaries to avoid infected old-growth hemlock on clearcut perimeters is also highly recommended. Recent extensive surveys in young-growth stands up to rotation age in southeast Alaska indicate that the disease occurs at low frequency and low impact as long as residual trees are not present. Current studies are examining the incidence and impact of hemlock dwarf mistletoe in young-growth stands with large infected residuals present.

HEMLOCK CANKER

Xenomeris abietis Barr.

An outbreak of hemlock canker continued to develop from last year's onset on Prince of Wales Island. Small hemlocks and the lower crowns of large hemlock trees were killed along more than 60 miles of road.

The disease has been inconspicuous since 1985, the year of its last outbreak. In the 1985 outbreak, the disease was confined to old-growth stands along about 30 miles of roads on Prince of Wales Island. This year, the disease had a similar, although larger distribution and was again confined within about 100 ft of roads. However, in the current outbreak the disease was present in both old-growth and young-growth stands. As it killed more hemlock in managed young-growth stands, the disease became more of a management problem.

The causal agent is the fungus *Xenomeris abietis*, but it appears to be unable to damage trees far from roads. Apparently, road dust is necessary for the fungus to invade hemlock tissues successfully. The previous outbreak of the disease began before 1985 and before some roads were paved on Prince of Wales Island. None of the hemlock canker found this year was along paved roads, even though the disease was conspicuous in these locations during the previous outbreak. Thus, road dust may contribute to development of the disease.

SPRUCE NEEDLE CAST
Lirula macrospora (Hartig) Darker

L. macrospora causes the most important needle disease of Sitka spruce in coastal Alaska. The disease occurred at average infection levels in 1991. It was common on young Sitka spruce and the lower crowns of larger trees throughout coastal Alaska. The disease was especially visible in cutover areas and in urban areas. The life cycle of the fungus has recently been elucidated. The only needles infected are those that have recently emerged from buds in spring. Needles do not develop any symptoms until one year after infection, and the fungus does not produce infectious spores until needles have been infected for two years. The timing of sporulation coincides with bud break in the spring and ceases at about the time of full shoot elongation. Using this information, a study recently demonstrated that fungicides applied soon after spruce bud break successfully controls the disease.

SIROCOCCUS SHOOT BLIGHT
Sirococcus strobilinus Pruess.

Sirococcus shoot blight kills shoots and tops of western hemlock in young-growth stands in southeast Alaska. Sitka spruce is sometimes also attacked. The incidence of the disease was moderate in 1991. Young hemlocks in thinned stands have fewer infections than in nonthinned stands.

SHOOT BLIGHT OF YELLOW-CEDAR
Apostrasseria sp.

Shoot blight, caused by the fungus *Apostrasseria* sp., was abundant on regenerating yellow-cedar (*Chamaecyparis nootkatensis*) in southeast Alaska this year. The disease does not affect mature cedar trees. The incidence of shoot blight has not changed appreciably over the past several years. Attack by the fungus causes terminal and lateral shoots to be killed back 10 cm or so on seedlings and saplings during winter or early spring. Young seedlings are sometimes killed. The newly discovered fungus that causes the disease, *Apostrasseria* sp., is closely related to other fungi that cause disease to plants under snow. A recent study at Anita Bay on Etolin Island indicates that yellow-cedar seedlings planted near naturally regenerating yellow-cedar are more likely to become infected with *Apostrasseria* than seedlings planted well away from natural cedar regeneration. Inoculum source of the fungus probably explains this different level of infection.

SPRUCE NEEDLE RUST
Chrysomyxa ledicola Lagerh.

Spruce needle rust was abundant this year on Sitka spruce in Southeast Alaska and all species of spruce on the Kenai Peninsula and in Southwest Alaska (see Figure 3). Infection levels were particularly heavy in Juneau and Dillingham. The spores that infect spruce needles are produced on the alternate host, Labrador-tea (*Ledum* spp.), a plant that is common in boggy, poorly drained areas; thus the disease on spruce is most pronounced in these boggy (muskeg) areas. Although the disease can give spruce trees the appearance of being nearly dead, trees rarely, if ever, die from this disease even in years of intense infection.

SPRUCE BROOM RUST
Chrysomyxa arctostaphyli Diet.

Spruce broom rust causes perennial infections that result in dense clusters of branches on white, Lutz, Sitka, and black spruce. The incidence of the disease changes little from year to year. It is common wherever spruce grows near the alternate host, bearberry or kinnikinnik (*Arctostaphylus uva-ursi*) in Alaska. The disease is common in interior and south-central Alaska, where scattered individual trees are infected, but only occurs in localized areas of Southeast Alaska where the alternate host is common (e.g., Halleck Harbor area of Kuiu Island and Glacier Bay). The disease may cause slow growth on spruce, although this has not been determined by research. The dense clusters of branches and needles (brooms) are known to provide nesting and hiding habitat for many birds and perhaps for small mammals.

HEMLOCK NEEDLE RUST
Pucciniastrum vaccinii (Rab.) Joerst.

Hemlock needle rust occurred at low, endemic levels on needles of western hemlock this year. The alternate hosts for this rust fungus are blueberries (*Vaccinium alaskensis* and *V. ovalafolium*), which are very common understory plants in hemlock-spruce forests.

WESTERN GALL RUST
Endocronartium harknessii (J.P. Moore) Hirat.

The rust fungus *E. harknessii* continued to cause spherical galls on branches and main boles of shore pine. The disease was common throughout the distribution of pine in Alaska. Typically, the rust fungus does not kill pine tissues. Another fungus, *Nectria macrospora*, colonized and killed many of the pine branches with these galls this year. In cases where galls were located on the main bole, *N. macrospora* commonly caused top-kill.

FOLIAGE DISEASES OF CEDARS
Gymnosporangium nootkatense Arth. and ***Didymascella thujina*** (Durand) Maire

Two fungi that occur on the foliage of cedar, *Gymnosporangium* on

Alaska-yellow cedar and *Didymascella* on western redcedar, occurred at low, endemic levels this year. They neither severely defoliated nor killed cedar trees.

VENTURIA LEAF BLIGHT

Venturia populina Frabic.

Quaking aspen on the Kenai Peninsula, especialy around the Mile 35 area of the Seward Highway north of Moose Pass, were heavily impacted with leaf blight. Leaf blight causes infections on leaf tips which result in leaf distortion and discoloration. Normally the leaf bases remain alive. However, leaf beetle (Chrysomela sp.) populations were also feeding on infected leaves thus increasing the defoliation levels. However, overall impact on aspen health should be low with very little long term consequences. At worse, some limited branch dieback and growth reduction may have occurred. Control of leaf blight on ornamentals is by prunning blighted twigs; however, no practical control exists in forested stands.

YELLOW-CEDAR DECLINE

Yellow-cedar decline persists as one of the most spectacular and important forest diseases in Southeast Alaska (Figure 4). About 526,000 acres of decline have been mapped during aerial detection surveys. Concentrated mortality occurs in a wide band from western Chichagof and Baranof Islands to the Ketchikan Area. Ground surveys indicate that 65% of the basal area of Alaska yellow-cedar is dead on this acreage. Other tree species are relatively unaffected.

Cedar trees have probably died throughout southeast Alaska every year since the onset of the problem about 100 years ago. This year, as in the previous several years, dying discolored trees were particularly common in areas around south Wrangell Island and of Slocum Arm on Chichagof Island.

All research suggests that no contagious organism is the primary cause for this intensive and extensive mortality. Some abiotic (non-living) site factor, probably associated with the poorly-drained anaerobic soils where decline occurs, appears to be responsible for initiating and continuing cedar decline.

A detailed list of acreage affected by Alaska-yellow cedar decline has been determined from a composite map developed by mapping dead and dying cedar during annual aerial detection surveys conducted over the previous 22 years (Appendix A). Recent research suggests that the total acreage of cedar decline has been increasing very slowly; the slow increase in area of cedar decline is a result of the expansion of existing decline-affected areas (less than 1 m per year) of decline to adjacent stands. Contained within most declining stands are trees that died up to 100 years ago (snags still standing), more recently killed cedars, dying cedars (with yellow, red, or thinning crowns), healthy cedars, and other tree species.

HEMLOCK FLUTING

Fluting on the boles of western hemlock is common throughout southeast Alaska. Hemlocks with fluting have deeply incised grooves and ridges extending vertically along their boles; a condition that reduces the value of hemlock logs because they yield less sawlog volume and bark is contained in some of the wood. The cause of fluting is not completely known, but associated factors include increased wind-firmness of fluted trees, common occurrence on sites with shallow soils, triggering of fluting by growth release, and fluting on boles corresponding with patterns of translocation. Researchers have recently documented the presence of fluting in young hemlock stands.

DECAYS

Conifers. Decay fungi (including heart rot, sap rot, and butt rot fungi) cause substantial loss of wood volume in Alaskan forests. A comprehensive list of wood decay fungi found in Alaska would be quite extensive. Appendix B lists the more common species, and indicates, for each species, its known conifer hosts, type of decay, and mode of attack.

Decay problems are particularly serious in southeast Alaska where long-lived tree species predominate in old-growth forests, and the slow-growing decay fungi have ample time to cause significant losses. Decay fungi play an important role in the structure and function of coastal old-growth forests where fire and other forms of catastrophic disturbance are uncommon. By predisposing large old trees to bole breakage, these fungi serve as important disturbing factors that cause small scale canopy gaps.

The importance of decay fungi in managed young-growth conifer stands is less certain. Wounds to live trees caused by logging activities may allow decay fungi to cause appreciable losses. Studies in progress are investigating how frequently fungi enter wounds of different sizes and the rate of subsequent decay in these wounded trees.

In southeast Alaska, the following fungi are the most important causes of wood decay in live trees:

Sitka spruce
Fomitopsis pinicola
Phellinus pini
Armillaria sp.
Phaeolus schweinitzii
Laetiporus sulphureus

Western hemlock
Fomitopsis pinicola
Armillaria sp.
Heterobasidion annosum
Laetiporus sulphureus
Phaeolus schweinitzii
Phellinus robustus
Phellinus pini

Western redcedar

Poria albipellucida
Phellinus weirii

With the exception of *Armillaria* sp., all decay fungi important on Sitka spruce are also important in decay of white spruce in south-central and interior Alaska (and on Lutz spruce on the Kenai Peninsula). In addition, significant volume loss occurs in white and Lutz spruce from butt rot caused by *Coniophora puteana*, and recent studies indicate that *Pholiota alnicola* is an important cause of butt rot in Lutz spruce on the Kenai Peninsula.

Saprot fungi typically decay dead branches and large woody debris and therefore play an essential role in recycling wood in nondisturbed forests. However, saprot decay also routinely becomes established in spruce trees attacked by spruce bark beetles. Large volumes of potentially recoverable timber volume are currently being lost annually on the Kenai Peninsula, where salvage logging has not kept pace with tree mortality from the continuing spruce beetle outbreak. Significant volume loss from saprot appears to begin about 4-5 years following tree death. Several species of saprot fungi (Appendix B) are associated with spruce beetle-caused mortality, but *Fomitopsis pinicola* occurs most commonly.

At population levels typical in an outbreak, spruce beetles show little or no preference for trees weakened by disease. Attacks are frequently successful even when trees are relatively healthy because beetles attacking individual trees in mass are able to overcome host defenses. Recent studies on the Kenai Peninsula have examined the relation between spruce beetle activity and root disease occurrence when spruce beetle populations are at endemic (low) levels. Results indicate that trees with moderate to severe root decay are preferentially attacked by beetles when a local beetle population is still relatively small. Diseased trees were often observed to be attacked lightly by beetles for a few, to several, consecutive years before succumbing to beetle attack. Once successfully attacked, diseased trees served as focal points for new attacks on neighboring trees. Root disease conditions in a stand may therefore have a significant influence on the population dynamics of endemic spruce beetle populations.

Hardwoods. Heart rots are the most important cause of volume loss in Alaskan hardwood species. Incidence of heartrot in hardwood species of interior and south-central Alaska is generally high by the time a stand has reached maturity (about 50 years old). Substantial volume loss can be expected in stands 80 years old or older. Detailed data on volume losses by stand age class and forest type are currently lacking; large scale studies are needed to better characterize these relationships.

Pleurotus sp. and *Pholiota* sp., which produce annual sporophores, commonly occur on trembling aspen, black cottonwood, and paper birch, but are not as common as heartrot fungi that form perennial sporophores on these tree species. *Phellinus igniarius* (L. ex Fr.) Quel. and *Fomes fomentarius* (Fr.) Kichx. account for the majority of decay in paper birch, with the former stem decay fungus being the most important in terms of both incidence and decay volume. *Phellinus tremulae* (Bord.) Bond & Boriss. accounts for the majority of stem decay in both trembling aspen and black cottonwood.

STATUS OF ANIMAL DAMAGE

PORCUPINE
Erethizon dorsatum

Porcupines continued to cause damage to tree species in southeast Alaska. This year, an extensive survey continued to document levels of porcupine damage in young-growth stands in southeast Alaska. Thus far, damage is confined to the known distribution of porcupine and is most common on Sitka spruce and western hemlock. Damage is especially serious on Mitkof Island in southeast Alaska. Other damage has been noted at Thomas Bay, Cleveland Peninsula, Bradfield Canal, Anita Bay, Douglas Island, the Juneau area, and the Haines area. Shore pine near Haines received notable damage the last few years.

Survey results indicate that the feeding behavior of porcupines changes as stands age and trees become larger and older. Porcupines climb smaller trees and kill or cause topkill by removing bark along the entire bole, or the bole near the top of the tree. As trees become larger, somewhere around 40-50 years old, porcupines climb fewer trees and most of the damage is caused by basal wounding. Most of these larger trees are not killed, but the large basal scars allow fungi to enter the bole and begin to cause wood decay.

BROWN BEAR
Ursus arctos

The lower boles of Alaska-yellow cedar trees were wounded in spring on Baranof and Chichagof Islands, particularly in the Peril Strait and Slocum Arm areas. Other tree species were unaffected. Trees with old scars have associated columns of wood decay that will limit the value of their butt logs.

INTEGRATED PEST MANAGEMENT ACTIVITIES

Integrated pest management has been described as a "systems approach to reducing pest damage to feasible levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical pesticides." Current FPM activities in Region 10 include:

(1) Participation in a cooperative effort with Alaska Agricultural Research Station and the Cooperative Extension Service to provide pest management information to Alaska residents. The program, which includes education, research and survey activities, provides integrated pest management information concerning urban forestry and garden and greenhouse pests. This program includes an IPM Newsletter that is published monthly throughout the summer. There were eight pest scouts (6 full-time, 2 part-time) in seven communities in Alaska: Fairbanks, Delta Junction, Palmer, Anchorage, Soldotna, Juneau, and Kodiak. In 1991, pest scouts made over 3,000 contacts including 400 site visits.

(2) An aerial and ground application of methylcyclohexenone (MCH) for the prevention of spruce beetle attacks and population build-up in downed material was undertaken in the spring of 1991. MCH is the naturally occurring anti-aggregating pheromone of the spruce beetle. That is, it functions as a repellent. The project was undertaken on a recently constructed gas-line right-of-way (ROW) between Beluga and Tyonek on the west side of Cook Inlet. The objective of the study was to test the effectiveness of various dosages and application techniques of a formulated slow release pellet of MCH in reducing or eliminating spruce bark beetle build-up in downed ROW debris. There were no significant differences between aerial treatments and untreated check plots. Lack of significance was attributed to poor distribution of pellets. The ground application, with its greater control over deployment and final location of pellets, resulted in a reduction in the number of spruce beetle attacks and subsequent

population build-up. Follow-up studies are planned for 1992.

(3) A study was undertaken last summer to evaluate the effectiveness of covering spruce beetle infested logs with visqueen in order to sufficiently raise the sub-cortical temperatures of the logs to kill developing spruce beetle brood. Fifteen infested bolts were each covered with black and clear visqueen. An additional 15 infested bolts were left untreated as a check. Thermistors were used to record ambient and sub-cortical temperatures of the treated and untreated check logs. Post-treatment sampling indicated no significant increases in mortality due to the visqueen treatments. Apparently, summer temperatures in South-Central Alaska are not warm enough to raise visqueen covered log temperatures sufficiently high enough to kill developing spruce beetle brood.

4) A U.S. Forest Service, Forest Pest Management, sponsored survey of residents and visitors to the Kenai Peninsula, Alaska, revealed several consistent patterns of perceptual and attitudinal responses to the on-going spruce bark beetle outbreak in the area. Residents and visitors consistently rated bark beetle damaged forest vistas lower in scenic beauty, and the more tree mortality present the lower the perceived scenic beauty.

Results indicated that the majority of residents and visitors in the designated study area noticed the dead trees, and most were aware that the spruce bark beetle was the killing agent. Residents cited <u>increased fire danger</u>, <u>loss of scenic beauty</u>, and <u>loss of wildlife habitat</u> as the most important effects of the spruce bark beetle damage. <u>Decreased attractiveness to tourists</u>, <u>loss of timber values</u>, and <u>decreased property values</u> were judged as less important effects. The Alaska state survey confirmed the high levels of awareness and concern about the spruce bark beetle outbreak, with over 70% volunteering that bark beetle damage is the major problem affecting Kenai Peninsula forests. Residents cited <u>less attractive views</u>, <u>increased fire threat</u>, and <u>loss of privacy</u> as the most important effects of the beetle outbreak.

The Forest Service sponsored survey sought to determine the cicumstances under which respondents would agree with the policy of "letting nature take its course" in the bark beetle outbreak. There was strong agreement with this policy for areas "far" from developed areas when damage was expected to be "less severe", but disagreement with the policy for areas "near" developments when damage was expected to be "more severe". Similarly, the state survey showed strongest support (49%) for leaving damaged forest areas "as is" in the backcountry, while there was slightly less support (42%) for cutting, burning, and replanting backcountry areas. This is in contrast to greater than a 60/40 split favoring treatment along hihways and nearly 80% favoring treatment near homes.

Several conclusions are indicated by the Forest Service survey of public perceptions of the effects of the spruce bark beetle outbreak. These conclusions are also supported by the related survey conducted for the State of Alaska:

1. The substantial majority of residents and visitors notice the large numbers of dead trees in the Cooper Landing study

area, and most are aware that the spruce bark beetle is the cause of tree mortality.

2. Both residents and visitors cite loss of scenic values as an important effect of the beetle damage, and visitors consistently report siteseeing as a dominant activity, and indicate views (of mountains, forests, and coastlines) as a major factor affecting the quality of their visit to Alaska.

3. Scenic beauty perceptions and preferences for alternative forest condition scenarios consistently show that visitors and residents: a) indicate decreased scenic values as the number of dead trees in a scene increases, b) prefer treatments of damaged forest stands that accelerate recovery of forest cover, and c) prefer a preventative thinning scenario to a no-control scenario that results in substantial bark beetle-induced tree mortality.

4. Respondents expressed high agreement with a policy of allowing "nature to take its course" in backcountry areas where damage was indicated as "less severe", but expressed disagreement with this policy for areas near devlopments, especially when damage is "more severe".

In sum, the survey reveals that there is a high level of awareness of bark beetle effects on the forest and that these effects are consistently perceived as having negative consequences for important scenic values.

SUBMITTING INSECTS AND DISEASES FOR IDENTIFICATION

The following procedures for the collection and shipment of specimens should be used for submitting samples to specialists:

I. Specimen collection:
   1. Adequate material should be collected
   2. Adequate information should be noted, including the following:
      a. Location of collection
      b. When collected
      c. Who collected the specimen
      d. Host description (species, age, condition, # of affected plants)
      e. Description of area (e.g., old or young forest, bog, urban);
      f. Unusual conditions (e.g., frost, poor soil drainage, misapplication of fertilizers or pesticides?).
   3. Personal opinion of the cause of the problem is very helpful

II. Shipment of specimens:
   1. General: Pack specimens in such a manner to protect against breakage.
   2. Insects: If sent through the mail, pack so that they withstand rough treatment.
      a. Larvae and other soft-bodied insects should be shipped in small screw-top vials or bottles containing at least 70% isopropyl (rubbing) alcohol. Make certain the bottles are sealed well. Include in each vial adequate information, or a code, relating the sample to the written description and information. Labels inserted in the vial should be written on with pencil or India ink. Do not use a ballpoint pen, as the ink is not permanent.
      b. Pupae and hard-bodied insects may be shipped either in alcohol or in small boxes. Specimens should be placed between layers of tissue paper in the shipping boxes. Pack carefully and make certain that there is very little movement of material within the box. Do not pack insects in cotton.
   3. Needle or foliage diseases: Do not ship in plastic bags. Sprinkle lightly with water before wrapping in newspaper. Pack carefully and make sure that there is very little movement of material within the box. Include the above collection information. For spruce and other conifers, include a description of whether current year's-needles, last-year's needles, or old-needles are attacked.
   4. Mushrooms and conks (bracket fungi): Do not ship in plastic bags. Either pack and ship immediately, or first air dry and then pack. To pack, wrap specimens in dry newspaper and pack into a shipping box with more newspaper. If on wood, include some of the decayed wood. Be sure to include all collection information.

III. Shipping:
   1. Ship as quickly as possible, especially if specimens are fresh and not air-dried. If samples cannot be shipped rapidly, then store in a refrigerator.
   2. Include address inside shipping box.
   3. Mark on outside: "Fragile: Insect-disease specimens enclosed; For scientific purposes only; No commercial value."

FOREST INSECT AND DISEASE BIOLOGICAL EVALUATIONS, TECHNICAL REPORTS, AND MISCELLANEOUS PUBLICATIONS

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MAILING LIST UPDATE AND REVISION

At this time, we wish to update our mailing list of all cooperators. Only those persons or agencies returning this form by June 15, 1992 will receive subsequent mailings of reports. Please complete this form and return to:

Forest Pest Management
USDA Forest Service
201 E. Ninth Ave., Suite 206
Anchorage, Alaska 99501

Your current address:

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I would like to receive the following publications:
(please check one or more)

O Entomology biological evaluations
O Pathology biological evaluations
O Technical reports - entomology
O Technical reports - pathology
O Forest Pest Management Annual Reports

Appendix A

ACREAGE AFFECTED BY ALASKA YELLOW-CEDAR IN SOUTHEAST ALASKA

AS OF 1991

	Acres
NATIONAL FOREST LAND	500,406
Chatham Area	132,590
Juneau Ranger District	1,167
Hoonah Ranger District	2,179
Sitka Ranger District	
Chichagof I	36,897
Baronof I	58,564
Kruzof I	27,971
Total	123,432
Admiralty Island Nat'l Mon. Wilderness	5,812
Stikine Area	220,794
Petersburg Ranger District	
Kupreanof I	79,602
Kuiu I	66,030
Mitkof I	5,644
Woewodski I	2,258
Mainland	7,707
Total	161,241
Wrangell Ranger District	
Etolin I	22,341
Wrangell I	14,313
Zarembo I	9,496
Woronofski I	622
Mainland	12,781
Total	59,553
Ketchikan Area	147,022
Thorne Bay Ranger District	
Prince of Wales I	27,024
Kosciusko I	12,027
Heceta I	685
Total	39,736

	Acres
Ketchikan Area (continued)	
Craig Ranger District	
Prince of Wales I	36,637
Dall I. and Long I	1,323
Total	37,960
Ketchikan Ranger District	
Revillagigedo I	19,382
Gravina I	3,200
Mainland	19,070
Total	41,652
Misty Fjords Nat'l Mon. Wilderness	
Revillagigedo I	11,599
Mainland	16,075
Total	27,674
NATIVE LAND	17,511
Prince of Wales I	10,196
Kupreanof I	312
Sukkwan I	156
Ketchikan area	5,058
Annette I	1,789
STATE AND PRIVATE LAND	8,718
Sitka area	1,246
Mitkof I	1,362
Kupreanof I	234
Prince of Wales I	632
Wrangell area	311
Pelican area	156
Ketchikan area	1,508
Gravina I	2958
Koscusko I	311
TOTAL LAND AFFECTED	526,567

Appendix B

DECAY FUNGI ASSOCIATED WITH SPRUCE AND HEMLOCK IN ALASKA.

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Antrodia albobrunnea (Rommell) Ryvarden	WS	BC	S-HR
Antrodia carbonica (Overh.) Ryv. & Gilbn.	SS, WH	BC	S-HR
Antrodia crassa (Karst.) Ryvarden	WS	BR	S-HR,SR
Antrodia heteromorpha (Fr.) Donk	WS	BC	S-HR,SR
Antrodia serialis (Fr.) Donk	WS, SS	BC	S-HR
Antrodia xantha (Fr.) Ryv.	WS	BC	S-HR,SR
Armillaria ostoyae (Romagn.) Herink	WS, SS, WH, MH?	YS	P,S-R&B
Bjerkandera adusta (Willd.:Fr.) Karst.	WS	WR	P-SR
Botryobasidium vagum (Berk. & Curt.) Rogers	WS	WR	?
Ceriporiopsis rivulosa (Berk. & Curt.) Gilbn. & Ryv.	WS, SS, WH	WSR	P-HR
Chondrostereum purpureum (Fr.) Pouz.	WS	WR	S-SR
Climacocystis borealis (Fr.) Kotl. & Pouz.	SS	WMR	P-HR
Coniophora puteana (Schum. ex Fr.) Karst.	WS, WH	BC	P,S-R&B,HR,SR
Crustoderma dryinum (Berk. & Curt. in Berk.) Parm.	WS	WR	P-SR?
Dichomitus squalens (Karst.) Reid	WS	WPR	P-HR
Diplomitoporus crustulinus (Bres.) Dom.	WS	WR	S-SR
Diplomitoporus lindbladii (Berk.) Gilbn. & Ryv.	WS	WR	S-HR,SR
Echinodontium tinctorium (Ell. & Ev.) Ell. & Ev.	MH, WH?	YS	HR
Fomitopsis officinalis (Vill.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-HR,SR
Fomitopsis pinicola (Swartz.:Fr.) Karst.	WS, SS, WH, MH	BC	P,S-HR,SR
Fomitopsis cajanderi	WS, WH	BC	P,S-HR
Ganoderma applanatum (Pers.:Wallr.) Pat.	WS, SS, WH	WSR	S-HR,SR
Ganoderma oregonense Murr.	SS, WH	WSR	S-HR,SR
Gloeophyllum odoratum (Wulf.:Fr.) Imazeki	WS	BR	S-HR,SR
Gloeophyllum saepiarium (Wulf.:Fr.) Karst.	WS	BR	S-HR,SR
Hericium abietis (Weir in Hubert) Harrington	SS, WH, MH	WPR	P-HR,SR
Heterobasidion annosum (Fr.) Bref.	SS, WH	WPR	P-R&B,HR
Inonotus tomentosus (Fr.) Gilb.	WS, SS, MH	WPR	P-R&B
Laetiporus sulphureus (Bull.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-R&B
Laurilia sulcata (Burt) Pouz.	WS	WR	P-R&B
Lentinus kauffmanii Smith	SS	BPR	P-R&B
Perenniporia subacida (Peck) Donk	WS	WSR	P-R&B
Phaeolus schweinitzii (Fr.) Pat.	WS, SS, WH	BC	P-R&B
Phanerochaete gigantea (Fr.:Fr.) Rattan	WS	WR	P-SR

See footnotes at end of table.

Decay fungi associated with spruce and hemlock in Alaska (continued).

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Phanerochaete laevis (Pers.:Fr.) Fr.	WS	WR	S-HR?
Phellinus pini (Thore ex Fr.) Pil.	WS, SS, WH, MH	WPR	P-HR
Phellinus punctatus (Fr.) Pilat	WH	WR	S-HR,SR
Phellinus robustus (Karst.) Bourd. & Galz.	WH, MH	WR	P-HR,SR
Phellinus viticola (Schw.:Fr.) Donk	WS	WR	S-HR,SR
Pholiota alnicola (Fr.) Sing.	WS	YS	P-R&B
Pholiota aurivella (Bat. ex Fr.) Kumm.	WS, SS, WH	BMR	P-HR
Postia (Oligoporia) balsamea (Peck) Julich	WS, SS, WH	BC	P-R&B,SR
Postia (Oligoporia) guttulata (Peck) Julich	WS	BC	P-R&B
Postia (Oligoporia) placenta (Fr.) M.J. Larsen & Lombard	SS, WH	BC	S-HR,SR
Postia (Oligoporia) sericeomollis (Rommell) Julich	WS, SS, WH	BC	P,S-HR
Pycnoporellus alboluteus (Ell. & Ev.) Kotl. & Pouz.	WS	BC	S-SR
Scytinostroma galactina (Fr.) Donk	WS, WH	YS	P-R&B
Stereum sanguinolentum (Alb. & Schw.:Fr.) Fr.	WS, SS, WH, MH	YS	P,S-HR,SR
Trametes versicolor Fr.	SS, WH	WSR	S-SR
Trichaptum abietinus (Dicks.:Fr.) Ryvarden	WS, SS, WH	WPR	S-SR
Veluticeps abietina (Pers.:Fr.) Hjort. & Telleria	SS, WH	BC	S-HR

[a]Host species are: SS, Sitka spruce; WS, white spruce; MH, mountain hemlock; WH, western hemlock.

[b]Types of decay are: WR, white rot; YS, yellow stringy or yellow spongy rot; WMR, white mottled rot; WSR, white stringy or white spongy rot; WPR, white pocket rot; BR, brown rot; BC, brown cubical rot; BPR, brown pocket rot; BMR, brown mottled rot.

[b]Mode of attack is defined in a two-part code given as A-B. Before the hyphen, P and S are used to indicate primary and secondary attack, respectively. Primary attack means the decay typically occurs in living trees. After the hyphen, the codes R&B, HR, and SR are used to refer to root & butt rot, heart rot, and sap rot, respectively.

United States
Department of
Agriculture

Forest Service

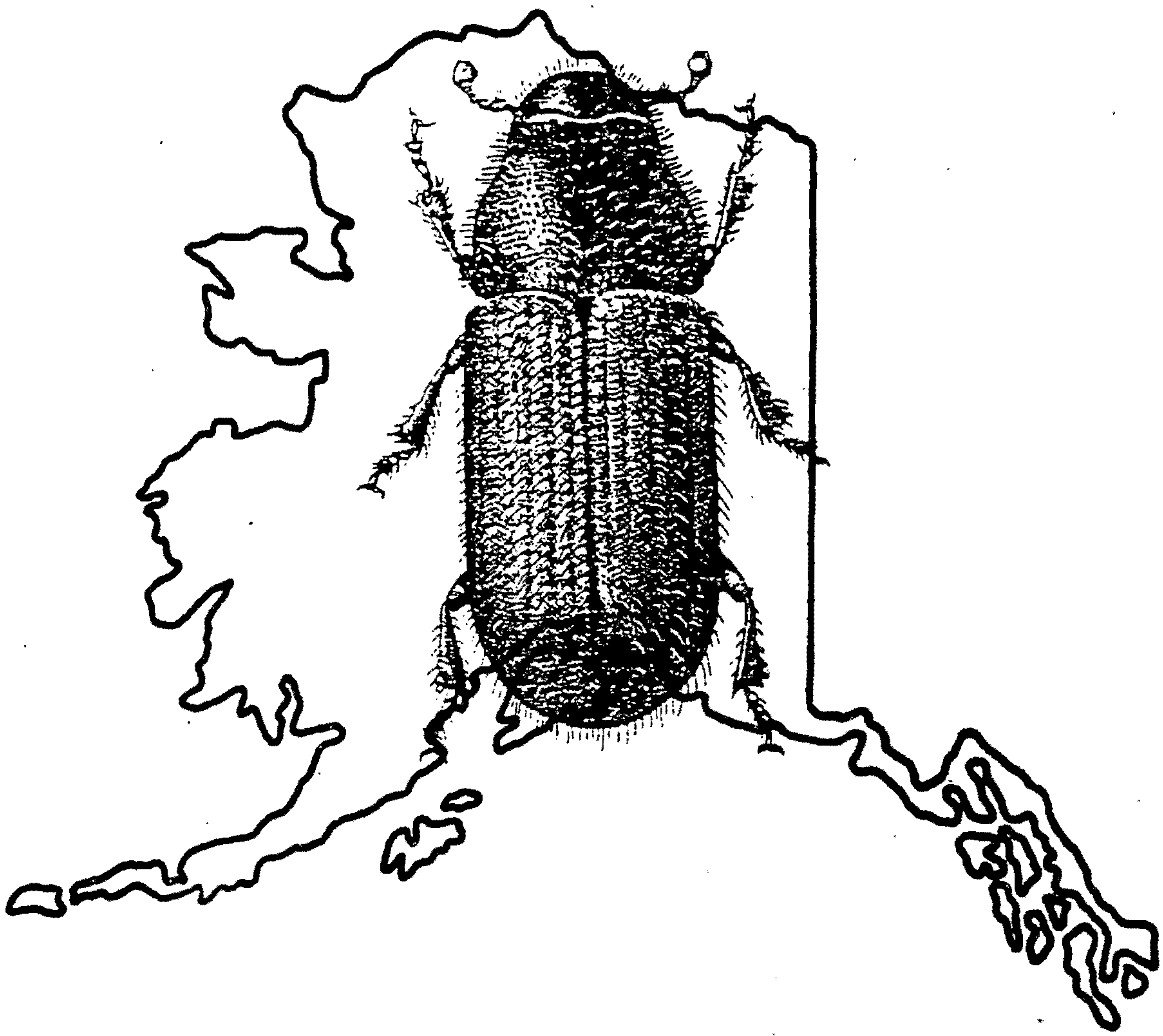
Alaska
Region

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

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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).

1941-1950

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 apparent 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

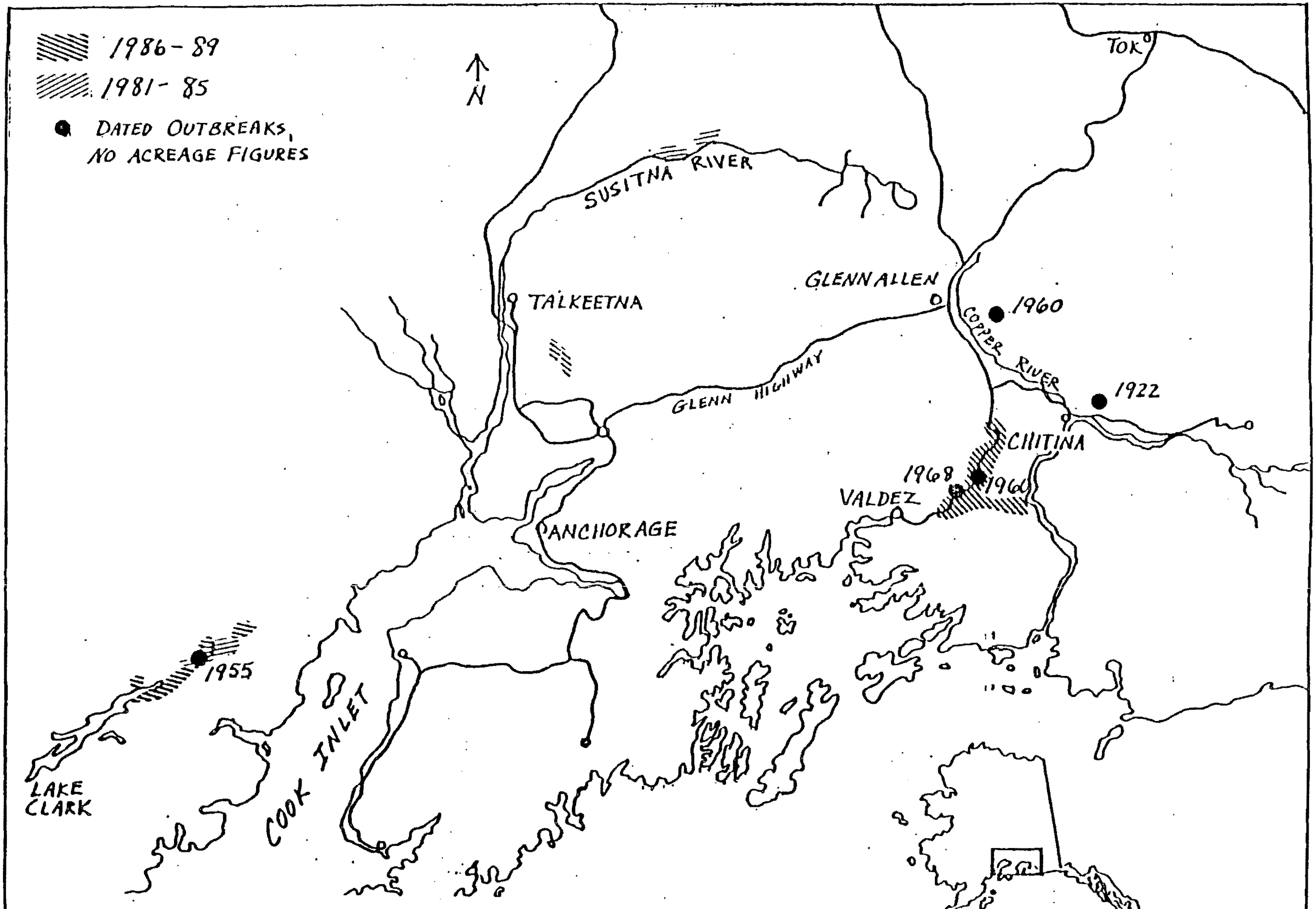

Figure 1a. Location of spruce beetle outbreaks in south-central Alaska except for the Kenai Peninsula.

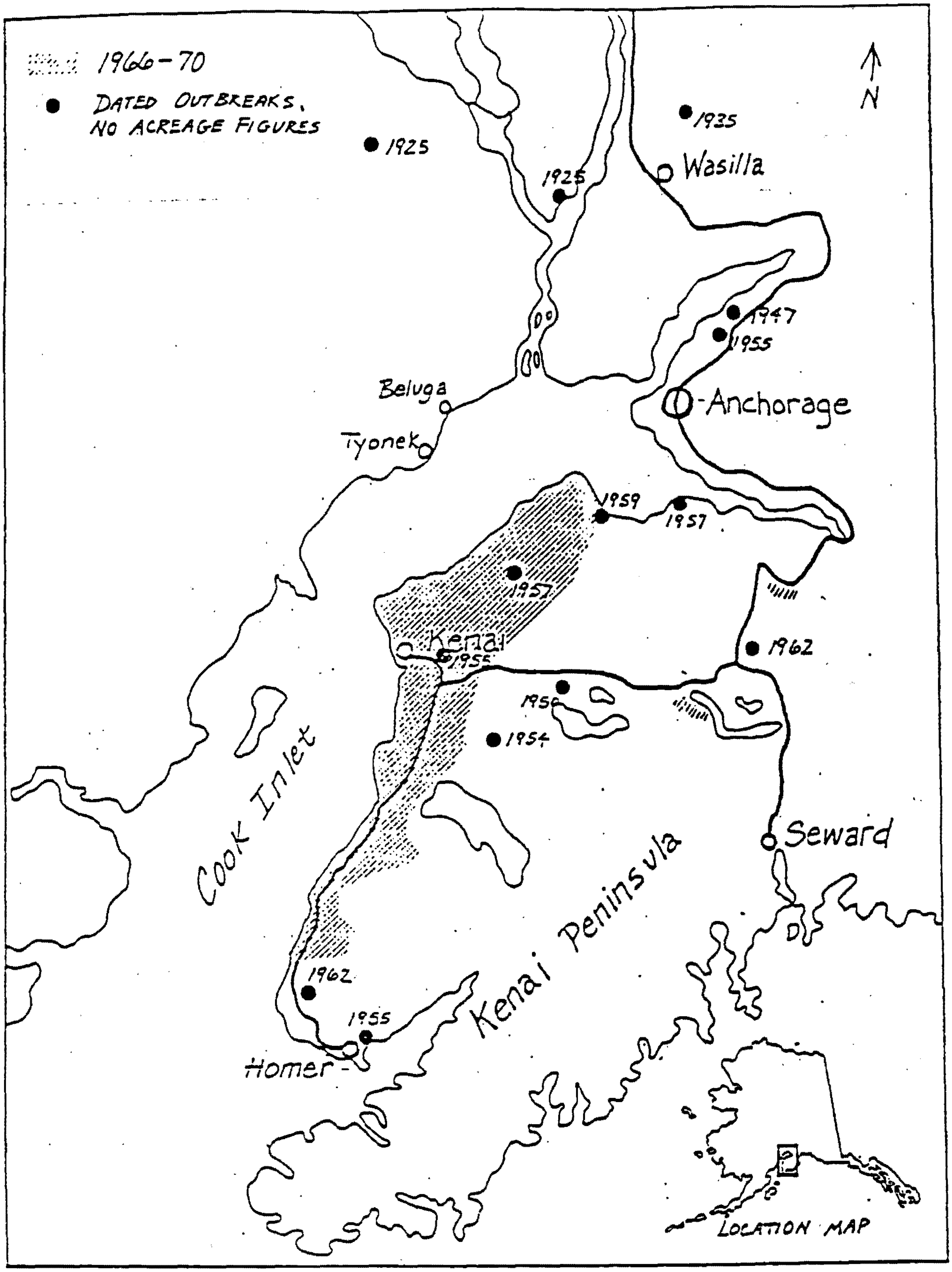

Figure 1b. Location of spruce beetle outbreaks in south-central Alaska up to 1970; specifically on the Kenai Peninsula.

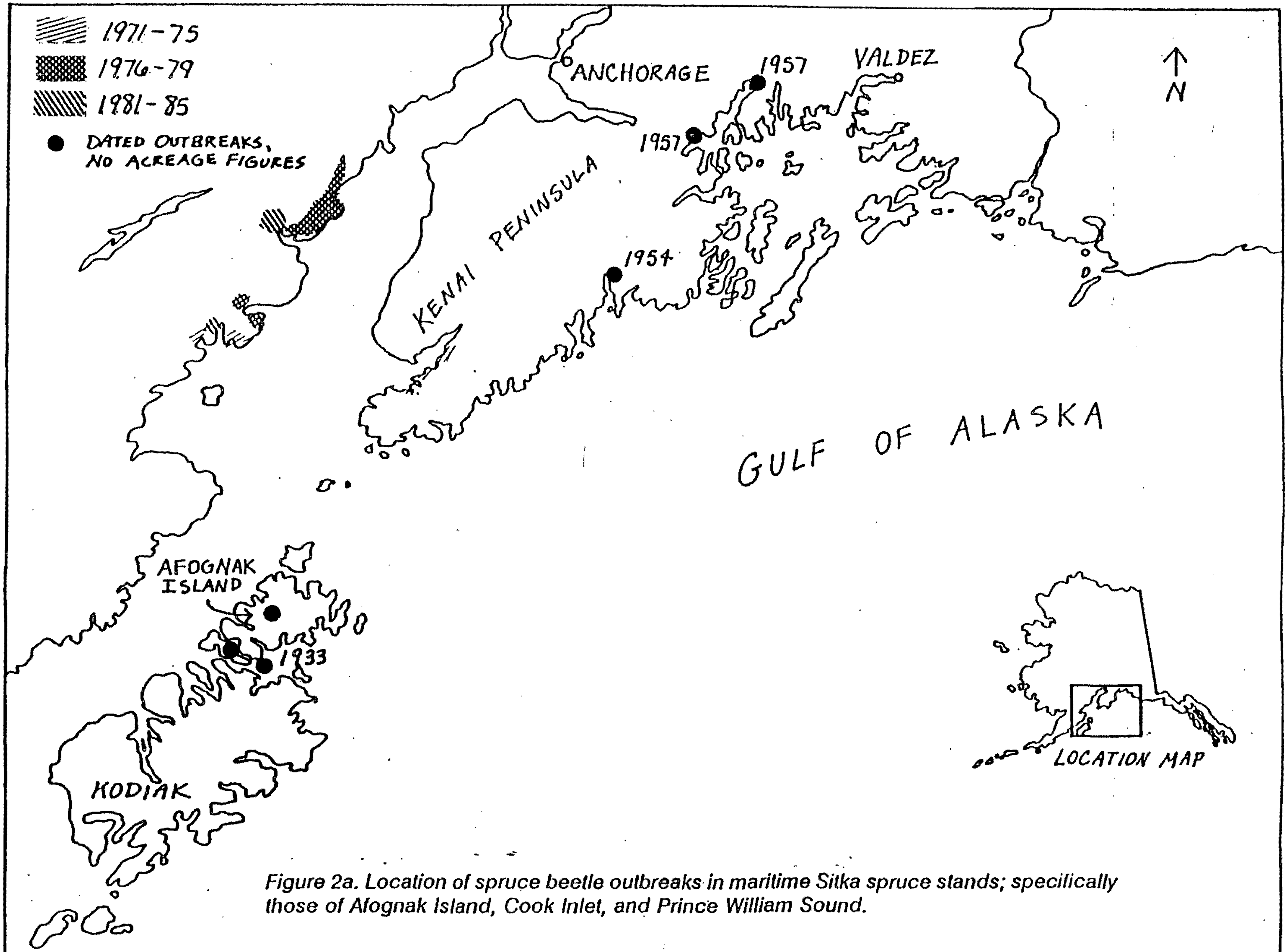

Figure 2a. Location of spruce beetle outbreaks in maritime Sitka spruce stands; specifically those of Afognak Island, Cook Inlet, and Prince William Sound.

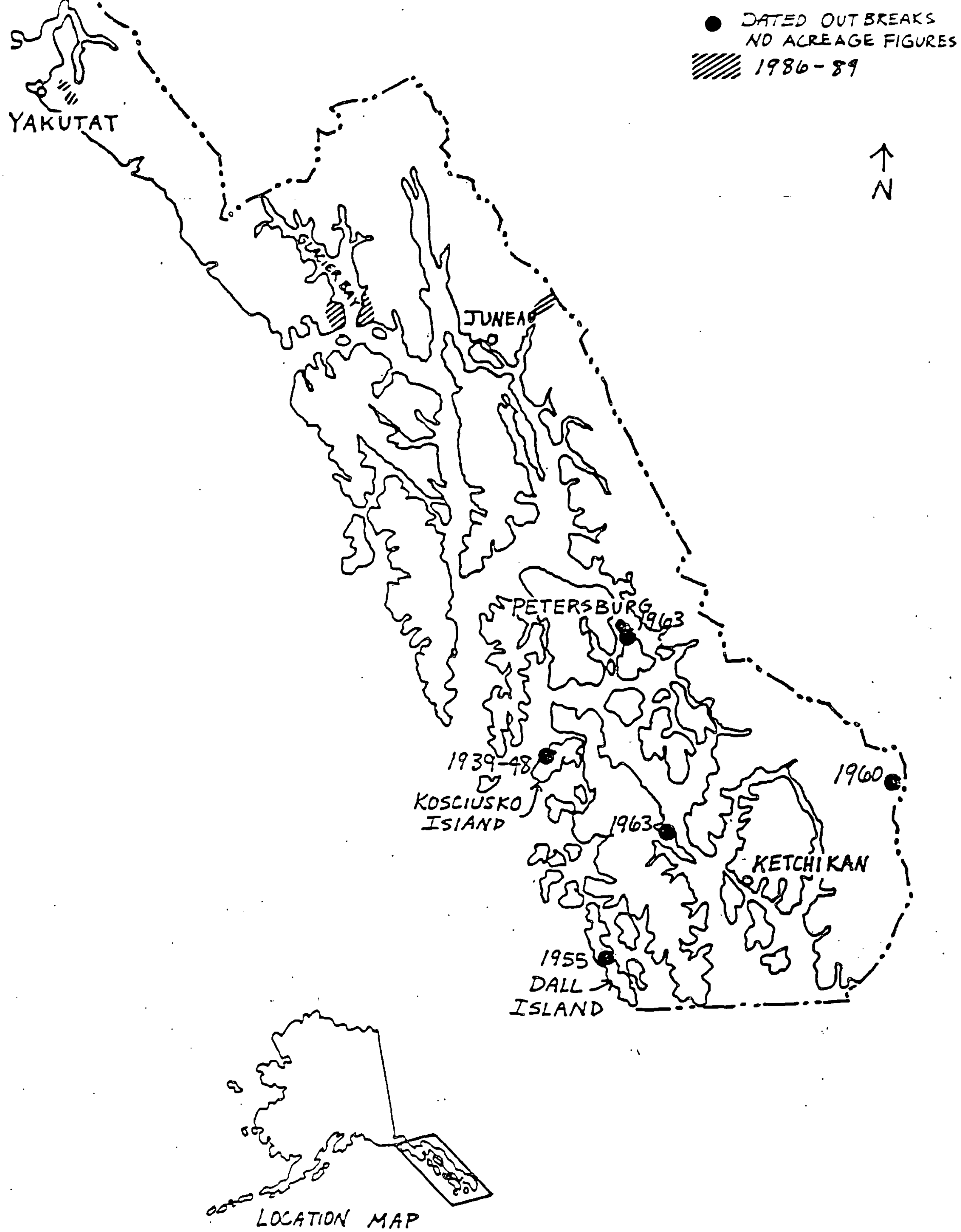

Figure 2b. Location of spruce beetle outbreaks in southeast Alaska's maritime Sitka spruce stands.

(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 portion 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).

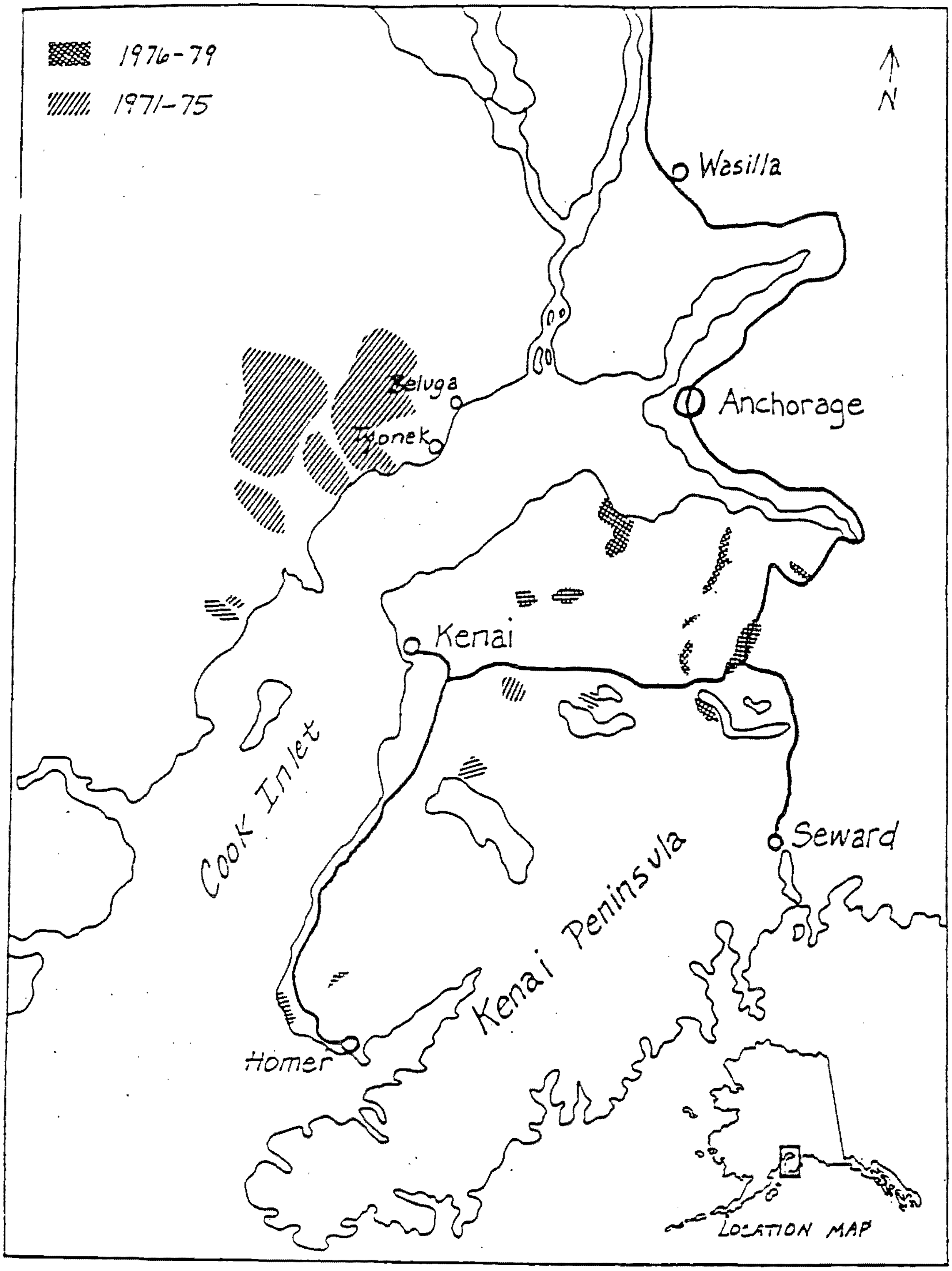

Figure 1c. Location of spruce beetle outbreaks from 1971-1979 in south-central Alaska; specifically on the Kenai Peninsula and the west side of Cook Inlet.

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 southwest 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).

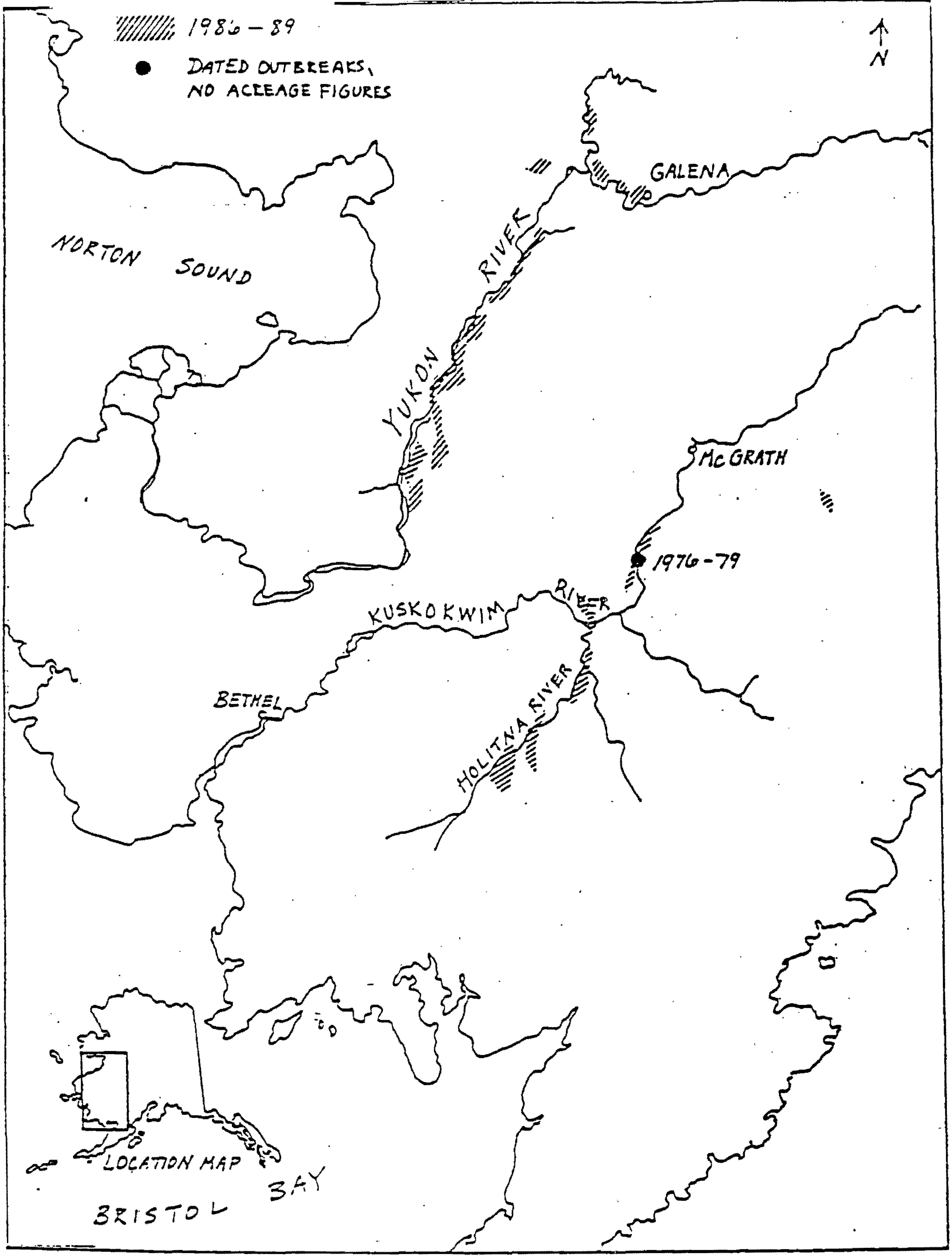

Figure 3. Location of spruce beetle outbreaks in interior Alaska's white spruce stands.

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).

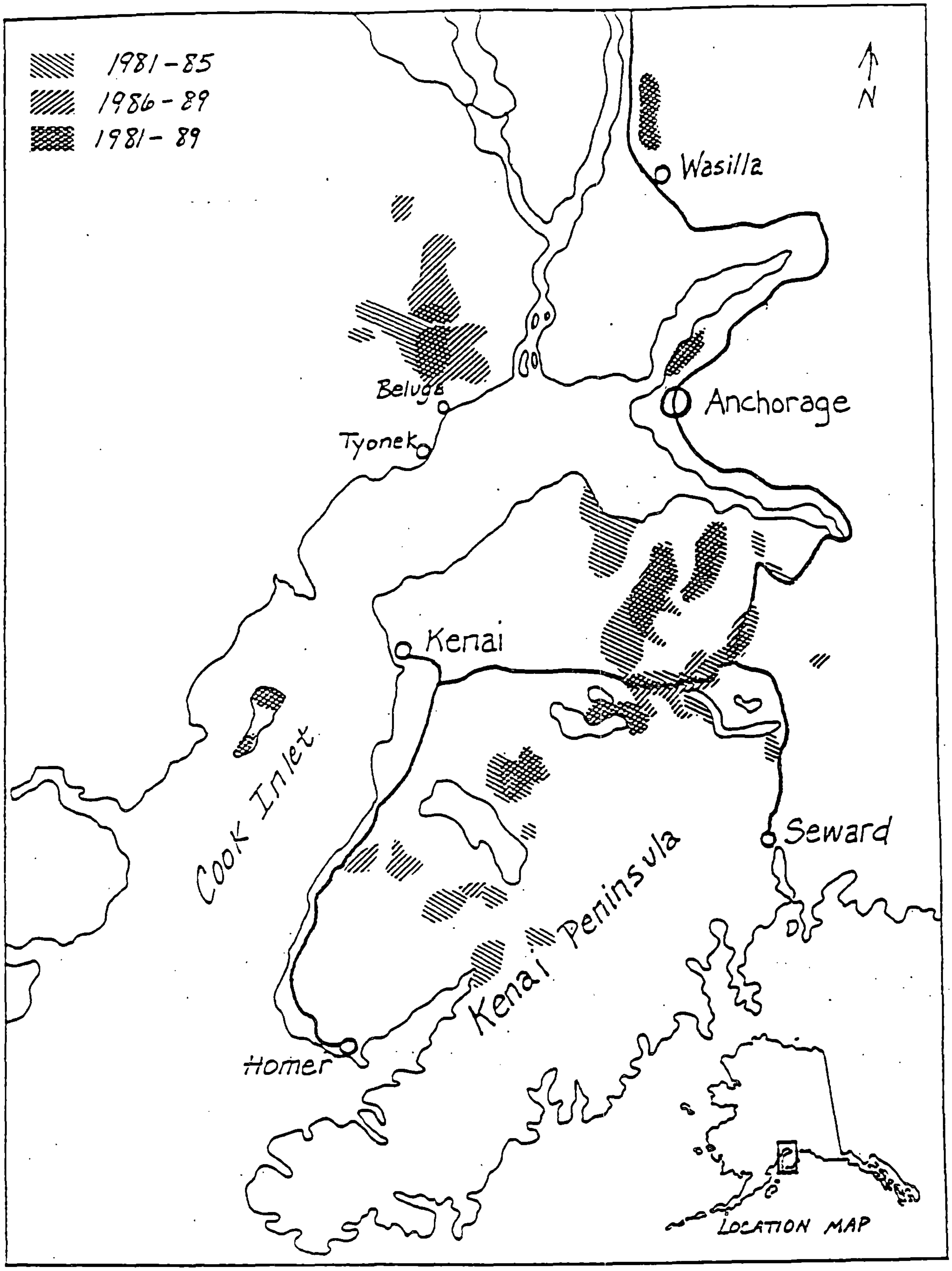

Figure 1d. Location of spruce beetle outbreaks from 1981-1989 in south-central Alaska; specifically on the Kenai Peninsula and the west side of Cook Inlet.

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 located 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 débris 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 (Tlikakila 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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STATE OF ALASKA
DIVISION OF FORESTRY
1992
ANNUAL REPORT





Alaska Department of
NATURAL
RESOURCES

George K. Hollett

This annual report is dedicated to George K. Hollett, in appreciation for his many years of dedicated service to the State of Alaska.

August 12, 1963 to December 31, 1992

George Hollett retired on the last day of 1992, completeing a 30-year career with the Department of Natural Resources. He served the department in many capacities and through many changes. George joined the Department of Natural Resources as Area Forester in Fairbanks in 1963, when Forestry was a section of the Division of Lands. In 1968 he became Fairbanks Area Manager for the Division of Lands and the following year the Fairbanks District Land Manager. George moved to Anchorage in 1974 and was appointed State Forester by Governor Hammond. When the Division of Land and Water Management was created in 1976, George was named deputy director. He returned to forestry in 1982, soon after the Division of Forestry was created, and served as deputy director until his retirement. He worked one year in Juneau and the remainder in Anchorage.

George's exceptional memory, experience and understanding of the development of DNR and its changes in administration, policy, structure, focus and staffing were invaluable to those who worked with him. Through the years, George's institutional memory and historical perspective of the management of natural resources in Alaska helped the Division of Forestry look ahead and prepare for the challenges of the future.

George is turning his attention to new challenges, such as learning to weld, improving his skills in woodworking and taking time to pursue his love of sailing in Prince William Sound. George's former co-workers wish him well as he applies himself to these new interests with the same proficiency, steadiness and good humor that will be missed at the Division of Forestry.

Alaska Division of Forestry

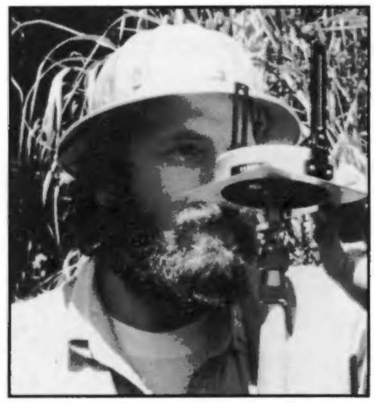
he Division of Forestry is one of eight divisions within the Department of Natural Resources. It was established as a division in November, 1981. Prior to that time it as a section within the Division of Forest, Land and Water Management.

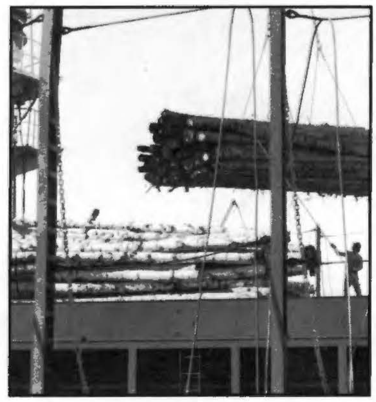
he division's mission is to protect the state's forested land and forest resources, and to manage them for multiple use and sustained yield. The Division of Forestry:

- protects water quality, fish and wildlife habitat and other forest values through appropriate forest practices and by administering the Forest Resources and Practices Act;
- manages a wildland fire program on public, private and municipal lands;
- encourages development of the timber industry and forest products markets;
- administers the Community Forestry and Stewardship programs;
- manages the Haines and Tanana Valley state forests (over two million acres);
- conducts personal-use and commercial timber and fuelwood sales;
- gives technical assistance to forest landowners;
- operates the Forest Regeneration Center.

he division has a central office in Anchorage for policy and program direction, d ten area offices responsible for program support and field work.

In 1992 the division employed 90 people full-time, 130 seasonally and about 600 emergency firefighters.





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Highlights of 1992

Forest Management

- Held ground breaking for the new Forest Regeneration Center near Palmer.
- Grew 196,800 seedlings and supplied 433,922 for reforestation on federal, state, municipal and private land.
- Planted 367,100 seedlings on 689 acres of state land.
- Completed the Forest Health Management Plan for the Western Kenai Peninsula and Kalgin Island, and began work on a plan for the Copper River Basin.
- Prioritized seven parcels of state land on the Kenai Peninsula that are heavily infested with spruce bark beetles to consider for harvest.
- Processed 225 forest practices notifications of timber harvest on 83,386 acres, and conducted 169 field inspections.

mber Production

- Administered the harvest of 2,680 million board feet of timber on state lands, which provided $1,090,164 to the state coffers.
- Issued 27 commercial timber sale contracts, nine commercial fuelwood sales and 706 personal use fuel wood permits.
- Registered 74 log brands, up from 45 the previous year.
- Issued 28 beach log salvage contracts—a record high number.
- Proposed a 20 million board foot salvage sale of beetle-killed spruce on 5,300 acres of state land on the Kenai Peninsula.

re Protection

- Provided, in cooperation with federal agencies, fire protection for 134 million acres of private, state and municipal land.
- Employed emergency fire fighters who collected $1.39 million in state and federal wages.
- Administered federal Rural Community Fire Protection Grants, totaling $76,550, to 10 communities.
- Negotiated a new five-year contract for fire fighting aircraft that resulted in a savings of 18 percent, or $265,200, compared to the previous contract.

Cooperation, Education, Assistance

- Granted $29,000 in federal community forestry funds to eight communities. The grants were matched with $72,000 in local funds and in-kind services.
- Administered a $32,000 grant from the Small Business Administration for tree planting projects in Wasilla, Anchorage, Fairbanks and Soldotna.
- Co-sponsored Project Learning Tree, a nationwide environmental education program that trains teachers to help students make wise decisions about the use, management and protection of natural resources.
- Cooperated with the Department of Transportation to plant an arboretum with 18 species of trees in a Soldotna greenbelt.
- Implemented the new Forest Stewardship Program, which provides technical assistance to private forest landowners to help them achieve healthy and productive forests.
- Sponsored a spruce bark beetle exhibit and demonstration of log cabin construction using beetle-killed spruce at the Anchorage Fur Rendezvous, visited by 4,000 people.

Resource Management

Forest Regeneration

Lawrence A. Dutton
Forest Regeneration Center

Ground breaking for the new Forest Regeneration Center was held in Palmer in June. The headhouse building was completed in September and foundations for the two greenhouses were laid in November. The greenhouses at the former nursery site in Eagle River were moved during the winter. The new facilities were located on 12 acres on the Matanuska Research Farm through an agreement between the division and the University of Alaska.

New greenhouses could not be included in the upgrade but the division has placed in storage two greenhouses from the former U.S. Forest Service nursery at Petersburg. Even without the new greenhouses, major improvements were achieved. The location has excellent soils and room for producing transplants or bare root seedlings. The headhouse includes expanded work and storage space and a walk-in seed freezer. New equipment was purchased that automatically fills trays and sows seeds.

There is ample space for construction of additional greenhouses when funding is available. Utility connections were designed to allow for expansion and the water source can supply up to eight greenhouses.

The process of moving and upgrading facilities disrupted the normal growing schedule and resulted in a smaller crop si than in previous years. A total of 196,800 seedlings were grown and 433,922 (produced the prior year) were shipped. As i the past, most of the seedlings were used for reforestation of state lands. Other users included forestry researchers, non-industrial private forest landowners, the forest industry, state fairs and the Society of American Foresters.

Greenhouse and headhouse at the Forest Regeneration Center's new site in Palmer.

The nursery was staffed with a manager, maintenance mechanic, technician and inmate laborers provided by the Department of Corrections. The Division of Park Design and Construction Section provided engineering expertise for development of the new facility.

Fabric mat study

In some areas regeneration is difficult because of the thick grass that competes with seedlings. In 1991 the division, in cooperation with the Institute of Northern Forestry, began a study of fabric mats that inhibit the growth of vegetation around seedlings. Test plots were established on the Kenai Peninsula and near Willow to asses the use of mats with white spruce seedlings.

In the second year of the study the divisio measured and evaluated the overall health of the seedlings at all test plots. Early results indicate that seedlings planted in heavy grass with the benefit of fabric mat had almost 100 percent survival. However, seedlings planted without mats showed significant mortality due to the competiti from the grass. The study will continue to measure and evaluate the benefits of mats as well as the best type of fabric for conditions in Alaska's forests.

Vegetation management

A Forest Vegetation Management Workshop, sponsored by the Division of Forestry, Alaska Reforestation Council, Cooperativ Extension Service and U.S. Forest Service was held in October and attended by 31 people. The training session focused on th suppression of undesirable vegetation an the promotion of desirable trees and shrubs. Topics included herbicide use, manual and mechanical brush clearing, fire and other control techniques used in revegetation.

‿eedling Production in 1992

Seedling Species Sown

white spruce	133,600
lodgepole pine	21,230
black spruce	10,030
tamarack	10,000
Sitka spruce	6,800
Siberian larch	6,430
Scotch pine	6,200
paper birch	1,230
Siberian crab apple	630
common lilac	440
Norway spruce	40
Siberian pea shrub	40
silverberry	30
chokecherry	30
mountain hemlock	30
Sitka mountain ash	30
prairie rose	10
Total	**196,800**

Seed Processed

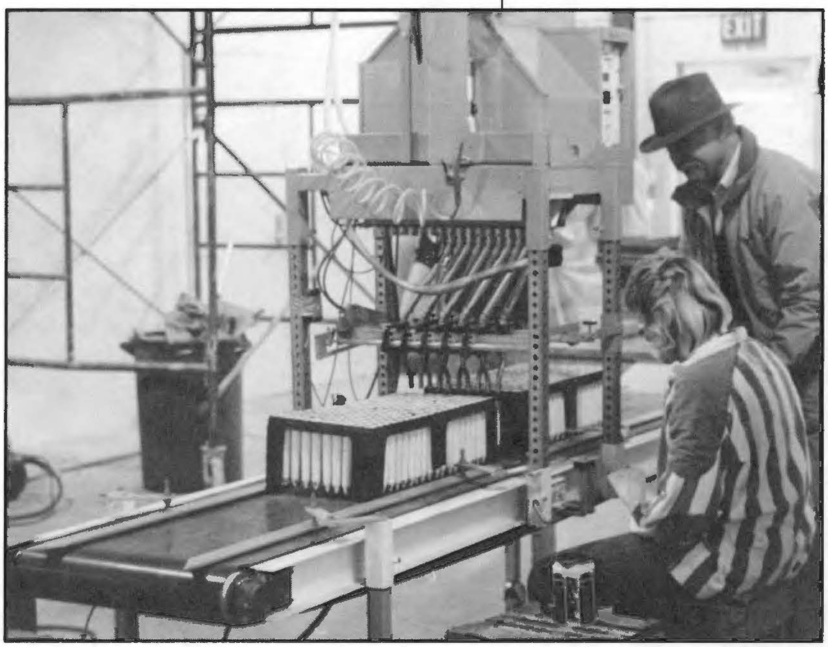
Species	Cones Received	Seed Recovered	Seed Shipped
	bushels	grams	
white spruce	3	313	2,670
Sitka spruce	18	5,630	514
paper birch	—	—	44
tamarack	—	—	1,000
Scotch pine	—	—	454
other	—	—	20
Total	**21**	**5,943**	**4,702**

Seedlings Sown & Shipped

Client	Sown	Shipped
state	155,800	376,649
private	27,200	18,856
federal	7,000	28,652
research	6,800	9,765
Total	**196,800**	**433,922**

Reforestation on State Land

	Seedlings planted	Acres planted
Fairbanks Area	330,000	535
Kenai/Kodiak Area	16,300	59
Southeast Region	20,800	95
Total	**367,100**	**689**



This new seeder automatically places one seed in each seedling container, eliminating the time-consuming task of seeding by hand.

Timber Development

Haines State Forest

This year marked the resumption of an active timber sale program on the Haines State Forest, after several years with no sale activity due to Mental Health Land management restrictions. Sales were prepared for both the University of Alaska and the Mental Health Land Trust for a total volume of 13.3 million board feet. Klukwan Forest Products, Inc. bought both sales totaling 576.5 acres.

The University Sunshine Timber Sale covers 209.5 acres predominately composed of spruce that has been killed or infested by bark beetles. A total volume of 4.4 million board feet (MMBF) will be harvested and three miles of road will be constructed during the life of the contract. Haines Area staff will administer the sale.

The Little Salmon Combo Sale, held for the Mental Health Land Trust had a volume of 8.87 MMBF on 367 acres. The primary silvicultural goal is the salvage of spruce bark beetle infested timber. The sale will require construction of 5.4 miles of road and substantial upgrades to portions of the existing road.

This feller buncher, operating in the Tanana Valley State Forest, is very efficient at harvesting timber. The owner, using a crew of three, harvests nearly one million board feet each year from state and private land.

Valdez/Copper River harvests

The Valdez/Copper River Area had a very productive year in terms of timber harvesting. The area sold six timber sales for a total volume of 465 thousand board feet (MBF) and approximately 1,447 cords of fuel wood. All sawtimber and fuel wood was white spruce.

The area office received several inquiries from large timber companies interested in harvesting from three to 15 million board feet of timber on state lands.

The Ahtna Corporation began preparing sale to make available 46,000 acres of spruce that has been killed or threatened bark beetles near Chitina. The corporation also sold about ten sections of timber on its land near the Kotsina River.

Southwest Area harvests

The Southwest Area sold two timber sales in 1992, both located at Devil's Elbow on the Kuskokwim River. The sales totaled 600,000 board feet of white spruce sawtimber and allow the operators to mill for the next three years.

The area also responded to a request for timber sales near Big River, up the Kuskokwim from McGrath. One sale was laid out for sale in March, 1993.

Fairbanks Area harvests

The Fairbanks Area held a fall auction in which seven sales were offered, for a total of 6,127 cunits of spruce sawlogs and 1,43 cunits of fuel wood. Five sales sold for a total of 5,404 cunits of sawlogs and 843 cubic feet of fuelwood. The area also prepared negotiated sales in Manley Hot Springs and Central, and sold five house log sales near Fairbanks.

The Fairbanks Area has computerized its timber sale records on a geographical information system called ARC-INFO this year. The new system allows instant access to the records and is able to do computations and data comparisons. It provides maps of all timber sales and allows staff to look at vegetation, water, roads and land ownership in the area. This makes it useful for timber inventory, sale planning, reforestation and other forest management functions including fire management.

_ ılls Creek Salvage Sale

Harvesting began on the Falls Creek ɔoperative Salvage Sale near Kasilof and ‿am Gulch in January. The sale was a cooperative effort between the Division of restry, the University of Alaska and ɔok Inlet Region, Inc. The division proposed the sale of beetle-killed and ᵢ⁻fested spruce to combat the infestation.

conjunction with the sale, Forestry put in 50 beetle attractant traps and felled 45 een trees to serve as beetle trap trees. The ɛes successfully drew a large portion of the emerging spruce beetles and were then removed in the spring, as part of the timber ɛration, before adult beetles could ‿ıerge and attack new host trees.

ılvage harvests provide ski trails

. .re salvage logging operations were completed in the Rosie Creek burn area ar Fairbanks. The logging roads and skid ıils have been transformed into a classic 10 km Nordic ski trail system by the ᴵᴵniversity of Alaska and the Nordic Ski ub. Local skiers and the university's cross country ski team are benefiting from this example of multiple use in the Tanana ılley State Forest.

Harvest operations improve ildlife habitat in Southwest

ı ne Division of Forestry, in cooperation with the Department of Fish and Game, s modified the timber sale contracts used the Southwest Area to provide better habitat for fur bearing animals. The new ntracts require the operator to leave ıall piles of small-diameter slash randomly throughout the sale area. The piles create habitat for mice and moles under the ow, which, in turn, provide a winter ..ɔd supply for fox and marten.

The small-diameter of the slash (under four :hes) minimizes the chance of creating breeding material for spruce bark beetles. This practice also reduces the cost of the eration by allowing the operator to leave ne material in the field rather than moving everything to a landing and rning it.

There is a growing international market for Interior and Southcentral Alaska timber, such as this white spruce being loaded onto a ship in Anchorage.

MBF = thousand board feet

MMBF = million board feet

CCF = hundred cubic feet

Board foot is the unit used to measure lumber. One board foot equals one foot square by one inch thick.

Cubic foot is the unit used to measure volume of wood for purposes other than lumber, such as pulp or firewood.

Cut and Sold on State Lands 1959 ~ 1992

Year	Annual Sales Volume (MBF)	Annual Cut Volume (MBF)	Cut Value ($)
1959-69	709,843	236,035	786,778
1970	14,926	53,568	229,101
1971	41,077	43,191	246,091
1972	23,110	50,591	401,133
1973	449,452	38,356	218,357
1974	21,146	51,241	376,450
1975	4,655	33,540	430,486
1976	2,358	41,714	73,043
1977	2,412	60,251	544,884
1978	6,932	30,301	638,806
1979	156,235	32,382	1,016,585
1980	4,949	47,547	1,254,500
1981	18,402	53,678	1,491,554
1982	24,154	35,198	488,512
1983	72,145	35,511	402,774
1984	21,087	28,044	833,793
1985	20,178	12,864	192,109
1986	10,469	18,995	233,862
1987	27,588	25,884	379,540
1988	27,475	25,177	515,980
1989	21,600	22,711	514,632
1990	35,783	18,603	477,580
1991	10,156	16,241	236,205
1992	9,969 (24,105 ccf)	26,802 (63,702 ccf)	1,090,164*

* Includes a back payment of $413,665.

Average Sawtimber Stumpage per MBF 1981 ~ 1992

Year	Aspen	Birch	Cottonwood	Hemlock	Sitka Spruce	White Spruce
1981	0	$32.22	$7.46	$14.53	$24.82	$35.96
1982	0	$27.27	$10.00	$10.92	$28.24	$25.65
1983	$14.47	$29.95	0	$3.50	$166.93	$39.95
1984	$10.60	$26.70	0	0	$32.72	$20.20
1985	0	0	$15.10	$21.85	$17.65	$26.52
1986	$20.13	$30.00	$15.10	$9.22	$19.44	$25.00
1987	$10.00	$8.76	0	$14.13	$18.78	$7.32
1988	$2.03	0	$9.42	$3.00	$97.80	$21.11
1989	$2.13	$7.01	$9.96	$5.88	$71.29	$34.25
1990	0	$6.86	$10.00	$3.67	$46.95	$17.14
1991	0	$24.76	0	0	$82.57	$14.32
1992	0	0	0	$3.59 ($1.47 ccf)	$66.42 ($30.41 ccf)	$34.17 ($14.24 ccf)

Cut and Sold Report by Region
Calendar Year 1992

Volume Cut

Region	Sawtimber MBF	Sawtimber CCF	Other Products[1] MBF	Other Products[1] CCF	Total Volume MBF	Total Volume CCF
Northern	4,462	11,676	6,673	16,282	11,135	27,958
Southcentral	605	1,289	815	2,012	1,420	3,301
Southeast	13,816	31,458	431	985	14,247	32,443
Total	**18,883**	**44,423**	**7,919**	**19,279**	**26,802**	**63,702**

Volume Sold

Region	Sawtimber MBF	Sawtimber CCF	Other Products[1] MBF	Other Products[1] CCF	Total Volume MBF	Total Volume CCF
Northern	6,305	15,383	2,143	5,230	8,448	20,613
Southcentral	840	1,787	596	1,519	1,436	3,306
Southeast	82	180	4	6	86	186
Total	**7,227**	**17,350**	**2,743**	**6,755**	**9,970**	**24,105**

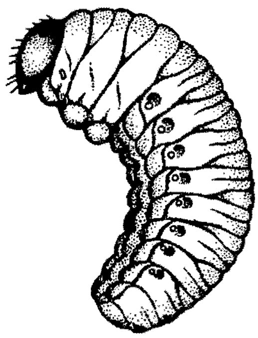
[1]*Other products include pulp logs, fuel wood, house logs, etc.*

Contracts Issued by Type and Area
Calendar Year 1992

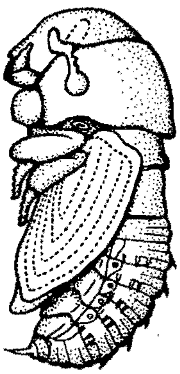
Region	COMMERCIAL USE Fuel wood Sales	COMMERCIAL USE Saw log Sales	COMMERCIAL USE Beach log Salvage	PERSONAL USE Fuel wood Permits	PERSONAL USE House log Sales	PERSONAL USE Saw log Sales
Northern Region						
Fairbanks	2	5	0	400	4	2
Delta	4	9	0	70	0	0
Tok	0	1	0	110	0	0
Total	**6**	**15**	**0**	**580**	**4**	**2**
Southcentral Region						
Anchorage/Mat-Su	0	1	0	79	5	3
Kenai/Kodiak	0	1	0	17	8	0
Valdez/Copper River	3	3	0	30	2	0
Southwest (McGrath)	0	4	0	0	0	2
Total	**3**	**9**	**0**	**126**	**15**	**5**
Southeast Region						
Juneau	0	1	11	0	0	1
Haines	0	0	0	0	0	1
Ketchikan	0	2	17	0	0	0
Total	**0**	**3**	**28**	**0**	**0**	**2**
GRAND TOTAL	**9**	**27**	**28**	**706**	**19**	**9**

Forest Health and Protection

Spruce bark beetle



larva



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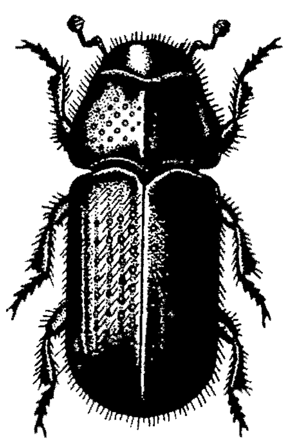


adult

Forest insects

Forest insect and disease damage increased throughout Alaska's forests in 1992. Insect populations, including the spruce beetle (*Dendroctonus rufipennis*), exploded, especially in southcentral and interior Alaska. Aerial surveys conducted by the Division of Forestry, in cooperation with the U.S. Forest Service, showed that new and ongoing spruce beetle infestations now cover more than 600,000 acres, with more than half of the activity on the Kenai Peninsula. The 1992 statewide total is the greatest known acreage affected by spruce beetles in a single year.

Bark beetle activity also increased in the Copper River area near Chitina, the Clam Gulch/Tustumena Lake areas on the western Kenai Peninsula, and portions of the west side of Cook Inlet near the Skwentna River. A significant increase was noted for the first time in Sitka spruce stands along Turnagain Arm near Anchorage. Approximately 600 acres of spot infestations were detected from Girdwood to Hope. The Yukon River outbreak decreased significantly in 1992.

Hardwood defoliator activity increased for the third consecutive year throughout most of southcentral and interior Alaska, with willow defoliation accounting for most of the increase. Assorted leaf miners, noctuid, and rusty-tussock moth larvae defoliated more than 150,000 acres of willow.

Spruce budworm populations increased dramatically near Fairbanks, Delta Junction and along the Yukon River where more than 160,000 acres of white spruce were defoliated. Spruce mortality was not observed, but repeated heavy defoliation has slowed tree growth. Young spruce plantings may be most seriously impacted by successive years of heavy defoliation. State and federal pest specialists began monitoring the most accessible budworm defoliation areas in 1992 and will continue monitoring in the coming year.

Black-headed budworm defoliation decreased in Prince William Sound in 1992, however, it increased for the first time along Turnagain Arm in the Portage and Turnagain Pass areas south of Anchorage. Spruce budworm and black-headed budworm defoliate both spruce and hemlock.

In Southeast Alaska, three defoliating insects—the black-headed budworm, spruce needle aphid and hemlock sawfly-caused substantial defoliation of western hemlock and Sitka spruce. Black-headed budworm defoliation was observed on more than 87,000 acres of mature western hemlock and Sitka spruce located primarily near Frederick Sound. Budworm defoliation of this magnitude has not been seen i Southeast Alaska since the early 1960s.

Spruce needle aphids defoliated 25,000 acres of Sitka spruce and caused significa damage to ornamental spruce in several communities. Hemlock sawflies defoliate 6,500 acres of mature western hemlock on Prince of Wales Island and within Misty Fjords National Monument. Spruce budworm caused heavy defoliation of Sitka spruce and western hemlock for the third consecutive year along the Chilkat River near Haines. Spruce beetle activity within Glacier Bay National Park, near Gustavus, increased slightly and on state lands near Haines activity increased substantially. Spruce beetle activity in these two areas covers about 25,000 acres.

Forest diseases

The most significant diseases in Alaskan forests are those that persist on sites year after year—yellow cedar decline, wood decay of live trees and hemlock dwarf mistletoe. There are more than 526,000 acres of cedar decline in southeast Alaska in a broad band from western Chichagof Island through the Ketchikan area. Heart rot and butt rot fungi caused significant cull in all tree species in Alaska. Hemlock dwarf mistletoe continued to limit growth and kill trees in old-growth forests of Southeast Alaska. Its impact in young stands appears to depend on the presence of large infected trees left after harvesting.

An outbreak of hemlock canker killed small hemlock and the lower branches of large hemlock along more than 60 miles of unpaved roads on Prince of Wales Island for the third consecutive year. The canker is caused by a fungus, *Xenomeris abietis*, and is possibly aggravated by dust. The disease was also recorded for the first time along roads near Rowan Bay on Kuiu Island, Corner Bay on Chichagof Island and Carroll Inlet on Revillagigedo Island.

Spruce needle rust was at relatively high levels throughout Alaska but most other foliar pathogens occurred at low to moderate levels. Rizosphaera needle cast, however, was quite visible on Sitka spruce in the Girdwood, Twenty Mile and Portage valleys south of Anchorage.

Porcupines continued to damage spruce and hemlock in valuable young-growth stands in Southeast Alaska. Decay, canker and foliar fungi caused a large, but unmeasured amount of damage to hardwood species in the interior of the state.

Pheromone testing

The division continues to work with U.S. Forest Service entomologists in testing spruce bark beetle pheromones as a way to manipulate bark beetle populations. Bark beetles produce pheromones, chemicals used to communicate with other beetles, for mating, to locate susceptible spruce hosts, and to attract or repel other spruce beetles.

Tests of the anti-attractant pheromone, methylcyclohexenone (MCH), used to treat spruce log decks along a pipeline clearing between Tyonek and Beluga, was completed in August. A joint Division of Forestry and U.S. Forest Service publication with details of the MCH test is available upon request. Its title is "Evaluation of Potential for Spruce Bark Beetle Population Build-up in Right-of-Way Clearing Debris—Tyonek/Beluga, August 1991." A report on the 1992 follow-up evaluation will be published in 1993.

Pheromones may eventually prove useful as natural biological controls for reducing damage caused by bark beetles in selected areas. With continued testing there is the potential for manipulating low-level beetle populations that develop from spruce clearing activities. Improved methods of trapping beetles in specialized pheromone traps near log storage areas and reducing damage over large areas is also possible. The division will continue pheromone testing in 1993, using improved formulas.

Since 1970, spruce bark beetles have killed trees on 700,000 acres—about 35 percent of the forested land on the Kenai Peninsula.

Checking pheromone traps for spruce bark beetles.

Pest management assistance

The Division of Forestry provides technical pest management assistance to private non-industrial landowners using matching grants from the U.S. Forest Service.

In 1992 the division provided a grant to the Fairbanks-based Tanana Chiefs Conference, Inc. to survey spruce beetle impacts along the Yukon River. The assessment complements forest inventories on corporate and village lands along the Yukon River corridor. Two publications with details of the spruce beetle impact assessments were prepared by TCC foresters for the division and are available upon request.

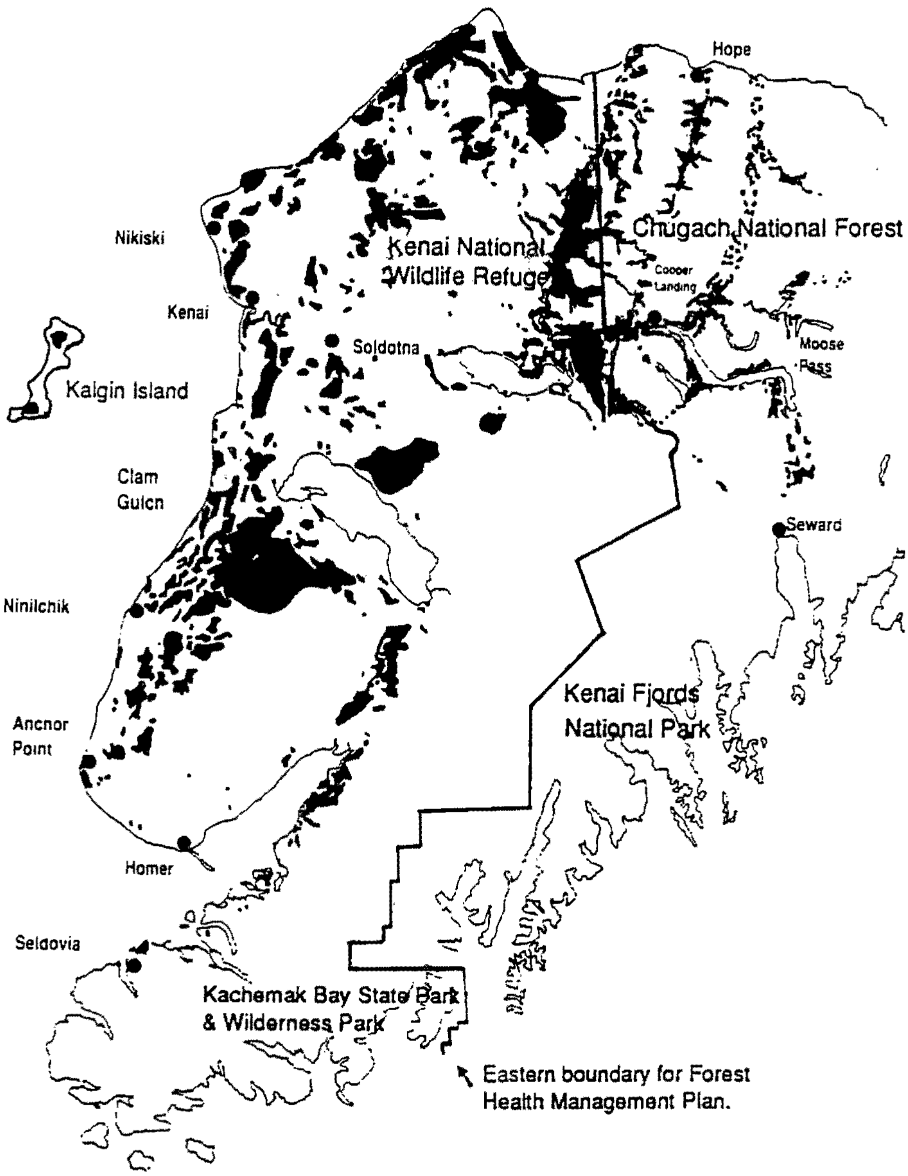
Spruce bark beetle surveys on the Western Kenai Peninsula

The Division of Forestry continues to survey the forests of the Western Kenai, where the beetle infestation is heaviest. In 1992, the division provided data collected over a two-year period on state and priva lands between Kasilof and Ninilchik to the University of Alaska, Institute of Econom Research for analysis.

This data came from field surveys done to verify aerial surveys conducted in 1989 ar 1990. The surveys were begun in 1990, however, due to the magnitude and rapid expansion of the infestation, it was extended in 1991 to areas where no activity had been seen in aerial surveys. A publication describing the ground survey, available in 1993, will include a case study of tl survey, projected stand impacts, maps of key infested areas—both recent and historical, and a summary of ISER's statist cal analysis.

The Division of Forestry's goals for the spruce beetle survey are to:

- document the large Kasilof-Ninilchik infestation and compare the current outbreak with past information;
- project information about stands impacted, damage levels, growth rates and volume impacts to determine the rate of increase, magnitude and intensity compared to surveys in other regions;
- rate the hazard of selected areas by comparing the stands with similar stand currently infested or at risk to infestation;
- provide a tool for public and private landowners and managers to use in assessing damage, or the potential for damage, from spruce beetle outbreaks in their forests.



This map shows areas infested by beetles at some time between 1970 and 1990, as detected in aerial surveys. Aerial surveys show only red tops, trees attacked one year earlier and now dead, not the level of the infestation or the volume of timber affected.

1992 Forest Insect Activity and Diseases in Alaska by Land Ownership[1]

The following figures are from the U.S. Forest Service, State and Private Forestry publication, "Forest Insect and Disease Conditions in Alaska - 1992."

Pest	State/Private	Nat'l Forest	Other Federal	Native	Total
Spruce beetle *Dendroctonus rufipennis (Coleoptera)*	231,856	28,816	225,343	118,794	**604,809[2]**
Larch beetle *Dendroctonus simplex (Coleoptera)*	— —	— —	2,000	— —	**2,000**
Engravers *Ips spp. (Coleoptera)*	811	182	— —	1,237	**2,230**
Spruce budworm Choristoneura spp. *(Lepidoptera)*	133,430	— —	— —	47,089	**180,519**
Black-headed budworm *Acleris gloverana (Lepidoptera)* affects w. hemlock, Sitka spruce	15,879	70,431	4,826	5,137	**96,273**
Hemlock sawfly *Neodiprion tsugae (Hymenoptera)*	— —	6,539	— —	— —	**6,539**
Large aspen tortrix *Choristoneura conflictana (Lepidoptera)*	16,076	— —	935	2,510	**19,521**
Spruce needle aphid *Elatobium abietinum*	7,317	14,945	778	2,180	**25,220**
Birch defoliation *various spp. (Lepidoptera)*	1,713	— —	— —	— —	**1,713**
Cottonwood defoliation . *various spp (Coleoptera, Lepidoptera)*	311	5,060	934	— —	**6,305**
Willow defoliation *(Coleoptera, Lepidoptera)*	57,256	1,090	55,712	39,621	**153,679**
Alaska yellow cedar decline[3] (cumulative)	10,430	541,349	— —	17,667	**569,446**
Total Acres by Ownership	**475,079**	**668,412**	**290,528**	**234,235**	**1,668,254**

[1] Table does not include many of the most destructive diseases, e.g., wood decays and dwarf mistletoe because those losses are not detectable in aerial surveys.

[2] More than half of ongoing spruce beetle activity mapped in 1992, over 300,000 acres, is on the Kenai Peninsula.

[3] Figures for yellow-cedar decline are not restricted to acreage with high concentrations of dying trees in 1992; it represents stands that have long-dead, recently-dead, dying and some healthy trees.

Forest Health Initiative

The Alaska State Legislature first funded the Forest Health Initiative as a capital improvement project in 1991. The division's goal is to improve the condition of forests as a means of suppressing insect infestations and preventing their spread. It also intends to capture the economic value of beetle-killed trees when feasible. Spruce killed by beetles remain usable for about three years after they die, depending on their location and condition.

Project Manager Pete Buist was hired in the fall of 1991 and began examining ways to improve forest health for a wide array of uses and values. A Working Group consisting of state and federal agency representatives, land managers, private landowners and others interested in forest health on the Kenai was formed. The group met regularly through the winter and spring and, after a series of public meetings, the final plan was published on November 1.

Dan Golden joined the division late in 1992 as Forest Health Initiative Coordinator. He transferred from the Department of Commerce and Economic Development and acts as liaison with other agencies and the DNR Commissioner's Office.

The division began a planning process for the Copper River Basin in November, modeled after that used on the Kenai Peninsula. Spruce beetle infestations in the area are similar in intensity to those on the Kenai and are of concern to local residents. The division intends to involve the public in the planning process by late winter and complete a management plan for the area by the end of 1993.

Like all resources, forests are a function of socio-cultural appraisal. Their utility is what society perceives them to be, hence, the meaning and value of forests change over time and space.

Pinchot Institute of Conservation - Monograph Series

Forest health summit

In mid-July the division, in conjunction with the Lieutenant Governor's Office, held a summit in Cooper Landing. An orientation tour was given in areas where various bark beetle suppression and prevention measures had been taken and of logging and reforestation projects. The tour was followed by a discussion of the group's observations and ideas. During the Lt. Governor's visit the division provided a helicopter flight over the western Kenai Peninsula where approximately 365,000 acres of spruce are now dead or infested with bark beetles.

Timber salvage priority areas

Within the Forest Health Management Plan for the Western Kenai Peninsula and Kalg Island are seven prioritized areas to consider for timber harvest. These are state-owned lands infested by beetles. They are identified as South Soldotna, Point Possession, Falls Creek, South Ninilchik, Corea Creek, Kalgin Island and Fox River. The areas include 36,000 acres of state land an an estimated 100 million board feet.

As more site-specific examinations are made, portions of these areas could produce wood by-products to support forest health measures and management practices that benefit other uses of the forest.

The division began work on these priority areas by proposing to salvage approximately 20 million board feet from 5,300 acres near Falls Creek, inland from Clam Gulch. Many issues surfaced as the proposed harvest was reviewed by the public and other agencies, including questions about whether or not to harvest, protection of fish habitat, access development, the effects of harvest on scenic and recreationa values, regeneration of harvested areas, and the economic return to the state.

The division continues to evaluate and address the public's comments and concerns as it moves forward in developing management options to deal with the ongoing infestation and tree mortality on the Kenai Peninsula. A volume and value sawmill recovery study for timber in various stages of beetle-caused decay is scheduled to be conducted by the division and U.S. Forest Service during July and August of 1993.

_ ur Rendezvous spruce beetle display and cabin demonstration

he division participated in a project uring Fur Rendezvous in Anchorage to promote awareness of the spruce bark etle and demonstrate the usefulness of cently-killed trees. A log cabin built by the Division of Parks, using beetle-killed ees provided a warm spot for visitors to ok at maps, photos and displays on the bark beetle, its biology, prevention methods and control options. Department of atural Resources employees staffed the bin and answered questions. The cabin, located near the Snow Sculpture exhibit, as later moved to Eagle River Campound to house campground hosts.

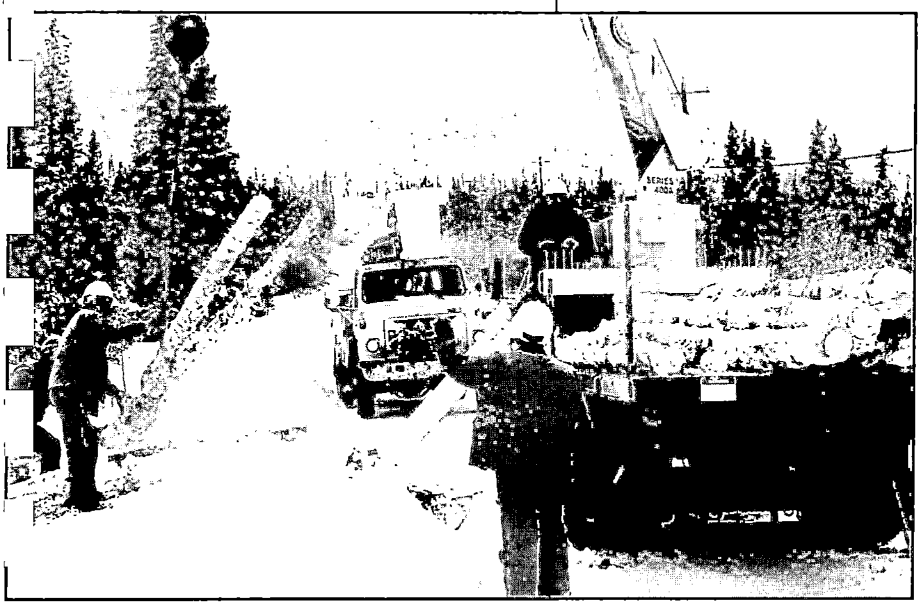
While the cabin was being built, students om the Anchorage School District's King areer Center helped DNR staff fell 30 beetle-killed trees near Anchorage. The nchorage Telephone Utility and the ternational Brotherhood of Electrical Workers provided a truck, equipment and labor to move the trees to the cabin site.

resters used the logs to show beetle damage to the public and to demonstrate peeling, slabbing and notching logs for nstruction of a log cabin. During the two weeks of Fur Rondy, over 4,000 people visited the cabin and demonstration site.

Removal of hazardous trees at Camp Kushtaka

The division entered into a contract with Ultra Light Logging to remove hazardous spruce trees killed by beetles within Camp Kushtaka near Cooper Landing. The camp, located on state lands leased to the Campfire Chugach Alaska Council, is used by the Kenai Peninsula Borough School District as an environmental education camp, as well as by Campfire. Over 90 percent of the spruce trees within the camp had been killed by bark beetles and posed a hazard to campers and buildings.

Ultra Light Logging uses a zig-zag cable yarder to remove trees, so no heavy equipment is used. As a result no skid trails are developed, no erosion results, no streams have to be bridged and the trees that are left have little or no damage.



The Fur Rondezvous log cabin demonstration and bark beetle display were successful due to the cooperation of, and assistance provided by, the following organizations and agencies:

- Anchorage Telephone Utility
- ARCO, Inc.
- Cooperative Extension Service
- Division of Parks
- DNR employees
- International Brotherhood of Electrical Workers
- King Career Center

Stewardship starts with landowners who care about their forest lands. They view their land as a source of family enjoyment and a chance to leave something special for future generations, as well as a potential source of income.

Forest Stewardship Program Guidelines

National Tree Program

The National Tree Program, begun in 1991, calls on the public, private businesses and local governments to work together to plant, improve and care for trees and forests in communities and rural areas nationwide.

In rural areas, the Forest Stewardship Program addresses tree planting and forest improvement on private lands through technical assistance and cost shares for private landowners. The Community Forestry Program addresses the planting and care of trees and forests in cities and communities by assisting local governments, businesses and volunteer groups.

The U.S. Forest Service provides national guidance and funding for these efforts through the State Forester's Office in each state. The division has one coordinator and two stewardship foresters to implement the Forest Stewardship Program, and two coordinators for the Community Forestry Program. Two citizen advisory groups, the Alaska Community Forestry Council and the Alaska Forest Stewardship Coordinating Committee have been appointed by the state forester to support and advise on the development and delivery of each program.

Benefits of trees

The National Tree Program was initiated because of the decline in the number and health of trees in communities and on private land throughout the U.S. This decline contributes to pollution and deprives communities of the important environmental, social and economic benefits provided by healthy trees and forests, including:

- providing wildlife and fish habitat;
- conserving energy by providing summer shade and winter wind protection;
- improving air, soil and water quality, and reducing soil erosion;
- acting as natural air cleaners by removing carbon dioxide and other impurities from the air and by releasing oxygen;
- providing valuable wood products and associated jobs, which strengthen local economies;
- improving quality of life in neighborhoods and business districts, which increases community pride and property values.

Forest Stewardship Program

The goals of the Alaska Forest Stewardship Program are to:

- help private landowners to more actively manage their land and resources to achieve healthy and productive forests;
- increase the number of trees planted and cared for;
- enhance the economic, environmental and aesthetic qualities of rural areas;
- help reduce global carbon dioxide levels.

To meet these goals, the division provides technical assistance to owners of non-industrial private forest land—forested land owned by private individuals, group associations, corporations, Indian tribes or other private legal entities, including Alaska Native Corporations—not involved in wood product manufacturing.

Landowners, with the help of a natural resource professional, prepare a forest stewardship plan that meets their personal land management objectives. Each plan must address management practices that protect, and maintain or enhance:

- soil and water quality;
- wetlands and riparian areas;
- timber potential;
- protection from fire, pests and disease;
- recreation opportunities and aesthetics;
- fish and wildlife habitat.

The Stewardship Incentive Program (SIP) is a financial assistance program for non-industrial, private forest landowners who own a maximum of 1,000 forested acres and who develop, and agree to maintain, a Forest Stewardship Plan. SIP allows up to 75 percent cost-sharing for certain management practices that achieve the landowner's objectives as stated in the stewardship plan.

The Forest Stewardship Program was first implemented in Alaska in 1992. The state's Forest Stewardship Plan was completed and approved by the Stewardship Coordinating Committee, state forester and U.S. Forest Service. Standards for individual landowner plans were developed and approved, a planning grant was made to an ANCSA corporation for a stewardship plan on several hundred thousand acres, 25 forest stewardship plans were begun and four were completed and approved by the state forester.

Community Forestry Program

The goals of Alaska's Community Forestry 'rogram are to:

- increase the awareness of, and appreciation for, the value of trees within the community;
- encourage citizens, community groups, local government and professionals to work as partners to sustain healthy people and communities by planting and caring for community forests and trees;
- increase the contribution of trees and forests in cities and communities toward energy conservation and overall aesthetic, economic and environmental viability and livability;
- provide opportunities for all communities to participate in the program;

'o reach these goals the program:

- provides information and training in proper techniques for retaining, planting and caring for community trees;
- supports local volunteer efforts to plant and maintain trees;
- encourages local governments to develop effective, long-term community forest and tree management programs;
- encourages local governments and the private sector to support and fund community forestry programs;
- provides information and training in methods of retaining, planting and caring for trees during construction;
- encourages and supports research and the introduction or trials of new tree and shrub varieties in Alaska.

'ommunity forestry grants

The division awards federal grants to ›mmunities to encourage and support the ›velopment of local ongoing programs to plant and care for trees. It also provides formation and technical assistance to help ıe projects succeed. Projects must have the support and involvement of community volunteers, accomplish a specific goal or medy a problem, and include a five-year aintenance plan for any trees planted.

Plant a tree. Plant a dozen of them, and then you will have done something for the generations who follow you, even as someone did something for you ages ago.

Fort Lauderdale Herald

In 1992, the division funded projects in Eagle, Homer, Healy, Palmer, Anchorage, Gustavus, Nelson Lagoon and Unalaska. Federal funds totaling $29,000 were matched by $70,000 in donations and in-kind services from communities. Projects included: tree plantings on the grounds of public buildings and along streets; wildlife habitat enhancement; creation of an outdoor classroom for interpretive programs; demonstration of appropriate species and techniques for northern conditions; and creation of living windbreaks.

The division also administers tree planting grants from the Small Business Administration. Grants totaling $32,000 were awarded to Wasilla, Anchorage, Fairbanks and Soldotna to hire small businesses to plant trees on public lands. Communities matched these grants with $57,000 in donations and in-kind services.

Educational Programs and Services

Arbor Day

Each spring communities around the country set aside a time to celebrate the beauty and usefulness of trees by holding special tree planting ceremonies and activities. In Alaska, Arbor Day is the third Monday in May. Planting trees is just a starting point; Arbor Day is an opportunity to educate people about the value and importance of trees and their ecological, social and economic roles in communities.

The division supported Arbor Day activities in 1992 by providing tree seedlings to the Society of American Foresters and other groups to distribute to the public, and by helping communities plan Arbor Day activities and celebrations.

Project Learning Tree

Project Learning Tree (PLT) is an environmental education program for kindergarten through 12th grade school teachers. It provides lessons, materials and activities for teachers, and training in how to use them in the classroom. The goal of PLT is to help students develop the skills, knowledge and attitudes needed to make wise decisions about the use and management of natural resources and the protection of environmental quality.

The program is introduced into schools by teachers who have completed the required course and received curriculum guides. In 1992 Dan Ketchum and Cindy Forrest were instructors in a 15-hour graduate level PLT course attended by 25 teachers in Anchorage, and Pete Simpson lead two PLT workshops in Fairbanks.

PLT is co-sponsored by the American Forest Foundation, Western Regional Environmental Education Council, Division of Forestry, Alaska Forestry Association, Cooperative Extension Service, Department of Education and U.S. Forest Service.

Forest management training for Fairbanks youth

The Fairbanks Area participated in a pilot training program for youth last summer by hiring a crew of five high school students. The crew was sponsored by the Alaska Federation for Community Self Reliance and funded by a grant from the Private Industry Council.

The crew received on-the-job experience in many aspects of forest management from reforestation to timber sale layout. The division considered the program a success and hopes to build on it next summer.

The area also benefited from the work of three University of Alaska Fairbanks interns. The students supported division staff in a variety of forest management programs with major emphasis on reforestation of harvested sites. Duties included conducting seedling survival surveys, identifying and marking previously planted areas, planting quality control plots, maintaining seedlings and traversing and marking future planting areas. Interns also examined stands in harvested areas to determine if there was a correlation between residual basal area and current regeneration stocking.

Arboretums established in Soldotna and Kodiak

The Division of Forestry helped the Department of Transportation beautify the highway maintenance facility in Soldotna by planting an arboretum. DOT spread topsoil and grass seed and the division planted 18 species of trees. The arboretum is located in a highly visible greenbelt along the Sterling Highway. As the trees grow they will provide the public with a beautiful display of trees that adapt well to local conditions. Each tree is labeled with its name and origin.

A second arboretum was established in Kodiak, in cooperation with a local nursery owner, to provide the public with a demonstration of trees that grow well in that area.

ee-planting project sponsored by Palmer Pride and funded by a Community Forestry Grant.

Homer Demonstration Forest

he Homer Demonstration Forest covers 360 acres of state-owned land just north-est of Homer. It was established in 1986 nd is managed by the Division of Forestry.

In 1991 a draft plan was prepared by the SDA Soil Conservation Service and the ivision, in cooperation with an inter-agency steering committee and members of he Homer community. The draft plan was viewed by the public in 1992 and adopted by the steering committee. Detailed imple-mentation plans will be developed that pecify how the land uses described in the lan will be carried out.

The demonstration forest provides an area here schools, organizations and the general public can:

- observe demonstrations and field trials of various ways to use and manage forests;
- learn first-hand about forest ecology;
- observe and learn about wildlife;
- recreate in ways compatible with other forest management objectives.

he forest will be managed so that the uality of its soils, waters, plants, animals and air is maintained for future genera-tions; and the potential productivity of its sources is not diminished by their use.

Forest Resources & Practices Act

Incorporating ecological knowledge into management systems, for the compatible production of commodities and protection of ecological values, is critical.

Jerry F. Franklin
Forest Ecologist

The Division of Forestry administers the Forest Resources and Practices Act by reviewing notifications of timber harvest, conducting forest inspections and taking appropriate enforcement action when necessary. An important aspect of the program is educating forest landowners, operators and the public about the requirements of the Forest Resources and Practices Act and responsible forest practices.

Draft regulations implementing revisions made to the Forest Resources and Practices Act in 1990 were adopted by the Department of Natural Resources in 1992. The regulations were submitted to the Department of Law for review in September. When the review is completed the regulations will be sent to the Lieutenant Governor for filing.

The Forest Practices notification and review process is not the typical permitting process in which a permit is required before an activity is begun. Rather, timber operators submit harvesting plans (notifications) to the Division of Forestry for review. The division coordinates the review of all notifications with the departments of Environmental Conservation and Fish and Game. When Forestry has completed the review (within 30 days after notification) the operator may begin.

Operators generally submit notifications well in advance of when they anticipate beginning operations. Forestry then coordinates the field inspections with the operator, DEC and Fish and Game. Field inspections are usually scheduled so that several notification areas can be inspected during one visit.

Some operations may have more than one field inspection due to the location or relative importance of the site. Other areas for which notifications have been submitte are not harvested within the one-year notification period. These areas require a renewal notice the following year before operations can begin. For these reasons, there is a difference in the number of notifications and the number of field inspections listed in the chart below.

Forestry assists in oil spill studies

The Division of Forestry assisted the Exxoi Valdez oil spill settlement working group on several occasions in 1992. A tour of harvest activities during a forest practices inspection on Afognak Island gave members a look at harvest operations, successional changes and forest regeneration following harvest.

The division also helped develop maps of coastal areas in southern Alaska, including historical maps of timber harvest areas an locations of harvests planned for 1993. The Oil Spill Trustee Council is using the maps for public meetings and other settlement activities.

Statewide Forest Practices Activities

Activity	1990	1991	1992
Number of notifications of timber harvest	201	193	225
Acreage under notification	55,091	57,237	83,886
Number of field inspections	146	222	169
Alaska coastal management project reviews	78	70	90
Number of agency/operator training sessions	*	*	2
Number of site specific variation inspections	*	*	21

* new category

Kenai winter road study

Winter roads have long been used in Alaska for timber harvest operations because it is usually far less expensive to cross bogs and muskegs when they are frozen than to develop summer access. The use of ice roads to protect vegetation and other resources has proven effective for the North Slope. However, the same standards of construction are not always appropriate outside of tundra and permafrost zones. The division is developing the methodology and equipment needed to evaluate construction standards and winter road use in Southcentral Alaska.

One item the study will consider is the best combination of snow and ice to use in winter road construction. The division will track snow levels and measure ground frost depths on undisturbed sites and compare them with frost levels on nearby logging roads. The study will also monitor the duration of frost levels in the roads in the spring to help establish when road use should be discontinued to prevent damage to underlying terrain and vegetation. The study is being done on the Kenai Peninsula in cooperation with an active timber operator on land owned by Cook Inlet Region, Incorporated.

Alaska Board of Forestry

The nine-member Board of Forestry advises the state on forestry-related issues and regulations. Board members are appointed by the governor from organizations that represent a wide range of forestry interests.

Board members during 1992 were State Forester Bob Dick; Ralph Malone, non-governmental forestry representative; Andy Miscovich, mining organization representative; Loisann Reeder, recreation organization representative; John Sturgeon, forest industry trade association; William Thomas, native corporation representative; Stephan Planchon, environmental organization representative; and Carl Yanagawa, non-governmental fish/wildlife biologist.

Forester Wade Wahrenbrock measures frost depths at this undisturbed control point station and compares them to frost depth measurements taken from winter ice roads.

Log brands

This was an active year for log brands, with new registrations up substantially from 1991. Most new brands were registered to beach log salvage operators and aerial logging companies. Following is the activity reported for five-year log brands issued in 1987.

Renewed	37
Older brands renewed	3
New brands registered	34
1987 brands that expired	17
Total 1992 Log Brands	**74**

Fire Management

Wildland fire suppression in Alaska is the responsibility of the Division of Forestry, the Bureau of Land Management's Alaska Fire Service and the U.S. Forest Service. Each agency protects specific geograhic areas under cooperative agreements. Without these agreements the state would need to spend an additional seven million dollars each year to provide comparable protection for state land.

Alaska is the only state with an interagency fire plan. The plan divides the state into fire protection levels based on major natural fire breaks and the objectives of land managers. This allows attack forces to be deployed to the highest priority areas, those where communities and valuable resources are located, and gives options for lower cost tactics in remote and unsettled areas.

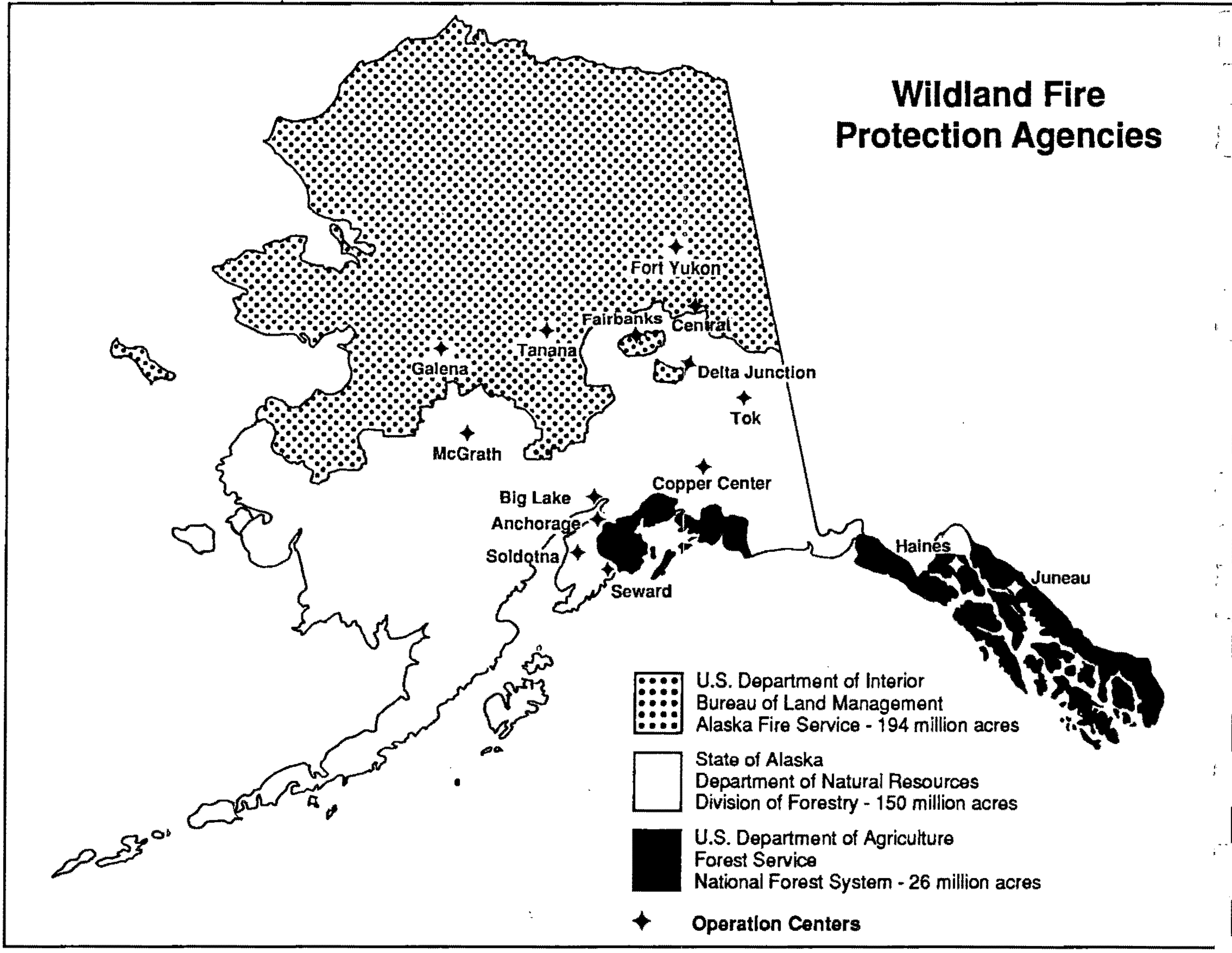
Fire protection levels

Critical Protection: Areas where life and property are present receive immediate and aggressive suppression efforts.

Full Protection: Areas with high value resources where fire may adversely impac resource management objectives also receive immediate suppression efforts.

Modified Action: Areas of high value resources where land managers may consider the trade-off of acres burned versus suppression costs. Fires are attacke immediately but resource managers guide the suppression effort.

Limited Action: Areas where fire is beneficial or fire fighting costs are greater than fire damage. Fires are monitored but no suppression action is taken except to prevent the fire from burning onto higher value land.



ı992 Fire Season

he 1992 fire season was very quiet. A total 474 fires burned 135,360 acres, compared to 1991 when 760 fires burned 1,750,653 acres. Heavy snow pack in the interior and uthcentral regions and record-breaking terior snow storms in May and September resulted in a short, wet fire season.

ı areas protected by the state, 332 fires urned 36,666 acres. One fire crossed into Canada and burned an additional 14,697 res in the Yukon Territory. Of the 332 res, there were only seven in Limited Action areas but they burned 33,865 acres the total.

nere were 117 fires on Alaska Fire Service-protected land, which burned 98,642 acres. owever, 48 fires and 85,070 acres burned Limited Action areas and required little or no suppression action. In areas protected by the Forest Service, largely in Southeast laska, 25 fires burned 51 acres.

Fires in state-protected areas

nere were more than the average number of fires during the spring but all were extinguished while small in size. Only 11 es were started by lightning, with the rgest burning 1,000 acres near Tok.

The first fire began on April 6 in the Mat-ı, followed by 16 other fires during the onth. May was average, for that month, in numbers of fires with 138 reported. More res burned in June than in any other onth of the year, but the number was lower than average for June. There were 82 e starts in June, with only three caused lightning. July and August fire numbers were also far below average, for those months, with 44 fires in July, six caused by htning, and 23 in August.

There were 21 fires in September, the first five in the Fairbanks and Tok areas. Nine es started on the Kenai on September 15 hen high winds blew trees onto power lines. Five fires in the Mat-Su area on tober 6 were all related to high winds. e last fire of the year in a state protection area began in the Mat-Su on October 21.

e quiet fire season resulted in considerly reduced earnings for fire crews in rural areas. The financial hardships this used have potential social impacts.

Training for emergency fire fighting crew bosses in McGrath. Properly trained and equipped crews are crucial to an effective suppression program.

Paradise Hills Fire

Paradise Hills was the only large fire in a state protection area in 1992. It was human-caused and began north of the Alaska Highway near Northway on June 11. The fire began in a Limited Action area but soon burned into a Modified area and threatened structures and Native allotments along the Alaska Highway.

On June 13 an Alaska Interagency Type II Overhead Team and six crews were assigned to the fire. The strategy used was to contain the fire on the south and west flanks and permit it to burn to the north and east into Canada, with the approval of the Canadian government.

The fire was declared out on September 1, with a total of 48,087 acres burned, including 14,697 in Canada. This fire demonstrated the importance of the interagency and international fire suppression cooperative agreements.

Alaska fire statistics
Averages, 1988 to 1992

Number of fires statewide	625
Acres burned statewide	1,455,795
Fires by protection area:	
Division of Forestry	63%
Alaska Fire Service (BLM)	32%
U.S. Forest Service	5%
Human-caused fires by protection area:	
Division of Forestry	80%
Alaska Fire Service (BLM)	11%
U.S. Forest Service	9%

1992 Fire Statistics

Number of fires: 474

Acres burned: 135,360.3

Fire activity by landowner

Landowner	No.	Acres
State	78	34,950.0
Borough/City	19	46.6
Private	213	156.8
Bureau of Land Mgmt.	43	22,649.8
National Park Service	7	199.0
Fish & Wildlife Service	33	64,579.6
Bureau of Indian Affairs	10	235.5
Native Claims Act Lands	33	2,279.0
Military	16	2,807.1
Canada	1	7,410.0
Forest Service	21	47.0
Total	**474**	**135,360.3**

1992 fires by cause on state protected land

	Number	Acres
Lightning	11	1,292.8
Smoking	16	1,053.7
Campfires	48	250.5
Field/debris	88	143.3
Children	35	12.7
Fireworks	23	8.1
Equipment use	10	1.5
Incendiary/arson	7	1.2
Other*	94	33,902.7
Total	**332**	**36,666.5**

*Includes one 33,390-acre fire of unknown origin

Emergency firefighter wages

Year	State	Federal	Total
1980-85	4,689,081	71,117,288	14,551,014
1986	2,515,750	2,832,208	5,347,958
1986[1]	561,770	——	561,770
1987	646,674	5,352,799	5,999,473
1987[2]	643,932	——	643,932
1988	4,474,107	5,146,861	9,620,968
1988[3]	907,865	——	907,865
1989	1,805,955	2,276,175	4,082,130
1990	7,398,211	5,765,547	13,163,758
1991	5,344,384	3,741,521	9,085,905
1992	786,747	612,048	1,398,795
Total	**$29,774,476**	**$35,589,092**	**$65,363,568**

[1] Special appropriation due to Fair Labor Standards Act.

[2] U.S. Dept. of Labor ruling required payment at time-and-one-half when week exceeded 40 hours. Amount shown was paid in 1990.

[3] U.S. Dept. of Labor ruling required payment at time-and-one-half when week exceeded 40 hours. Amount shown was paid in 1991.

Emergency out-of-state crew use

Number of 20-person crews sent outside of Alaska to fight fires.*

Year	Crews
1970	40
1973	6
1981	18
1982	4
1985	39
1986	22
1987	59
1988	54
1989	61
1990	7
1991	0
1992	5

*Wages are paid by other states or suppression agencies.

1992 Fires by Area and Protection Level

State Protected

Area[1]	Critical No.	Critical Acres	Full No.	Full Acres	Modified No.	Modified Acres	Limited No.	Limited Acres	Total No.	Total Acres
AMS	96	93.9	15	61.4	0	0	0	0	111	155.3
KK	77	22.9	15	51.9	0	130.0	2	0.2	94	205.0
VCR	0	0	9	4.5	3	0.3	0	0	12	4.8
SW	2	12.1	14	1,332.1	3	2.4	3	0.1	22	1,836.6
F	62	11.4	6	1.1	1	3.0	1	0	70	15.6
D	12	18.1	1	0.1	3	9.9	0	0	16	28.1
T	2	3.1	3	1,042.0	0	0	1	33,375.0	6	34,420.1
SE	0	0	1	1.0	0	0	0	0	1	1.0
Total	**251**	**161.5**	**64**	**2,494.1**	**10**	**145.6**	**7**	**33,865.3**	**332**	**3,666.5**

U.S. Forest Service Protected

Area	Critical No.	Critical Acres	Full No.	Full Acres	Modified No.	Modified Acres	Limited No.	Limited Acres	Total No.	Total Acres
Total	**1**	**2.0**	**20**	**48.4**	**2**	**0.2**	**2**	**0.6**	**25**	**51.2**

Alaska Fire Service Protected

Area[1]	Critical No.	Critical Acres	Full No.	Full Acres	Modified No.	Modified Acres	Limited No.	Limited Acres	Military Land[2] No.	Military Land[2] Acres	Total No.	Total Acres
GAL	1	0.1	7	726	15	503.1	14	3,552.0	0	0	37	4,781.2
TAL	0	0	12	956.7	6	64.7	5	26,185.0	16	2,807.0	39	30,013.5
UYK	2	1.1	1	0.5	5	1,100.7	29	55,333.3	4	7,412.3	41	63,847.9
Total	**3**	**1.2**	**20**	**1,683.2**	**26**	**1,668.5**	**48**	**85,070.3**	**12**	**10,219.3**	**117**	**98,642.6**

Statewide

Area	Critical No.	Critical Acres	Full No.	Full Acres	Modified No.	Modified Acres	Limited No.	Limited Acres	Military Land[2] No.	Military Land[2] Acres	Total No.	Total Acres
Total	255	164.7	104	4,225.7	38	1,814.3	57	118,936.2	12	10,219.3	474	135,360.3

[1] Area key

AMS — Anchorage/Mat-Su
KK — Kenai/Kodiak
VCR — Valdez/Copper River
SW — Southwest

F — Fairbanks
D — Delta
T — Tok
SE — Southeast

GAL — Galena
TAL — Tanana
UYK — Upper Yukon

[2] Military land has no designated protection levels

The average costs for controlling an escaped fire is $2 to $5 million—four times the estimated annual cost of maintaining a viable workforce to control fires while they are small.

Up to $25 million has been spent on a single escaped fire in the urban/wildland interface.

Fire Protection & Prevention

Grants for rural communities

The division administers Rural Community Fire Protection grants from the U.S. Forest Service. Volunteer fire departments serving communities of under 10,000 people may apply for grants of up to $5,000 on a 50/50 cost share basis to organize, train and equip fire protection units. In 1992 the division approved 20 grants, which funded training and purchased pumps, radios, protective clothing, fire extinguishers, smoke detectors, self-contained breathing apparatus, fire hose and other supplies.

Department	Grant Amount
Pelican VFD	$2,925
Petersburg VFD	500
Klehini Valley VFD	750
Big Lake VFD	5,000
Talkeetna VFD	900
Willow VFD	5,000
Butte VFD	5,000
Greater Palmer VFD	5,000
Bear Creek VFD	5,000
Anchor Point VFD	4,875
Cooper Landing VFD	1,482
McGrath VFD	2,500
Russian Mission VFD	5,000
Togiak VFD	5,000
Chefornak VFD	4,818
Egegik VFD	5,000
Bethel VFD	3,500
North Pole FD	5,000
Eagle VFD	5,000
Savoonga VFD	4,300
Total	**$76,550**

New Kenai Peninsula fire crew

The Kenai-Kodiak Area held Emergency Fire Fighter training classes open to the public in 1992. Fire crews from those who attended were organized on four occasions during the fire season. During a period of alert readiness when the fire danger was extreme, the crews built a memorial trail for state parks using techniques and tools used in fire line construction.

Division upgrades aircraft

The Division of Forestry upgraded its fire fighting aircraft this year by replacing the aging fleet of 1955 military surplus single engine lead planes with three contracted Beechcraft twin engine aircraft. The Beech craft are much more efficient as they are able to move personnel as well as support aerial retardant operations. They have a superior safety record and are more cost effective to operate than the older models.

In addition to these improvements, the st saved $265,200, or 18 percent (over the lif of the contract), by expanding the contract from three to five years, asking for input from the aviation industry and using the state, rather than the federal government, procurement system.

The division continues a training and education program that has resulted in an exceptional safety record and has proven to be efficient and cost effective.

Fire prevention in Fairbanks

The Fairbanks Area received the Preventi Plan of the Year Award from the Interior Fire Chiefs Association in recognition of its assertive prevention program. The associ tion also elected Forestry's Fire Management Officer Tom Kurth secretary-treasurer.

The prevention program includes burn permits, public service announcements, fi investigations and public awareness. More than 2,500 students and 250 teachers were educated in early spring about the dange of wildfire. The area office issued 1,500 burn permits, 29 warning notices for illegal burning and 11 citations. Of those citation eight went to court and resulted in an average sentence of 20 days of jail (suspended), $900 in fines, $1480 in restitution and 140 hours of community service.

The division helped form a task force in Fairbanks that is working to reduce the number of fires set by juveniles. The Fairbanks Area Juvenile Firesetters Task Force promotes communication, training and good working relationships among those involved in this problem. Participants include The Division of Forestry, the Fairbanks North Star Borough School District, U.S. Forest Service, Fairbanks Fire Department, Interior Fire Chiefs Association, Division of Family Services, Attorne General's Office, Fire Marshal's Office, an Juvenile Intake.

..aining Highlights

ire operations in the urban/ ildland interface

Because of a growing concern nationwide out the danger of wildland fires burning to communities and urban areas, the was top training priority in 1992 was the urse, Fire Operations in the Urban/ ildland Interface (S-205). It was offered in both Anchorage and Fairbanks for fire departments and other wildland fire ppression agencies. The course helped meet the training needs of initial attack incident commanders and company ficers confronting wildland fire that reatens life, property and improvements. The lead instructors in the class, and its velopers, were Mike Dannenberg of the issoula, Montana Rural Fire District and Gil Gray of the Rapid City, South Dakota Fire Department.

addition, the division developed the Alaska Wildlands Engine Fire Fighter course to train fire department cooperators suppress wildfire in the urban interface. re departments around the state participated in this training.

azardous materials awareness

The course, Hazardous Materials Aware- ss for the First Responder, was given for Forestry field personnel statewide in the spring. The division serves as initial sponders to incidents that may at times ntain hazardous materials. The course provided staff with the basic information necessary to safely and effectively deal ith incidents involving hazardous materials.

Shaker III

The Division of Forestry sponsored the Basic Incident Management training session (I-220) for the Department of Natural Resources, Pipeline Coordinator's Office, Department of Environmental Conservation and the Division of Emergency Services. The course was in preparation for the multi-agency Shaker III exercise, a simulation of a disastrous earthquake. Most of the exercise was managed under the Incident Command System.

Helitorch training

The Kenai/Kodiak Area Office co-sponsored a session to train commercial helicopter pilots in the use of helitorches for controlled burning and to meet the suppression needs of the state. The session included personnel from the Division of Forestry, the Office of Aircraft Services, the Forest Service, Fish and Wildlife Service, Kenai Helicopters and the Cook Inlet oil spill response team.

Training in 1992

Type	# of courses	Participants
Emergency fire fighter	9	562
Wildfire for fire departments	8	105
Initial attack	14	169
Extended attack	12	189
Fire management	40	323
First aid and safety	5	51
Forest management	6	85*
Totals	**94**	**1,484**

* 83 school teachers received Project Learning Tree training.

Fiscal Year 1992 Actuals[1]

Funding Sources	Forest Management	Fire Suppression	Total
General Funds	9,548.7	15,071.1	24,619.8
Federal Funds	705.7	4,126.0	4831.7
Other Funds	516.1	19.8	535.9
Totals	**$10,770.5**	**$19,216.9**	**$29,987.4**

Positions	Forest Management	Fire Suppression
Permanent-Full Time	88	2
Permanent-Part Time	127	3
Non-Permanent	17	750
Staff Months	1,836	1,545

	Northern Region	Southcentral Region	Southeast Region	Statewide	Total
Resource Management					
Forest Practices Administration	—	45.4	318.5	131.5	495.4
Small Timber Sales	527.2	239.5	186.2	27.3	756.0
Forest Stewardship	69.7	239.5	186.2	194.9	690.3
Board of Forestry	—	—	—	1.2	1.2
Forest Regeneration Center	—	—	—	399.4	399.4
Reforestation	375.3	71.5	47.4	—	494.2
Tanana Valley State Forest	3.4	—	—	—	3.4
Haines State Forest	—	—	63.9	—	63.9
Subtotal	**975.6**	**550.8**	**623.1**	**754.3**	**$2,903.8**
Fire Management					
Presuppression	1,734.8	2,784.1	15.1	445.2	4,979.2
Rural Community Fire Prot./Fed	—	—	—	287.9	287.9
Anchorage School District Interns	—	63.3	—	—	63.3
Subtotal	**1,734.8**	**2,847.4**	**15.1**	**733.1**	**$5,330.4**
Forest Administration					
Federal Coop. Forestry Assistance	—	—	—	417.8	417.8
Forest Administration	549.5	470.1	120.5	477.0	1,617.1
Unbudgeted RSAs	—	—	—	501.4	501.4
Subtotal	**549.5**	**470.1**	**120.5**	**1,396.2**	**$2,536.3**
Total	**$3,259.9**	**$3,868.3**	**$758.7**	**$2,883.6**	**$10,770.5**

[1]All figures are in thousands

Fiscal Year 1993 Budget[1]

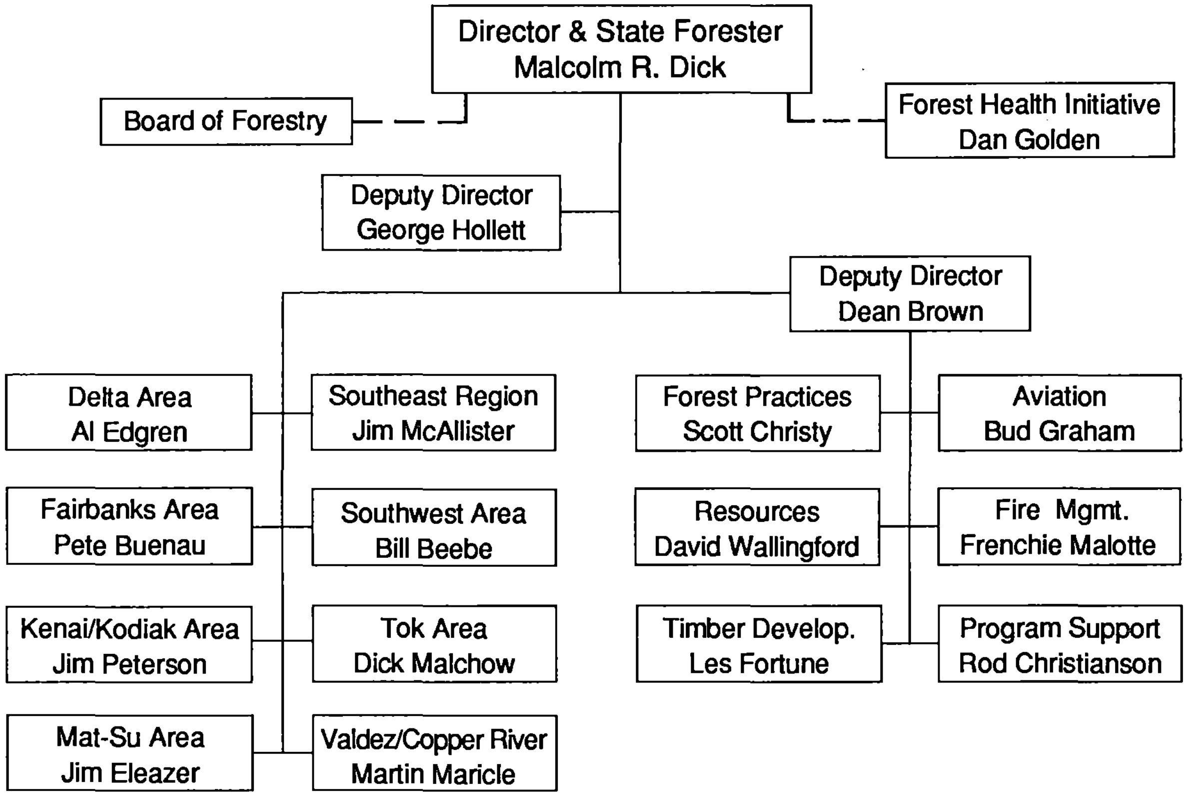
Funding Sources	Forest Management	Fire Suppression	Total
General Funds	8,825.4	1,997.4	10,822.8
Federal Funds	1,168.2	5,328.8	6,497.0
Other Funds	73.7		73.7
Totals	**$10,067.3**	**$7,326.2**	**$17,393.5**

Positions	Forest Management	Fire Suppression
Permanent-Full Time	78	2
Permanent-Part Time	125	4
Non-Permanent	17	750
Staff Months	1,710.6	1,552

	Northern Area	Southcentral Area	Southeast Region	Statewide	Totals
Resource Management					
Resource Management	884.1	420.8	651.0	423.3	2,379.2
Forest Regeneration Center	—	—	—	219.1	219.1
Board of Forestry	—	—	—	10.7	10.7
Subtotal	**884.1**	**420.8**	**651.0**	**653.1**	**$2,609.0**
Fire Management					
Presuppression	1,623.1	2,737.7	29.2	429.5	4,819.5
Rural Community Fire Prot./Fed	—	—	—	267.6	267.6
Anchorage School District Interns	—	41.0	—	—	41.0
Subtotal	**1,623.1**	**2,778.7**	**29.2**	**697.1**	**$5,128.1**
Forest Administration					
Federal Coop. Forestry Assistance	—	—	—	900.6	900.6
Forest Administration	481.2	353.1	127.3	468.0	1,429.6
Subtotal	**481.2**	**353.1**	**127.3**	**1,368.6**	**$2,330.2**
Total	**$2,988.4**	**$3,552.6**	**$807.5**	**$2,718.8**	**$10,067.3**

[1]All figures are in thousands

Division of Forestry Organization Chart - 1992



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SBB Public Consensus Svy (U of AK/ISER Summary)

Institute of Social and Economic Research
University of Alaska Anchorage

Research Summary

R.S. No. 51
October 1991

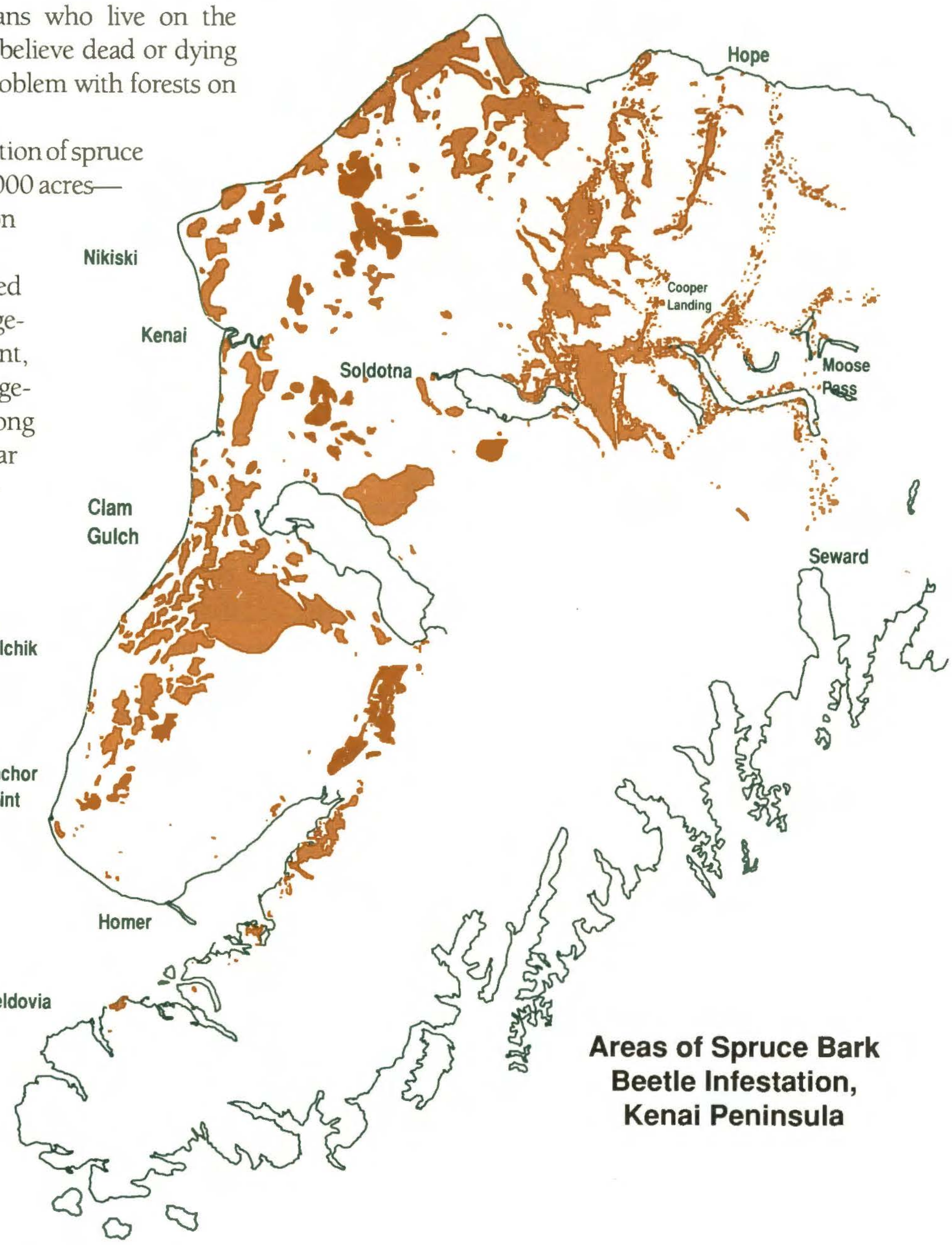
Managing Beetle-Killed Spruce on the Kenai Peninsula

Nearly 90 percent of Alaskans who live on the Kenai Peninsula and in Anchorage believe dead or dying spruce trees are the most serious problem with forests on the Kenai Peninsula.

Since 1970, a spreading infestation of spruce bark beetles has killed trees on 700,000 acres—about 35 percent of forested land on the peninsula.

What to do about the infested trees has become a prominent management issue for the state government, partly because areas of dead, orange-brown spruce are very visible along peninsula highways. Dead trees near communities can also be a fire hazard. The state Division of Forestry, which is part of the Department of Natural Resources, asked ISER to find out how residents of southcentral Alaska want the state to manage areas affected by the spruce bark beetles. The division manages about eight percent of forested land on the Kenai Peninsula.

In March and April 1991 ISER conducted a telephone survey of 400 peninsula households and 100 Anchorage households. ISER also created maps documenting the location and extent of the beetle infestation, using data collected by the U.S. Forest Service over the past 20 years.



Areas of Spruce Bark Beetle Infestation, Kenai Peninsula

This Research Summary is based on ***Developing A Public Consensus on the Management of Spruce Bark Beetles on the Kenai Peninsula,*** *by Jack Kruse and Robert Pelz. The report is available from ISER at a cost of $5.00. This publication is on recycled paper.*

Below we summarize the report findings. We surveyed three groups of southcentral residents: (1) affected homeowners (Kenai Peninsula residents who reported dead or dying spruce on their own or adjoining properties); (2) other Kenai Peninsula households; and (3) Anchorage households.

We asked southcentral residents whether the state should remove or leave beetle-killed trees; whether it should protect healthy trees near infested ones; and whether and how the state should speed re-forestation in affected areas. Affected areas are near homes, along highways, in campgrounds, and in backcountry.

Bear in mind that the state owns just a part of the beetle-infested lands. Areas of the Chugach National Forest and the Kenai National Wildlife Refuge are also affected, as well as borough and private lands. So whatever the state decides to do about the infestation on its own lands, federal, borough, and private landowners will make their own decisions about large areas of the peninsula.

How Big is the Problem?

Press coverage of the beetle infestation, and the growing swaths of dead trees, have made Alaskans very aware of the spruce beetle infestation. More than half of Anchorage residents and three-quarters of Kenai Peninsula residents have read about the beetle infestation, and half of all southcentral residents say they have seen dead trees along peninsula highways.

What are the problems created when beetles kill spruce trees? Figure 1 shows percentages of affected peninsula homeowners, other peninsula residents, and Anchorage residents who cited various kinds of problems created by the spruce bark beetle. Southcentral residents think the chief problems resulting from beetle-killed spruce are (1) less attractive views, (2) fire threat, and (3) loss of privacy. Other problems cited include large areas affected, loss of timber, and declining property values.

In researching the problem ISER found:

- Of the total 700,000 acres affected by beetles since 1970, 150,000 acres were infested within the past five years. Some areas that were first infested between 1970 and 1975 were re-infested between 1985 and 1990.
- The estimated value of buildings on or adjacent to properties with beetle-killed spruce is $686 million. That does not mean all these buildings are at risk in the event of fires, or that all these property owners have lost privacy. The figure simply establishes that a substantial number of homes and other buildings are in areas affected by the spruce bark beetle.
- About 33,000 acres infested by beetles are in the most populated areas of the peninsula, including the communities of Cooper Landing, Nikiski, Kenai, and Soldotna.
- About 5,000 Kenai Peninsula homeowners, or 51 percent of peninsula households, report beetle-killed spruce on their own or adjoining properties.

Dead Trees Near Homes

Figure 2 shows how residents of Anchorage and the Kenai Peninsula want the state to manage beetle-infested trees near homes:

- About three out of four residents of south-central Alaska want the state to cut down and remove dead trees near homes.
- More than half of southcentral residents want the state to plant new trees near homes and either scrape the ground or place mats around the new trees to discourage grasses that can choke seedling trees.
- Fewer than one-quarter of southcentral residents support the use of chemicals near homes to dry or kill grasses that could choke newly planted trees.

Figure 1. Six Most Commonly Cited Problems
(In Percentages of Respondents)

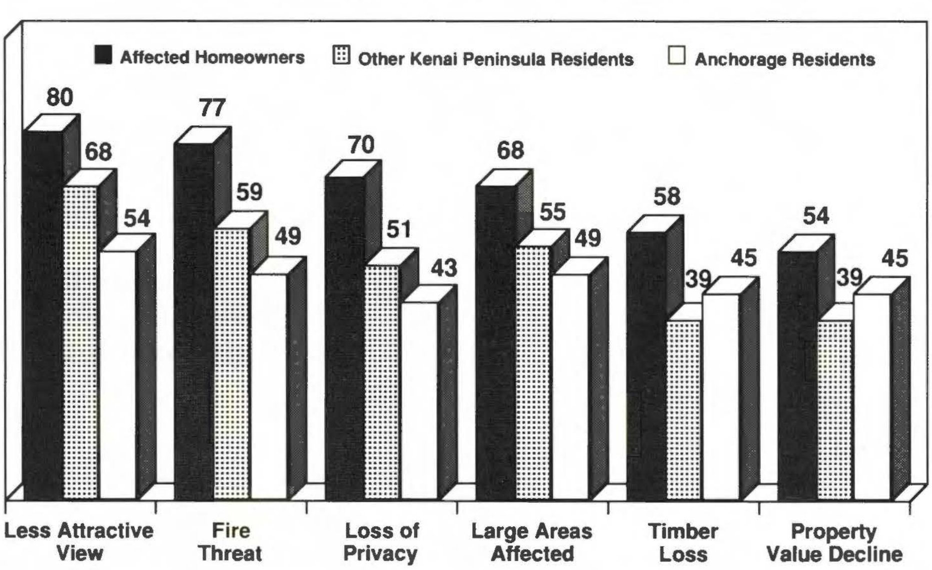


Figure 2. Public Support for Managing Infested Trees Near Homes
(In Percentages of Respondents)

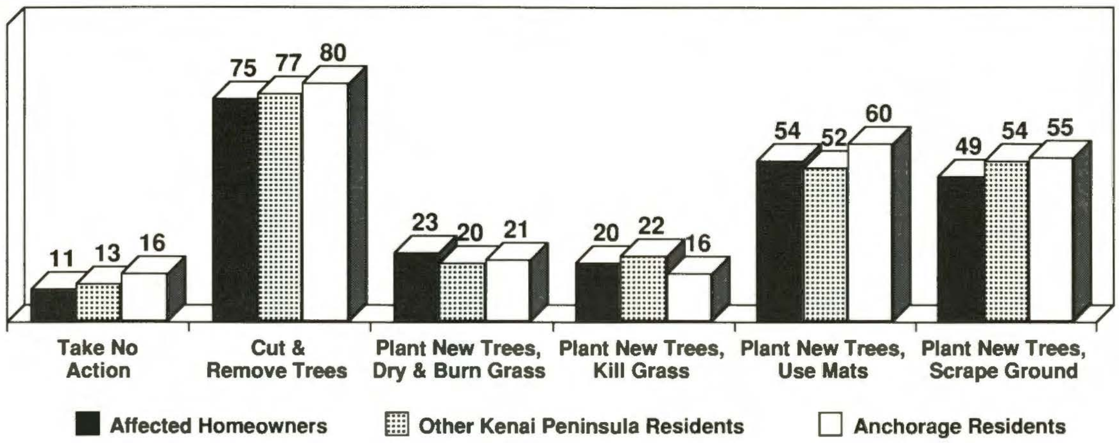


Figure 3. Public Support for Managing Infested Trees Along Highways
(In Percentages of Respondents)

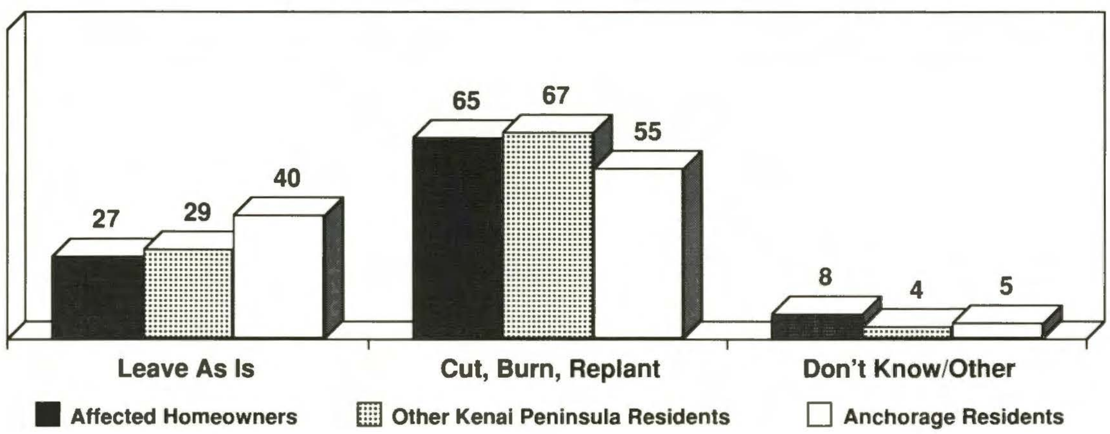
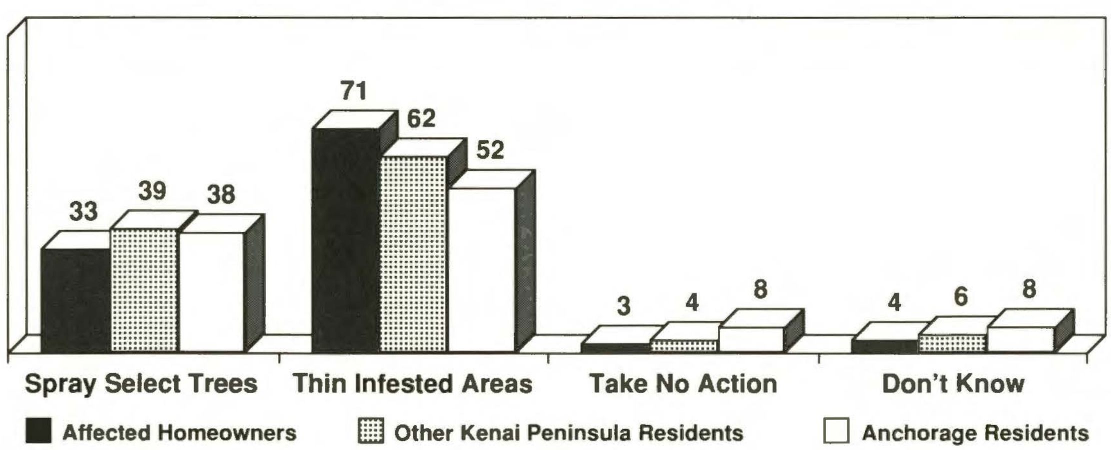


Figure 4. Public Support for Managing Spruce Beetles Near Campgrounds
(In Percentages of Respondents)



Dead Trees Along Highways

Figure 3 shows how southcentral residents want the state to manage beetle-infested trees along highways:

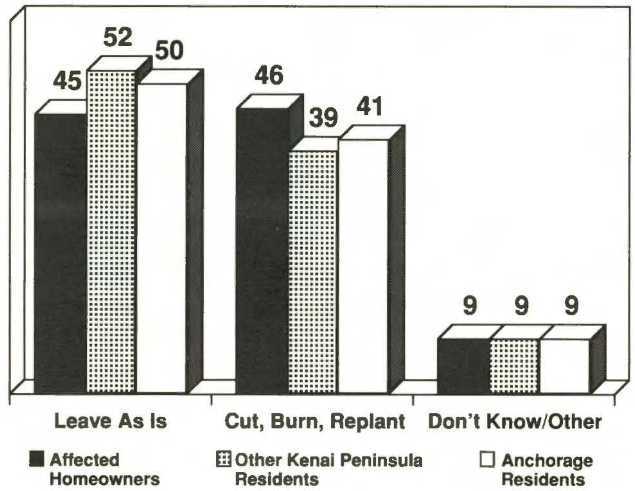
- Two-thirds of peninsula residents and more than half of Anchorage residents want the state to cut and burn beetle-killed trees along the highways and plant new trees.
- A substantial minority of southcentral residents—40 percent in Anchorage and nearly 30 percent on the peninsula—think the state should do nothing about beetle-killed trees along highways.

Dead Trees in Campgrounds and Backcountry

Figures 4 and 5 show how southcentral Alaskans want the state to manage beetle-infested trees in campgrounds and in backcountry:

- Most (71 percent) of peninsula residents whose own properties have been affected by the spruce bark beetle want the state to thin out infested trees in campgrounds. More than half of other southcentral residents also support thinning infested trees in campgrounds.
- Sizable minorities (nearly 40 percent) of Anchorage and Kenai Peninsula residents favor protecting selected trees in campgrounds by spraying them with insecticides.

Figure 5. Public Support for Managing Spruce Beetles in Backcountry
(In Percentages of Respondents)



- Southcentral residents are almost evenly split in their opinions about what the state should do about beetle-killed trees in backcountry: roughly half say the state should do nothing, and almost half want the state to cut and burn dead trees and plant new ones.

Research Summary (No. 51)
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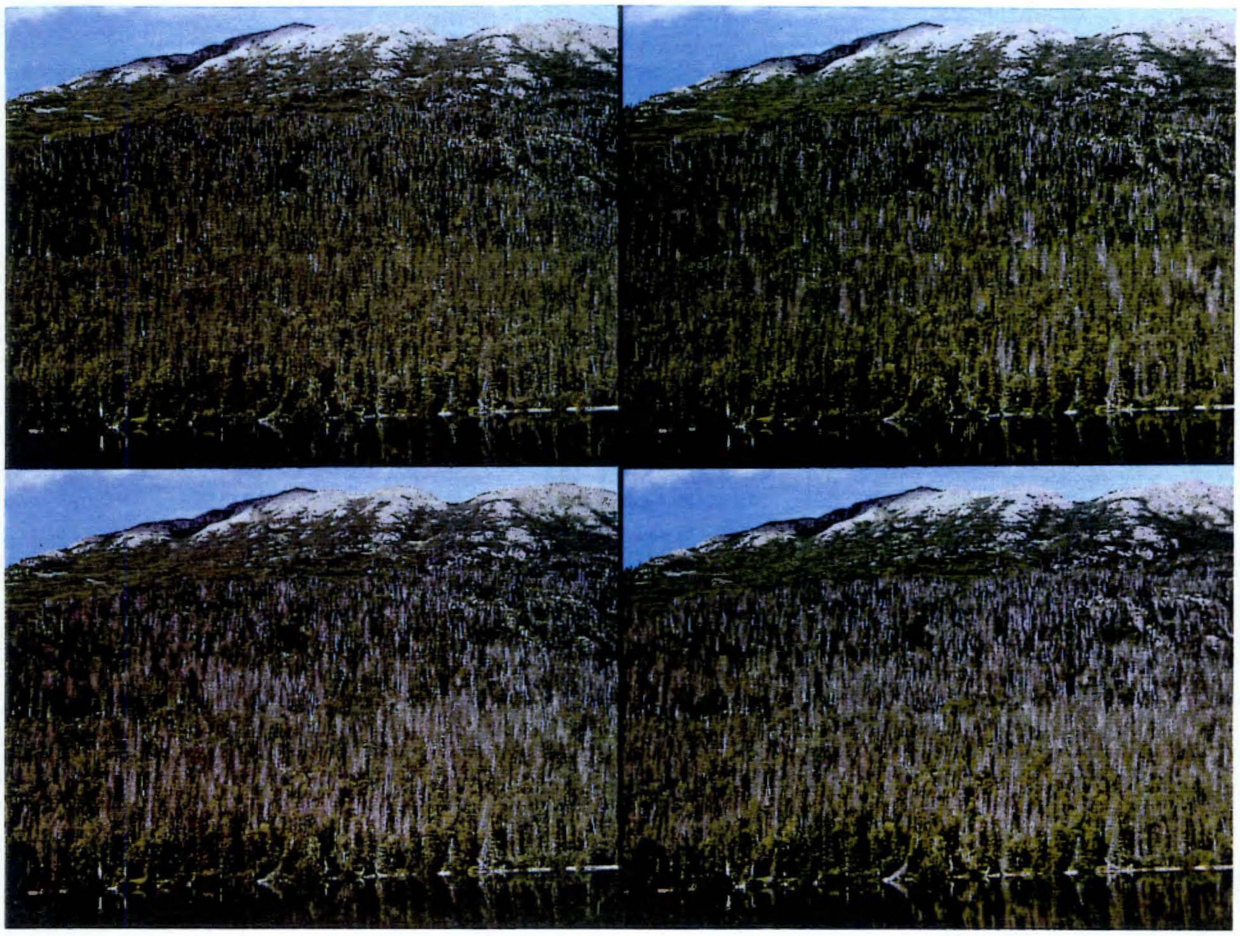

PUBLIC PERCEPTION AND ATTITUDES REGARDING SPRUCE BARK BEETLE DAMAGE TO FOREST RESOURCES ON THE CHUGACH NATIONAL FOREST, ALASKA

Final Report December 1992

prepared for:
USDA Forest Service
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PUBLIC PERCEPTION AND ATTITUDES REGARDING SPRUCE BARK BEETLE DAMAGE TO FOREST RESOURCES ON THE CHUGACH NATIONAL FOREST, ALASKA

The spruce bark beetle outbreak on the Kenai Peninsula, Alaska, has had effects on timber resources and on the habitat of some wildlife species. In some areas, wildfire hazard has increased. As the outbreak and its aftermath continues there will be further effects on natural resources important to local communities, the state of Alaska and the nation.[1]

Unequaled scenic landscapes and outstanding recreational opportunities are among Alaska's most important natural resources, and these resources are among those most directly at risk from the spreading beetle outbreak. Management response to the outbreak must, therefore, address the protection and rehabilitation of scenic and recreational resources in affected areas. However, choosing the best management strategies is complicated by the fact that significant parts of the affected area are highly visible to the public. Moreover, Alaska, and the Kenai Peninsula in particular, is the focus of considerable concern by local and national constituencies which often have conflicting goals. Thus, management direction must be carefully designed to be effective and efficient in ecological and economic terms, and at the same time responsive to the perceptions, attitudes and values of the various local and national publics that have a stake in the outcome.

The assessment presented in this report focussed on determining public perceptions of the effects of the spruce bark beetle outbreak on forest scenic values, and on gauging public attitudes toward alternative forest management approaches. Participants for the studies were sampled from residents, visitors and tourists in and near the affected areas of the Kenai Peninsula. Computer generated visual simulations of forest scenic vistas were employed to assess public perception of insect-affected (or threatened) areas, and to determine preferences for possible alternative future forest conditions. Additional questions investigated participants' attitudes toward different insect-targeted management strategies associated with the simulated forest conditions.

Results from two studies are reported. The first study, conducted in the summer of 1990, primarily addressed bark beetle effects on tourists' perceptions of forest *scenic beauty*. A small number of Alaska residents were also sampled, and their attitudes and values associated with the insect outbreak and with alternative management strategies were explored. The second study, in the summer of 1991, focussed on residents of Kenai Peninsula communities directly affected or threatened by the spreading bark beetle outbreak. The primary objective of the second study was to further articulate residents' perceptions of alternative future forest conditions, and their attitudes toward alternative forest management approaches for the *prevention* of outbreaks, the *protection* of stands during outbreaks and the *restoration* of areas already affected by outbreaks.

STUDY APPROACH

Public perceptions of alternative future forest conditions were assessed by having samples of residents and visitors view and rate the *scenic beauty* of forest scenes sampled from bark-beetle affected forest areas on the Kenai Peninsula. Scenes represented the full range of outbreak conditions, from sites with no detectable effects to sites where virtually all of the trees in the scene were dead.

Digital video imaging techniques[2] were used to create simulations of future (hypothetical) forest conditions for a representative sample of scenes. These simulated scenes allowed experimentally controlled manipulation of specific forest features expected to change as a result of the bark beetle infestation and associated management options. This procedure insured that only selected features of the scenes were changed, while other features not associated with the targeted beetle or management actions were held constant. Visual simulations representing expected consequences of alternative management actions (including no action) for up to 50 years into the future formed the basis for the public perceptual assessment process.

In conjunction with perceptual assessments, respondents also indicated opinions and attitudes toward a variety of forest management practices associated with bark beetle outbreak prevention and control, and with restoration of forest stands after severe infestations. Issues addressed in this verbal component of the study included: public awareness of the bark beetle outbreak; values judged to be at risk; the perceived likelihood of the outbreak spreading; and the acceptability of several management options, including forest overstory manipulations by clear cutting or thinning, the use of insecticides, herbicides and fire, and "allowing nature to run it's course."

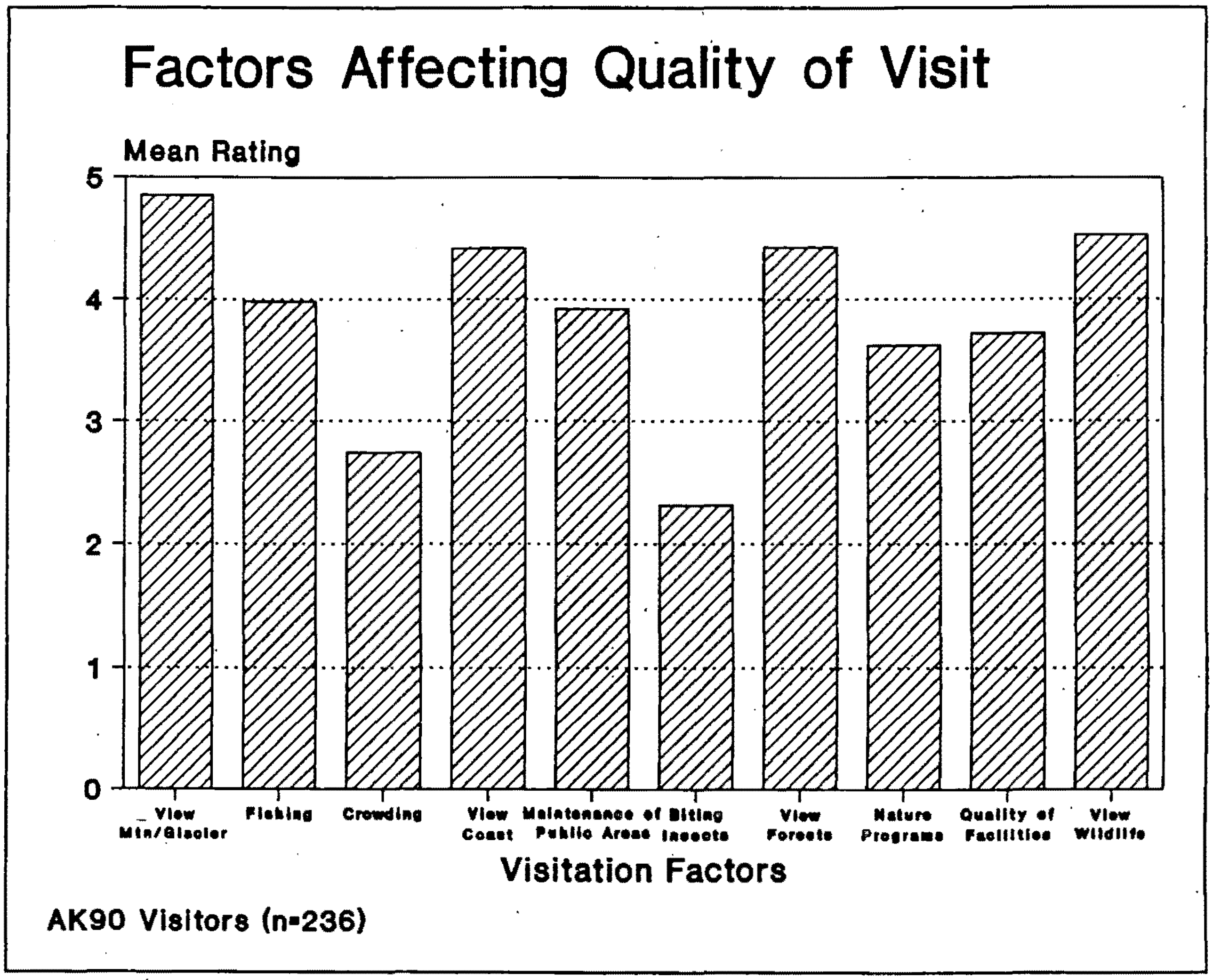
There was no effort to obtain formal random samples, but the study design allowed comparisons of the perceptions and attitudes of tourists/visitors and residents (1990 study), as well as comparisons among residents from different communities in affected and threatened areas on the Kenai Peninsula (1991 study). The relationships between perceptually preferred forest conditions, the desired *ends*, and the acceptability of the various management strategies required to achieve those conditions, the *means*, were also investigated.

RESPONDENTS

A total of 84 Alaska residents and 306 visitors participated in the 1990 study. Participants were recruited at shopping centers and at major tourist/recreation facilities in the Anchorage/Kenai Peninsula study area. The visitor sample included participants from a wide geographic area in the US and abroad. Most of the residents in this "convenience sample" were from the Anchorage area, with smaller numbers from Kenai Peninsula communities.

The 306 visitors represented many of the lower 48 states and several foreign countries. Most of the visitors (73%) were in Alaska for the first time, 94% planned to stay a week or more, and 50% were staying three weeks or more. Planned activities included *sight-seeing* (94%), *wildlife viewing* (75%), *hiking* (61%), *camping* (49%) and *fishing* (47%). Factors reported as having the greatest positive effect on the quality of the visit were (in order of rated importance): *viewing mountains and glaciers*, *viewing wildlife*, *viewing forest scenery*, and *viewing coastal scenery*. *Quality of fishing* was reported as either irrelevant or mildly positive for most visitors. The most negative factor reported was *biting insects*.

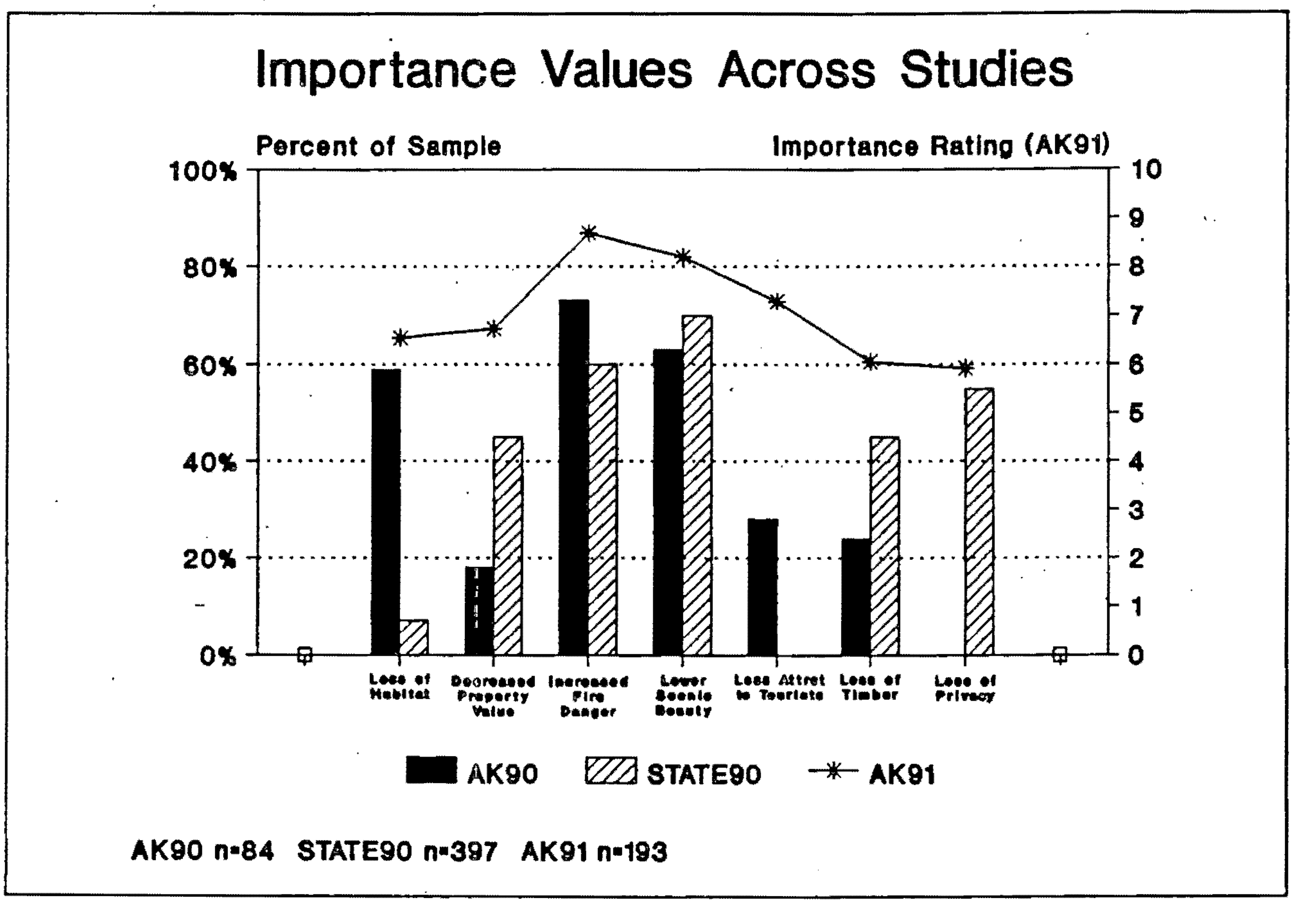
For the 1991 study 166 residents were recruited through civic organizations in targeted Kenai Peninsula communities. Participants responded individually to sets of color prints depicting alternative conditions for representative forest scenes and to management policy questions bound in "photo album" booklets. Participating groups ranged in size from 5 to 35 people.



Awareness of the spruce bark beetle outbreak was very high among respondents in both the 1990 and 1991 studies. Of the residents sampled in 1990, 73% reported *noticing dead* *trees* and 80% reported that they were *aware of the outbreak* prior to the study. For the resident sample in the 1991 study, 58% reported *noticing dead trees near their own community* and 79% *noticed dead trees elsewhere on the Kenai*. Over 80% reported being aware of the spruce bark beetle outbreak prior to the study. These results are very consistent with the Alaska State random telephone survey,[3] where an astonishing 88% of Kenai Peninsula residents cited "dying trees" or "beetles killing trees" in response to an open-ended question regarding the most serious problems with forests on the Peninsula.

For residents in the 1990 study the most important effects of the outbreak were *increased fire danger*, *loss of scenic beauty*, and *loss of wildlife habitat*. Less important effects were *decreased property values*, *decreased attractiveness to tourists* and *loss of timber values*.

The 1991 study produced essentially parallel results; effects rated most important were *increased fire danger*, *loss of scenic beauty*, and *lower attractiveness to tourists*. Judged less important were *loss of privacy*, *loss of timber values*, *loss of wildlife habitat* and *loss of property values*. The same basic pattern of concerns was also found in the Alaska State survey; *loss of scenic beauty* (70%), *increasing fire danger* (60%), *loss of privacy*(55%), *loss of timber values* (45%), *decrease in property values* (45%) and *loss of wildlife habitat* (4%).



Demographics - 1990/1991

1990 Residents		1990 Nonresidents		1991 Residents	
Anchorage	111	California	45	Ninilchik	34
Wasilla	17	Washington	22	Kenai C.C.	26
Eagle River	12	Oregon	19	Cooper Landing	25
Soldatna	11	Florida	15	Anchor Point	21
Fairbanks	6	Canada	13	Hilltop Youth	20
Kenai	5	Michigan	13	Kasilof	12
Girdwood	5	New York	13	Homer	10
North Pole	3	Minnesota	12	Salamatof	8
Homer	3	Arizona	10	Ninilchik Native Association	5
Sterling	3	Indiana	10		
Other	27	Other	122		
Total	203	Total	306	Total	161

Summary

Most visitors to the Kenai Peninsula were there for the first time, as is typical of many major tourist destinations, and they stayed for a considerable period of time, most planning stays of one to three weeks. Sight-seeing and wildlife viewing were the dominant activities reported, and spectacular natural scenery was the most important factor contributing to the enjoyment of the visit. The emphasis on viewing scenery clearly justifies forest managers' concerns about spruce bark beetle effects on visual/aesthetic resources in the area.

Residents in both the 1990 and 1991 studies were very much aware of the spruce bark beetle outbreak and its effects. Reports in the media, special government bulletins and meetings, as well as direct observation all contributed to the high awareness levels.

Major areas of concern to residents were the loss of natural scenic beauty and increased fire danger, with lesser concern expressed for loss of timber values and wildlife habitat. Based on these findings, forest management policies directed at protecting or restoring scenic values and reducing risk of wildfires should be supported by Kenai Peninsula residents.

VISUALIZING FUTURE FOREST CONDITIONS

The visual effects of the spruce bark beetle outbreak on the Kenai Peninsula were represented by a sample of over 500 color slides of forest vistas collected in the summers of 1989 and 1990. View points were sampled from along roads and trails, and within designated campgrounds frequented by visitors to the area as well as from locations within and near developed communities. Slides depicted dramatic as well as common (for Alaska) scenes of forested areas, and included bark beetle impacts ranging from undetectable to essentially 100% tree mortality.

Typical of the study area, over half of the scenes included either lakes or streams, and many exhibited a backdrop of high peaks, some with caps or patches of snow. Scenes dominated by development features (roads, buildings, disturbed areas) were excluded from the sample. A representative subset of the scenes, all meeting high standards of photographic quality, were selected as the basis for the public perception studies.

Digital Video Image Processing

All color slides selected for inclusion in the study were commercially scanned to produce digital computer files. This process allows translation of the color slide into a high resolution image (up to 512 by 482 lines) with over 32,000 different levels of color. When these images are displayed on high quality video monitors, or output as color slides or prints, the quality of the image is essentially equal to that of a good color photograph.

There are several important advantages of the digital format. First, the computer image can be quantitatively analyzed to determine precisely differences in color and other characteristics of features in the scene, e.g., differences between hardwoods and conifer trees, or between living and dead spruce trees. Second, selected features of the scene can be systematically altered to represent changes projected to occur as a result of insect infestation or of forest management activities.

For example, if increasing tree mortality is projected for selected areas in a forest scene, green trees can be "killed" by applying color "filters" to shift their color values from living green to the reddish or grey colors typical of beetle killed trees. If some trees are to be removed or some area is projected to burn, existing trees in that region of the scene can be "cut" out of the scene and replaced by "pasting" in appropriate open or burned area textures. Examples are shown in the color illustrations.

Simulations of the forest conditions that were the focus of the perceptual assessments reported here were developed at the Imaging Systems Laboratory at the University of Illinois. A combination of geographic information system view-modeling techniques and customized digital video image editing routines were used.[4] Different levels of insect damage and a number of alternative future forest conditions associated with selected management scenarios were simulated using image processing and pattern substitution techniques developed for this purpose. Digital image files for unaltered and for simulated scenes were used to produce color prints and slides, or they were directly displayed on a high quality color video monitor. All representations achieved near photographic quality levels for color, resolution and realism.

Selection of representative scenes and the detailed features of each simulation were guided by available forest inventory data, maps of stand boundaries, computer generated "perspective views" and by the expert judgements of forest silviculturalists and pest management specialists working in the area. In addition, the members of a multi-disciplinary citizen/professional panel charged with planning forest management responses to the bark beetle outbreak in the Cooper Landing study area served as expert judges for selecting representative forest scenes, and for validating the simulations of hypothetical forest conditions.

Alternative Future Conditions

Using the selected representative scenes as a starting point, two general types of "future forest" scenarios were created. Some scenarios depicted changes in forest scenes expected to occur over time as a result of a continuing bark beetle infestation, either assuming some preventative actions (e.g., thinning the susceptible spruce trees) or that no action was taken. The *no treatment* scenarios extended from "green" scenes, where very few or no dead trees were detectable, and progressed through scenes of intermediate stages to a condition where virtually all of the spruce trees in the scene were dead.

The infestation scenarios were created retrospectively, beginning with scenes of dead trees and using historic data to progressively "green up" the scene until it appeared as it did prior to the infestation (see color Plates 1 - 3a). Other scenarios were created to depict future conditions expected to occur over a 50-year period as a result of a number of different forest management actions that might be taken to restore areas already severely affected by the bark beetle infestation (color Plates 4 - 9).

Six *base* scenes were selected for modification to represent expected changes in forest characteristics relevant to the spruce bark beetle outbreak. Four of the base scenes were manipulated (retrospectively) to develop scenarios reconstructing the progressive changes that had occurred over the preceding twelve years of the outbreak. Beginning with the scenes as they appeared in the summer of 1990 (unaltered photographs showing over 90% mortality of spruce) simulations were constructed (nominally) representing how each of these four scenes looked 12, 9, 6 and 3 years in the past. These scenarios showed the typical progression from green forest to increasing numbers of dead trees. In addition, an alternative retrospective scenario was constructed covering the same time period for one of the scenes (Kenai River/Schooner Bend), but assuming that the affected stands had been thinned by removing 50% of the spruce (in two separate operations) and encouraging a mixed age forest with a greater proportion of hardwoods (see Plate 3b).

For the 1990 study four of the base scenes were manipulated to depict conditions expected to result at 5, 10, 20 and 50 years in the future from two alternative strategies for managing areas where spruce tree mortality was already severe (90% or more of spruce are dead). Strategies represented were; *no treatment*, postulating a moderately severe wildfire followed by unaided natural regeneration dominated by brush, grasses and hardwoods; and a *treatment* scenario in which dead spruce trees were clearcut and removed followed by a prescribed "site preparation" burn to encourage spruce regeneration (Plates 4 - 7). All other features of the scenes were held constant.

For the 1991 study additional 5-to-50 year scenarios were developed for the Kenai Lake/Snug Harbor base scene. All scenarios postulated clearcutting of the dead spruce followed by:

1. a high intensity burn (achieved by felling and leaving the dead spruce), leading to better spruce regeneration with some hardwoods (Plate 8a);
2. a light intensity burn (after removing the dead spruce), leading to predominately grass and some hardwoods (Plate 8b);
3. no special site preparation or regeneration efforts (only normal disturbance that occurs from summer logging operations), leading to predominately grass with a few hardwoods (Plate 9a); or
4. mechanical ground scarification, leading to better spruce regeneration with few hardwoods (Plate 9b).

Two additional scenarios were developed for one *near-view* scene representing views within the forest canopy, as would be typical in campgrounds or along trails. The near-view scene modification techniques required extensive "cutting and pasting" and relied largely on an artistic process. These simulations were intended only as an exploratory effort not central to the present study and thus they are not shown in the illustrations.

Summary of Visual Simulations

Retrospective Scenarios	3-6-9-12 years	Plate #
Jean Lake	• No Treatment	1
Kenai Lake/S. of Snug Harbor	• No Treatment	2a
Kenai Lake/Snug Harbor	• No Treatment	2b
Kenai River/Schooner Bend	• No Treatment	3a
	• Thinning	3b
Restoration Scenarios	**5-10-20-50 years**	
Cooper Creek Campground	• No Treatment	5a
	• Cut-Remove-Burn	5b
Cooper Creek from Resurrection Pass Trail	• No Treatment	6a
	• Cut-Remove-Burn	6b
Kenai River/Schooner Bend	• No Treatment	4a
	• Cut-Remove-Burn	4b
Kenai Lake/Snug Harbor	• No Treatment	7a
	• Cut-Remove-Burn	7b
	• High Intensity Burn	8a
	• Moderate Intensity Burn	8b
	• Normal Ground Dist.	9a
	• Mech. Scarification	9b
Near-View/Campground	• No Treatment	not shown
	• Thinning/Insecticide	not shown

ACKNOWLEDGEMENTS

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The continuing support of Bill White, Methods Applications Group, Forest Pest Management, USDA Forest Service is also gratefully acknowledged.

Finally, a very special thanks is extended to the citizens of the Kenai Peninsula who invited us into their communities and recruited their neighbors and friends to participate in this assessment.

EXECUTIVE SUMMARY

The spruce bark beetle outbreak on the Kenai Peninsula, Alaska, poses a continuing threat to internationally significant scenic and recreational resources. Reported here are the results of an assessment of perceptually preferred forest conditions and acceptable forest management policies as judged by residents and visitors in the affected area.

Computer visual simulations were employed to depict a range of forest conditions projected to occur over the next 50 years as a result of bark beetle infestation. Conditions expected to result from alternative forest management actions were also simulated for comparison. Respondents rated individual simulated scenes for ***natural scenic beauty*** or selected between pairs of four-scene scenarios that depicted expected outcomes of **treatment** *vs* **no treatment** options for representative forest scenes.

Alternative management strategies were described and respondents rated the relative acceptability of (or their agreement with) each. Management options assessed included **general policies**, methods for **prevention** of future beetle outbreaks, **protection** of threatened stands during outbreaks, **restoration** of stands already affected and **expectations** for continuing spread of the current outbreak. Principal findings of the assessment included:

> ***Sight-seeing*** was the predominant activity for visitors and ***views of natural scenery*** and ***viewing wildlife*** were the most important factors affecting the quality of their trip to Alaska.
>
> Residents were very much aware of the bark beetle outbreak and reported ***loss of scenic beauty*** and ***increased fire danger*** as the most important impacts.
>
> Based on computer simulations of forest scenes, residents' and visitors' **scenic beauty ratings** were highly consistent and significantly declined as the proportion of beetle-killed trees in the scene increased.
>
> Respondents consistently preferred four-scene scenarios depicting forest conditions projected for **treatment** options over those for **no treatment**. A preventative **thinning** scenario was preferred to **no treatment** for threatened stands, and **cut/leave/burn** was the most preferred restoration scenario for stands with high beetle-caused tree mortality.
>
> A substantial majority of respondents rejected ***let nature take its course*** as a policy for areas ***near*** developments where beetle effects were ***more severe***; this policy was most acceptable for areas ***far*** from developments where effects were ***less severe***.
>
> ***Thinning*** was preferred over ***clear cutting small patches*** as a method for **prevention** of beetle outbreaks, and residents agreed that ***cut trees should be sold to private companies*** even when ***selling the trees will only pay part of the costs***.
>
> The use of "environmentally approved" ***insecticides*** for **protection** of selected trees during an outbreak met with divided responses; the number "strongly agreeing" was essentially matched by the number "strongly disagreeing."

Restoration of areas already severely affected by bark beetles was a high priority for respondents and generally treatments that produced more rapid regeneration of spruce forests were preferred; ***cut/remove/burn*** (moderately hot fire) was the most preferred option, followed by ***cut/remove/scrape*** (mechanical scarification), with ***leaving the forest undisturbed*** least preferred. The use of "environmentally approved" ***herbicides*** produced strong responses almost equally split between support and non-support.

Respondents **expectations** were that the outbreak ***will continue to spread***, including ***to their own properties***, and that the effects will be severe, ***at least half of the spruce trees will die*** in affected areas.

Over 65% of respondents disagreed with ***allow(ing) most of the spruce trees in your area to be killed by bark beetles (rather) than to have the forest treated by cutting and spraying insecticides.***

The strongest differences among respondents were with respect to the use of insecticides and herbicides: Supporters of **chemical treatments** agreed that ***spraying insecticides is the best way to protect large trees near homes***; that sprayed trees are ***essentially 100% safe from beetle attack***; that ***approved insecticides are safe*** and they ***would be willing to use*** them; and supported ***applying environmentally approved herbicides*** to restore spruce in damaged areas. At the same time, supporters tended to disagree that ***other insects and animals might be harmed***, that insecticides are ***potentially dangerous to humans*** and that ***herbicides should not be used under any circumstances because of possible contamination of the environment***. Non-supporters of **chemical treatments** exhibited the opposite pattern of agreement/disagreement.

To be consistent, respondents who exhibited perceptual preferences for particular forest conditions should have supported management policies required to achieve those conditions. However, no consistent relationships were found between preferred perceptual *ends* and supported management *means*; preferences for forest conditions produced by **treatment** were not consistently associated with support for active management policies implied by those preferences.

In conclusion, results indicated that bark beetle-caused tree mortality has significantly reduced scenic beauty of forest scenes in the Kenai Peninsula study area. Future forest conditions resulting from active management policies were consistently preferred over conditions projected for non-intervention alternatives. There was substantial public support for active management response to the spruce bark beetle outbreak, but there was no clear consensus for any particular management strategy. The greatest divisions among the sampled publics revolved around the use of **chemical treatments**, with much of the controversy based on differing beliefs about the effectiveness of insecticides and the severity of environmental hazards associated with both insecticides and herbicides.

Forest managers can expect substantial public support for actions designed to protect or restore scenic values, but a concerted public information/environmental education program should be an important precondition for any application of insecticides or herbicides.

Public Perception and Attitudes Regarding Spruce Bark Beetle Damage to Forest Resources on the Chugach National Forest, Alaska

Color Plates

Each of the four-scene sets displayed in the following color plates shows simulations of the effects of a spruce bark beetle outbreak, or of a hypothetical forest management activity on a representative Kenai Peninsula forest scene. Simulations show progressive changes (3, 6, 9, 12 years for some scenarios and 5, 10, 20, 50 years for others) expected as a result of bark beetle infestation and/or some forest management activity. In each case, the image at the upper left represents conditions at the earliest time point (3 or 5 years) and the lower right represents the latest time period (12 or 50 years) after the postulated infestation or management action.

Plate 1

Jean Lake - Scene AJ 1319
3, 6, 9, 12 year scale

Simulations show progressive changes due to spruce bark beetle infestation with no management intervention. Simulations were created "retrospectively"; the year 12 (bottom right) representation shows the scene as it appeared in the summer of 1990.

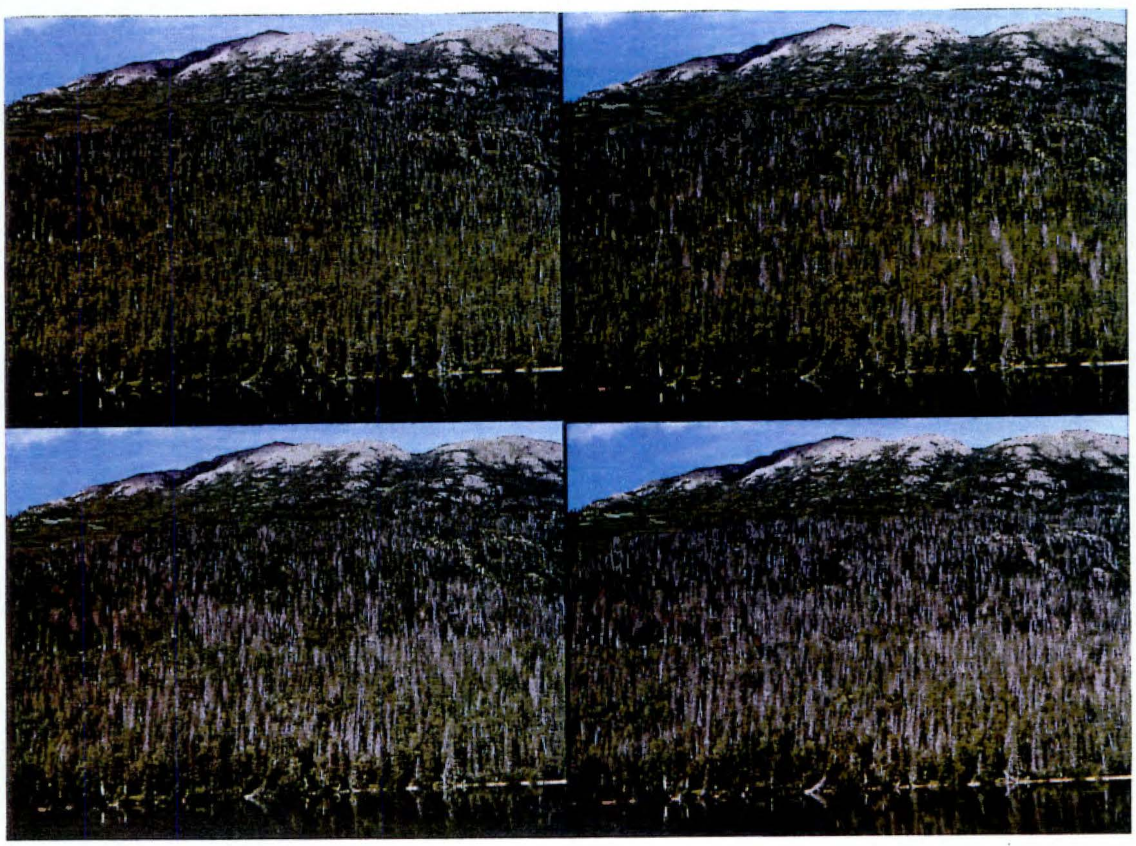


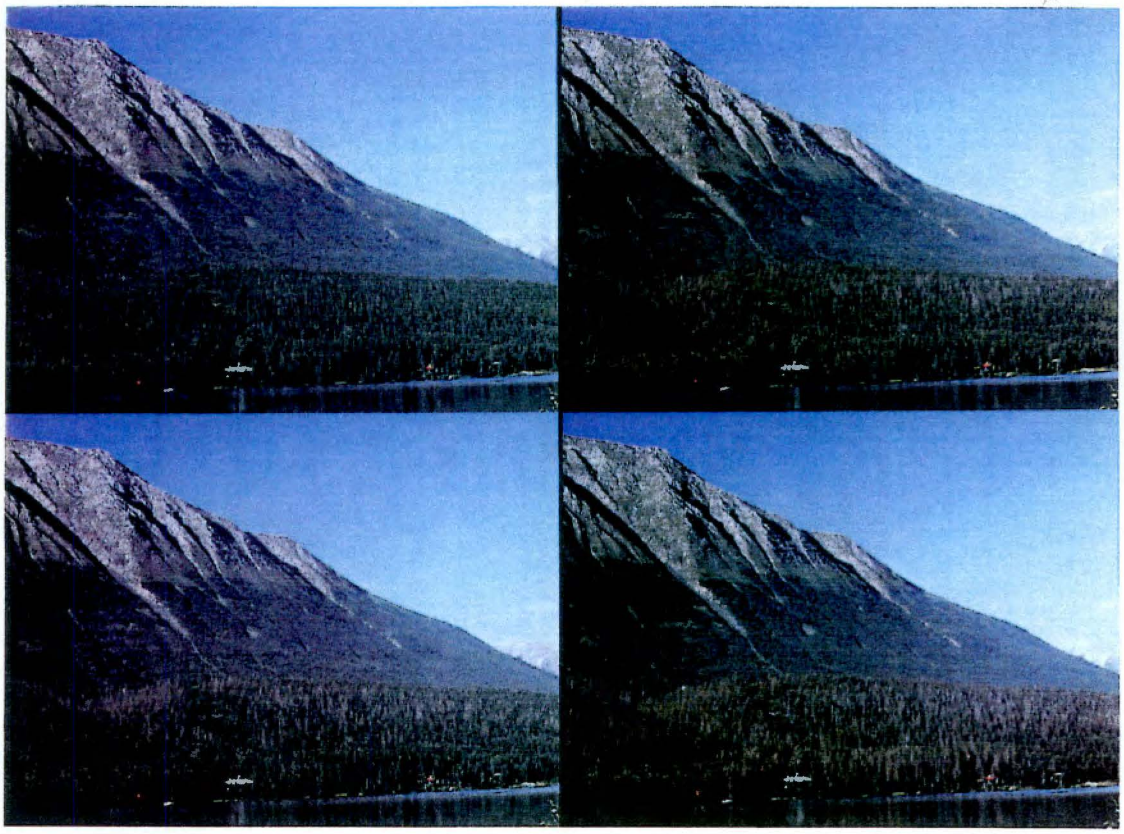
Plate 2a

Kenai Lake/South of Snug Harbor - Scene AI 1531
3, 6, 9, 12 year scale

Simulations show progressive changes due to spruce bark beetle infestation with no management intervention. Simulations were created "retrospectively"; the year 12 (bottom right) representation shows the scene as it appeared in the summer of 1990.

Plate 2b

Kenai Lake/Snug Harbor - Scene AI 1532
3, 6, 9, 12 year scale



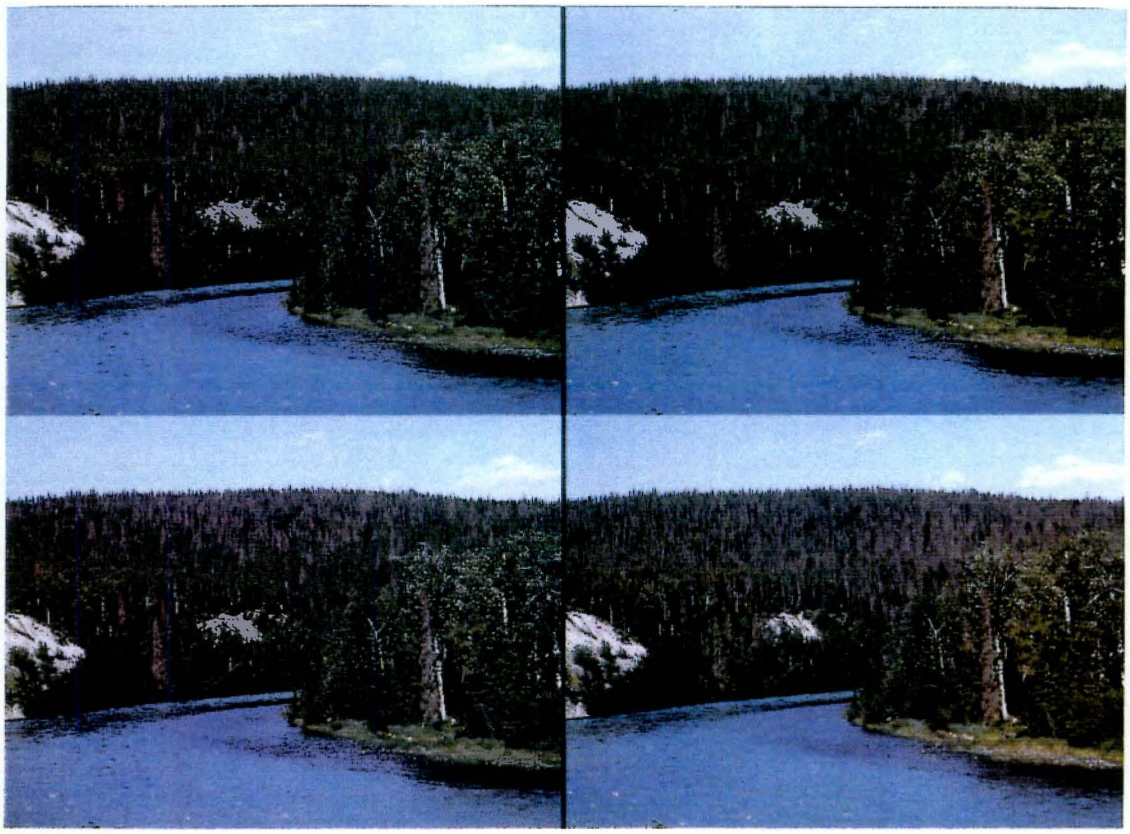
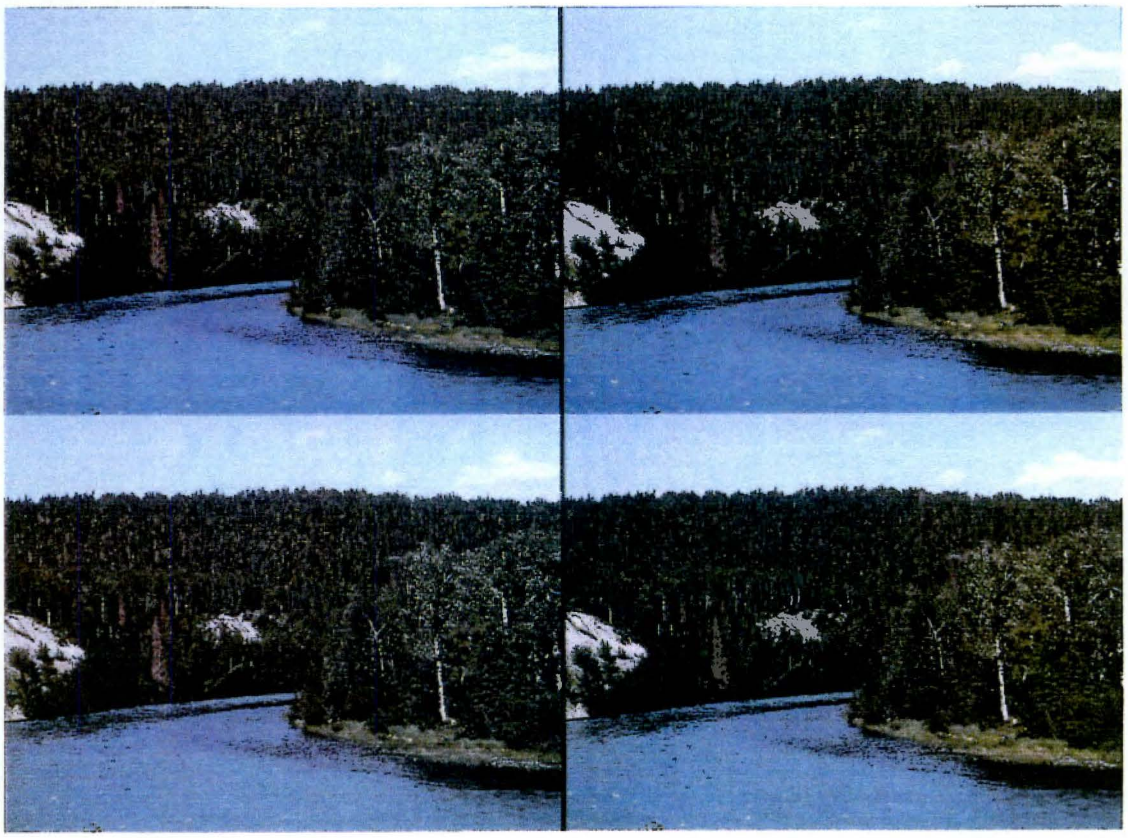


Plate 3a

Kenai River/Schooner Bend - Scene AI 0617
3, 6, 9, 12 year scale

Simulations show progressive changes due to spruce bark beetle infestation with no management intervention (Plate 3a). Plate 3b shows expected results following a pre-infestation thinning (at year 0) of susceptible spruce and subsequent thinning prior to year 9 (total thinning of 50%). The no-treatment simulations shown in Plate 3a were created "retrospectively"; the year 12 (bottom right) representation shows the scene as it appeared in the summer of 1990.

Plate 3b



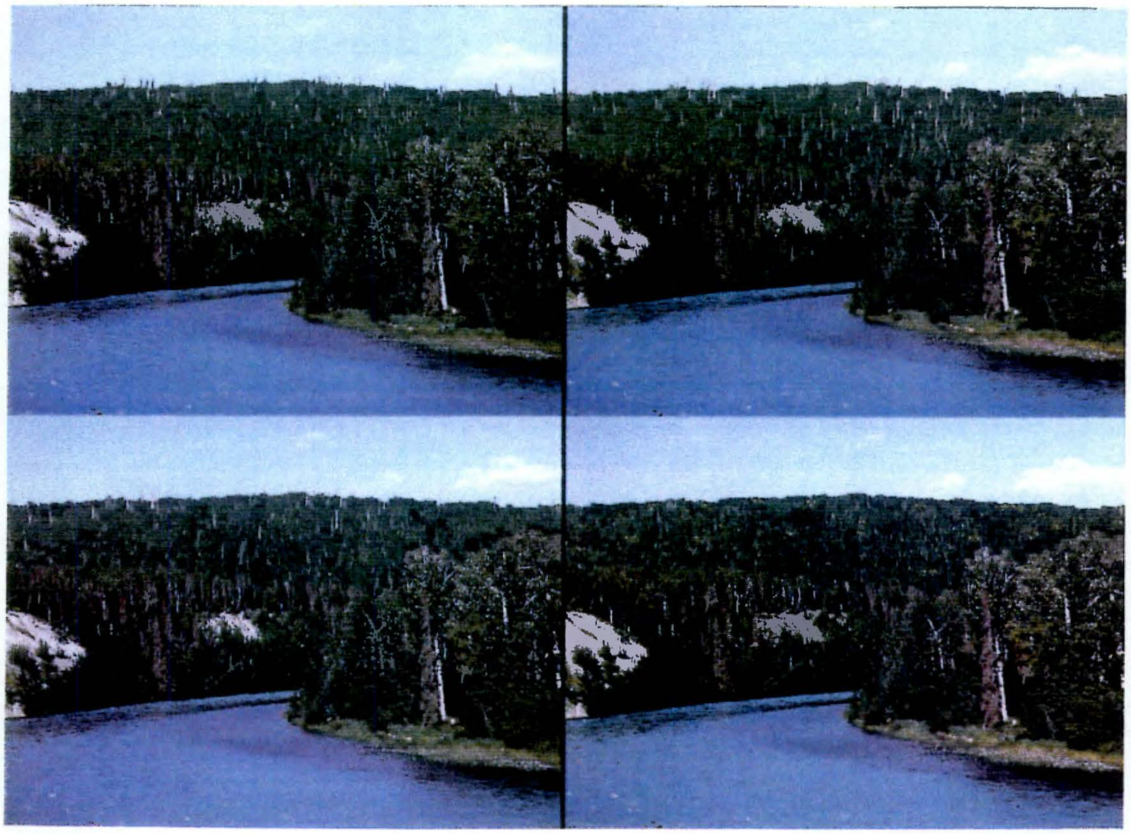
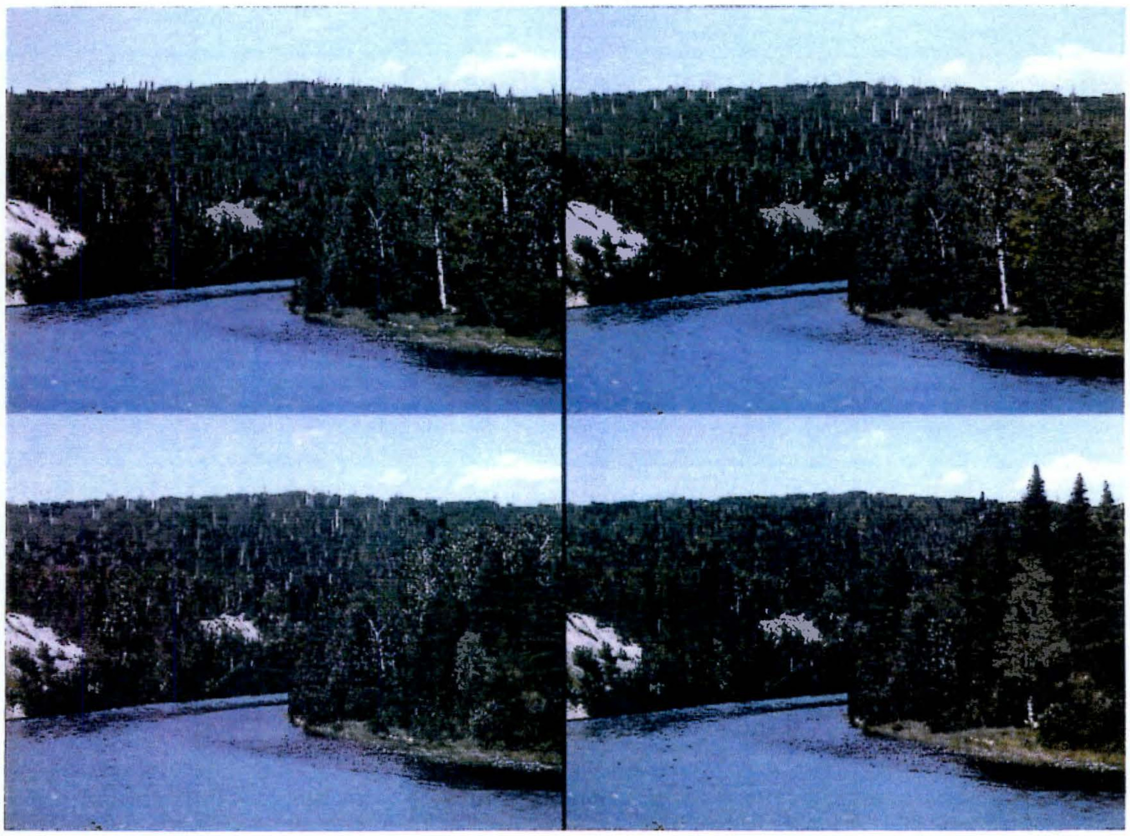


Plate 4a

Kenai River/Schooner Bend - Scene AI 0617
5, 10, 20, 50 year scale

Simulations show conditions as the forest recovers from a spruce bark beetle outbreak. In both cases, an anticipated wildfire occurs on the far slope with natural regeneration taking place over time. Plate 4a depicts natural regeneration in the foreground (along both river banks) as a result of no management intervention. Plate 4b shows natural regeneration in the foreground after an initial salvage removal of dead trees.

Plate 4b



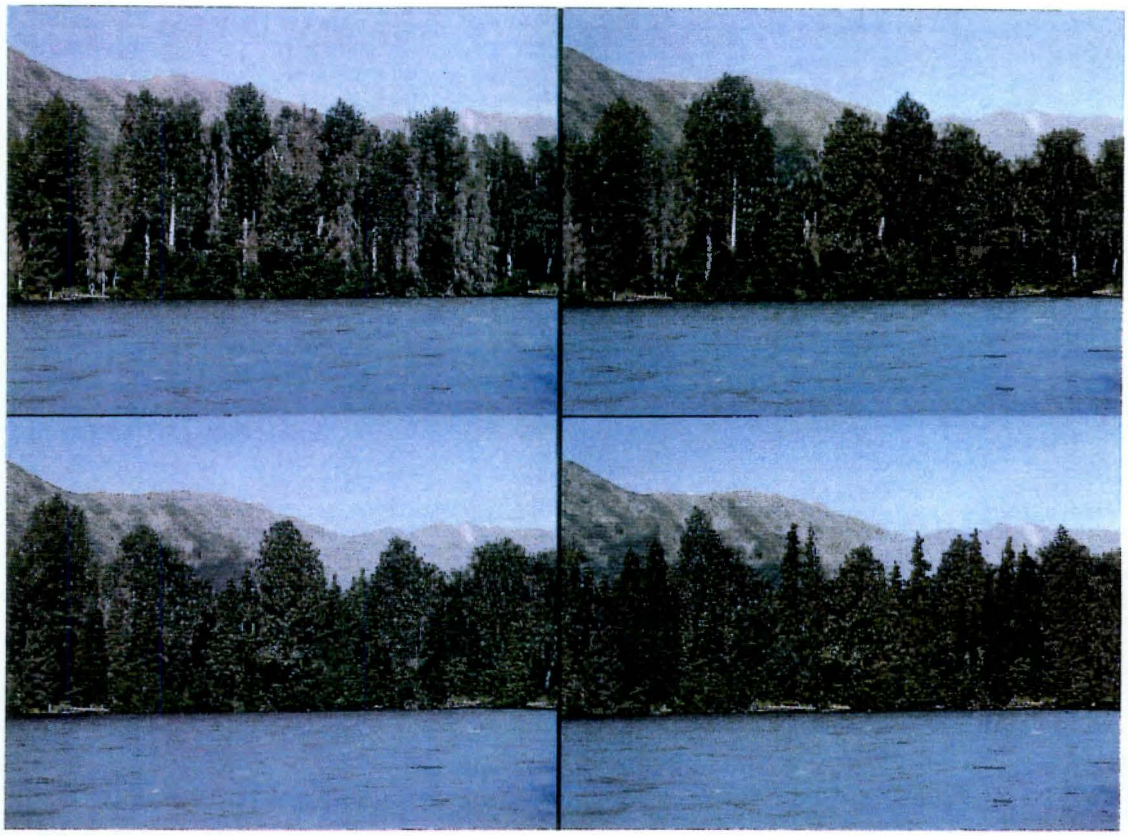


Plate 5a

Cooper Creek Campground - Scene AI 0614
5, 10, 20, 50 year scale

Simulations show conditions as the forest recovers from a spruce bark beetle outbreak. Plate 5a depicts no management intervention and natural regeneration occurs over time. Plate 5b shows natural regeneration after an initial salvage removal of dead trees.

Plate 5b

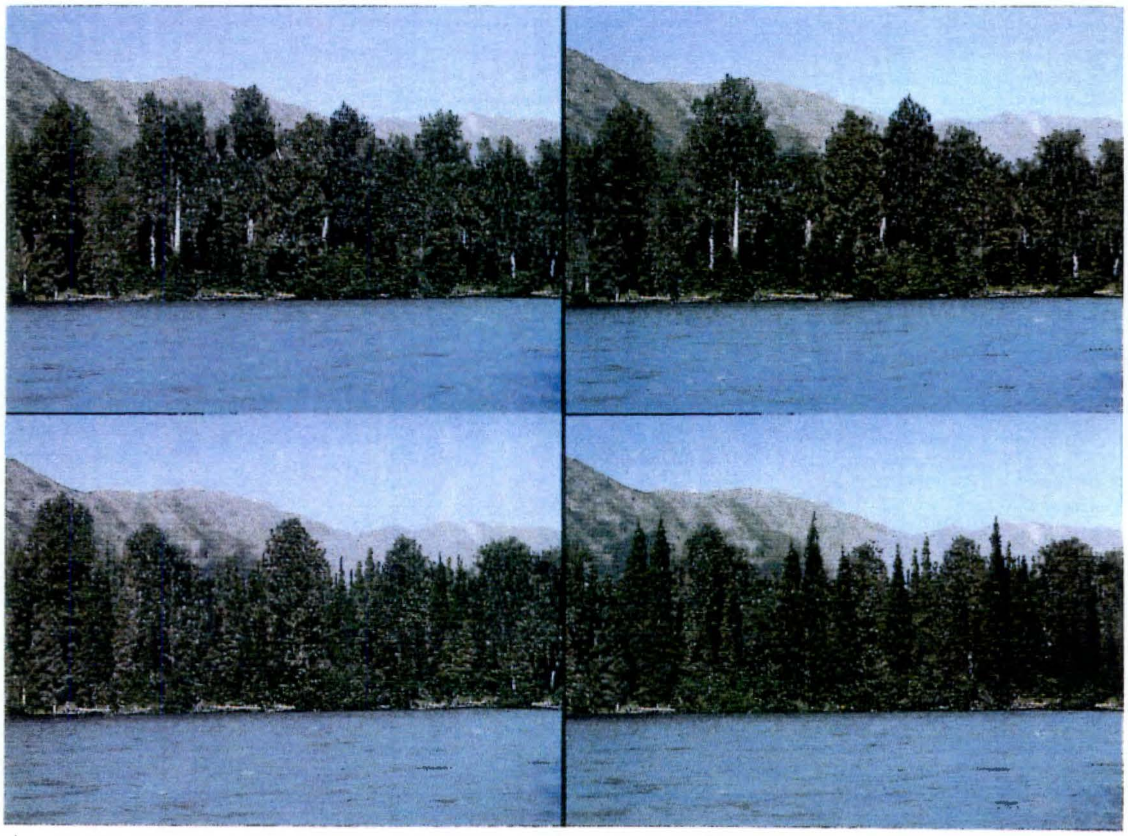
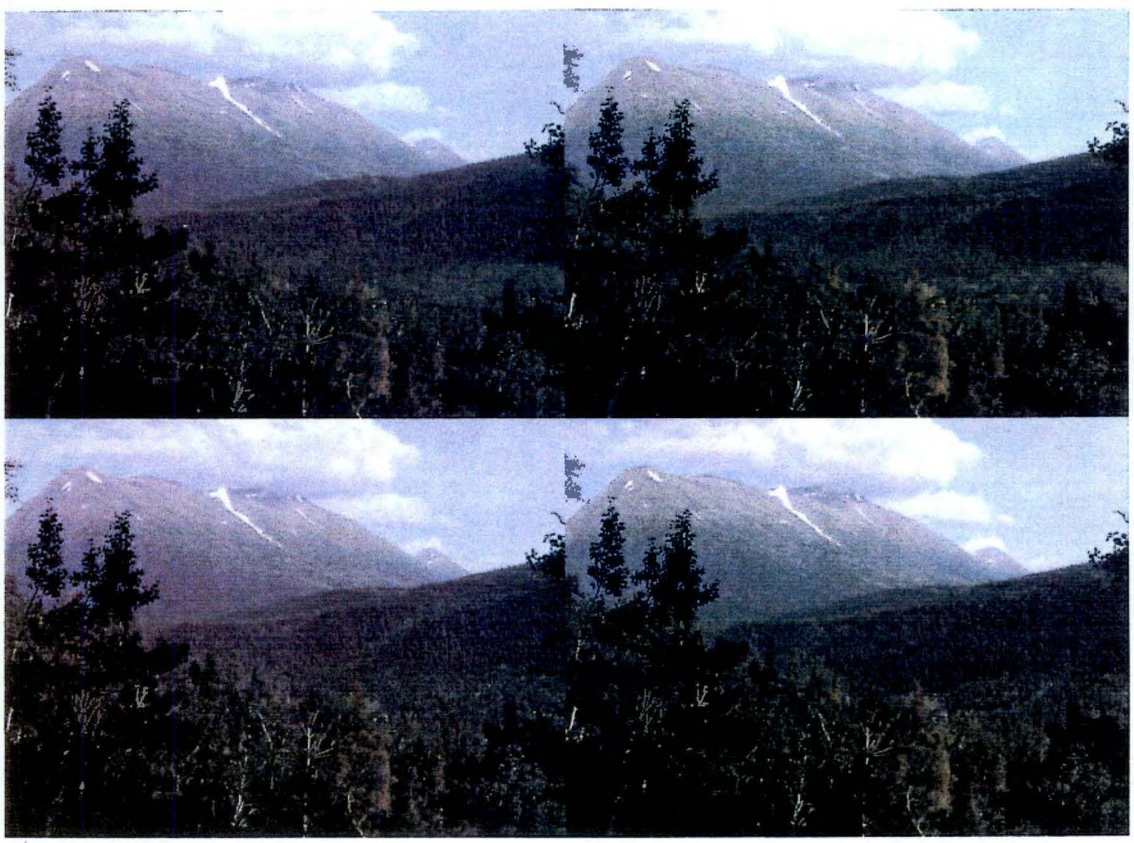


Plate 6a

Cooper Creek from Resurrection Pass Trail - Scene AI 0714
5, 10, 20, 50 year scale

Simulations show progressive changes as the forest recovers from a spruce bark beetle outbreak. Plate 6a shows natural regeneration after an anticipated wildfire. Plate 6b shows conditions after the salvage removal of dead trees on the lower slope and a controlled burn to promote natural regeneration of spruce.

Plate 6b



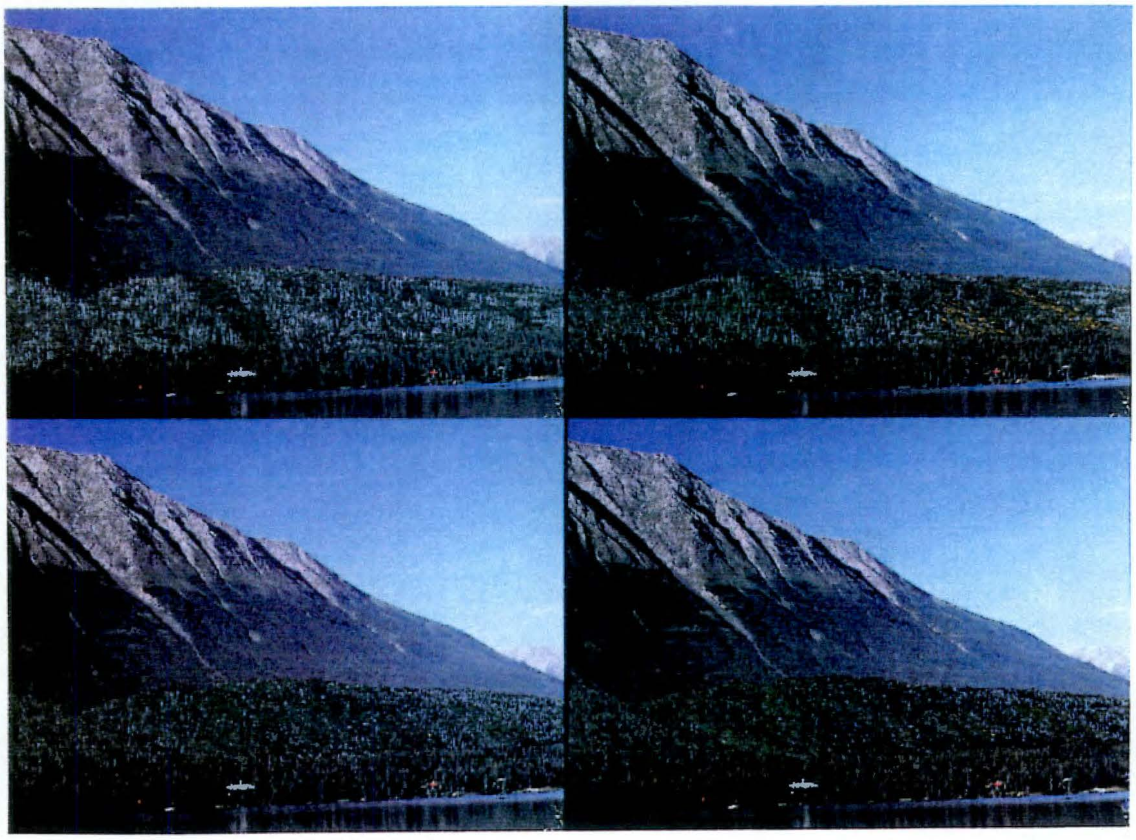
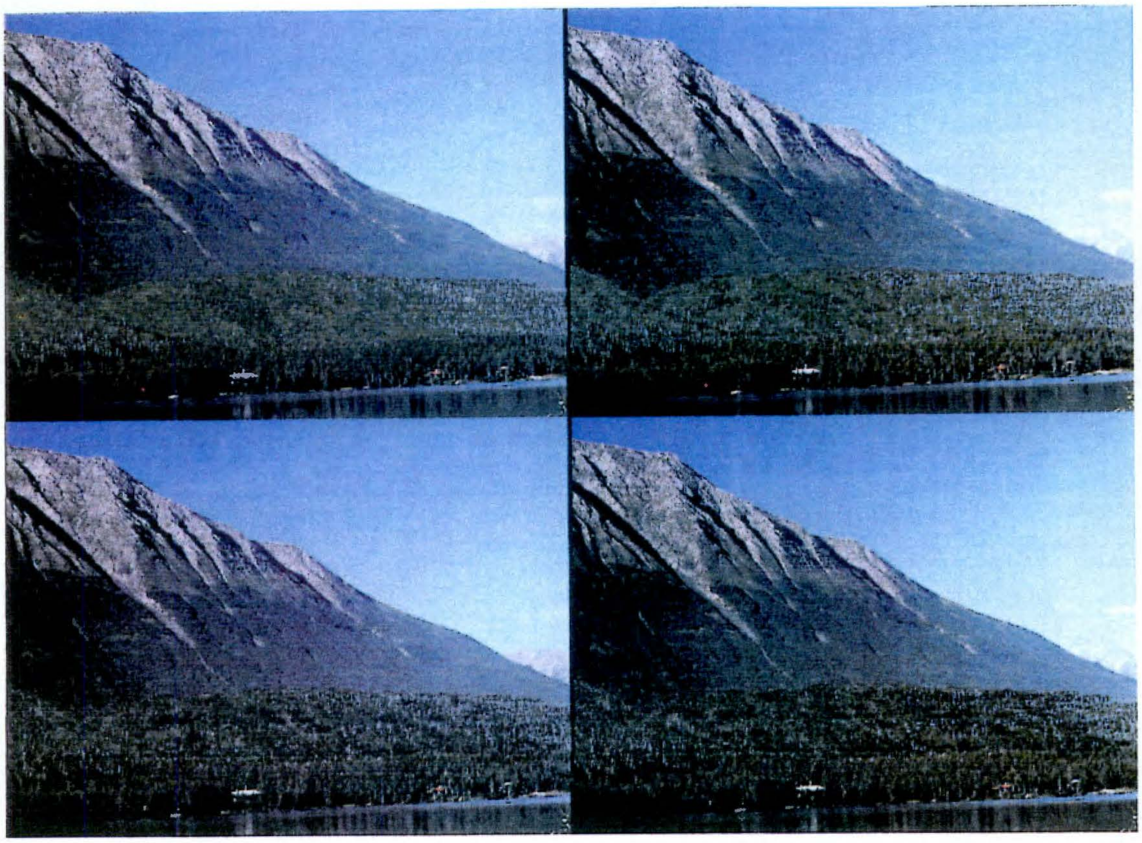


Plate 7a

Kenai Lake/Snug Harbor - Scene AI 1532
5, 10, 20, 50 year scale

Simulations show progressive changes as the forest recovers from a spruce bark beetle outbreak. Plate 7a shows natural regeneration after an anticipated wildfire. Plate 7b shows conditions after the salvage removal of dead trees and a controlled burn to promote natural regeneration of spruce.

Plate 7b



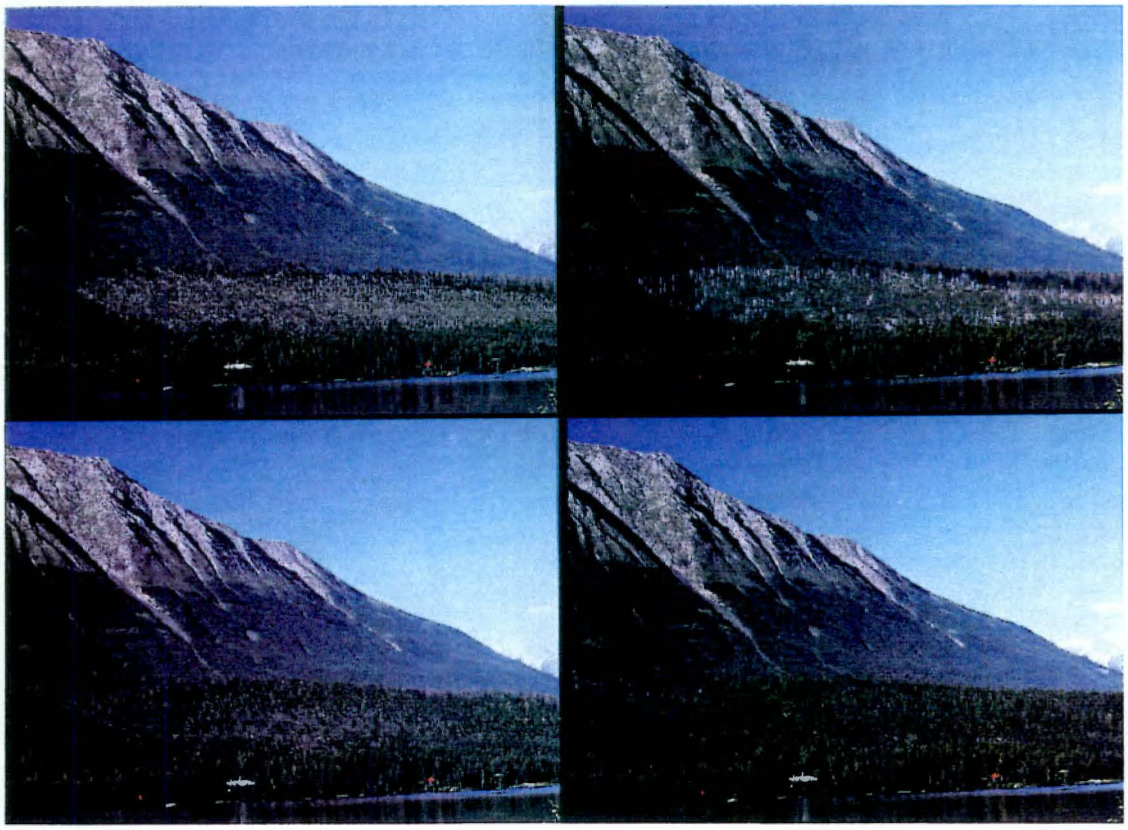
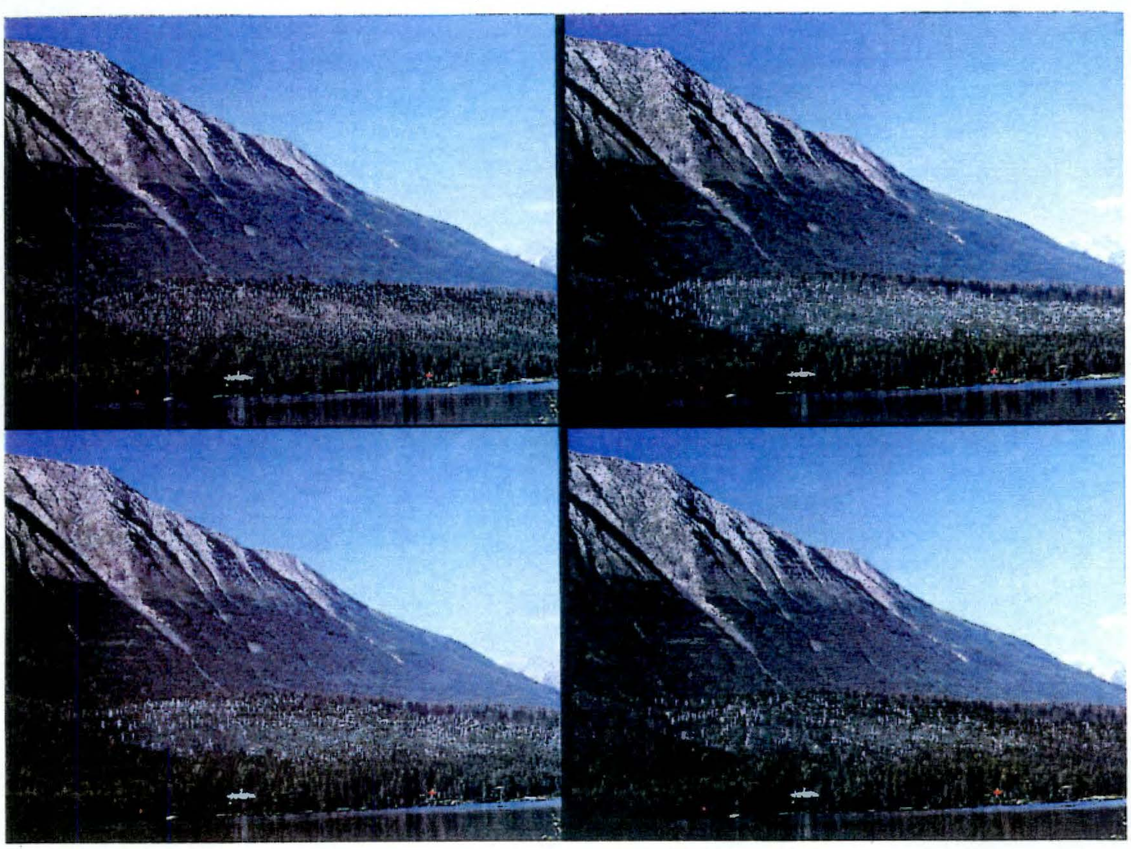


Plate 8a

Kenai Lake/Snug Harbor - Scene AI 1532
5, 10, 20, 50 year scale

Simulations show effects of prescribed burns over time. Plate 8a shows natural regeneration after cutting and burning the dead trees on site which results in a "hot" fire. Plate 8b shows natural regeneration after cutting and removing dead trees before burning which results in a fire of less intensity.

Plate 8b



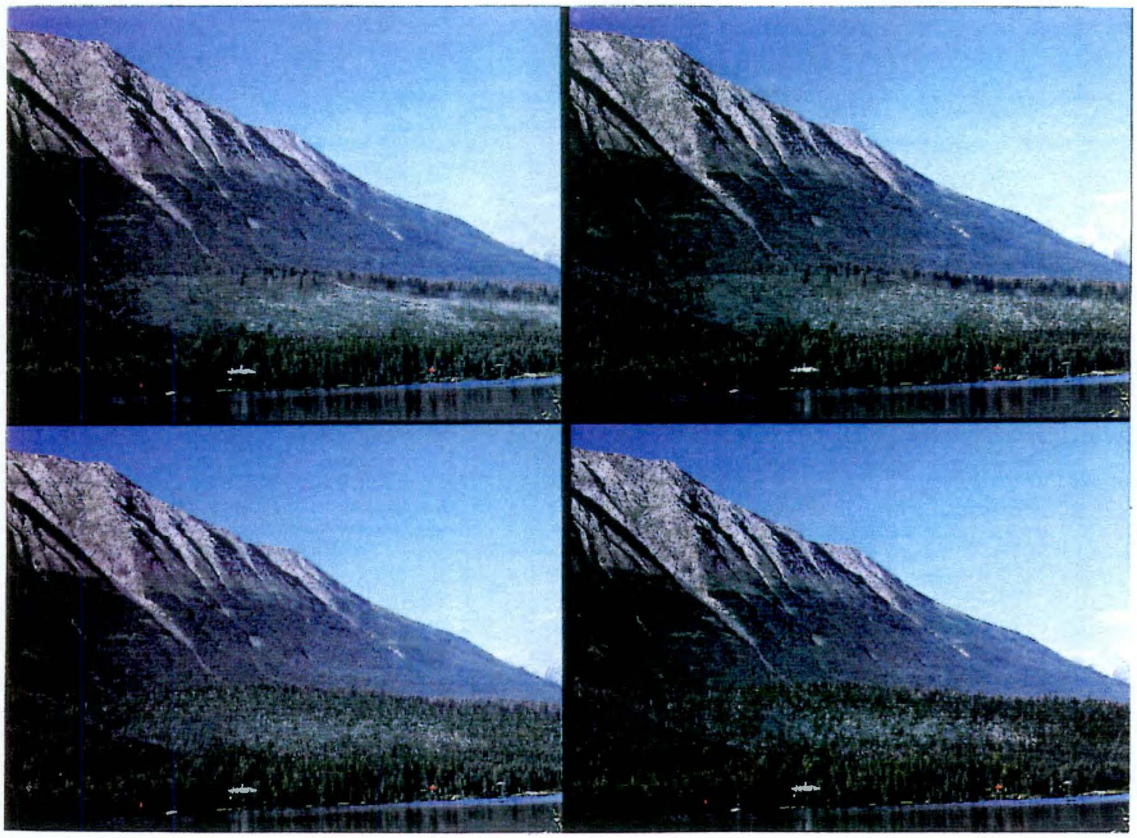
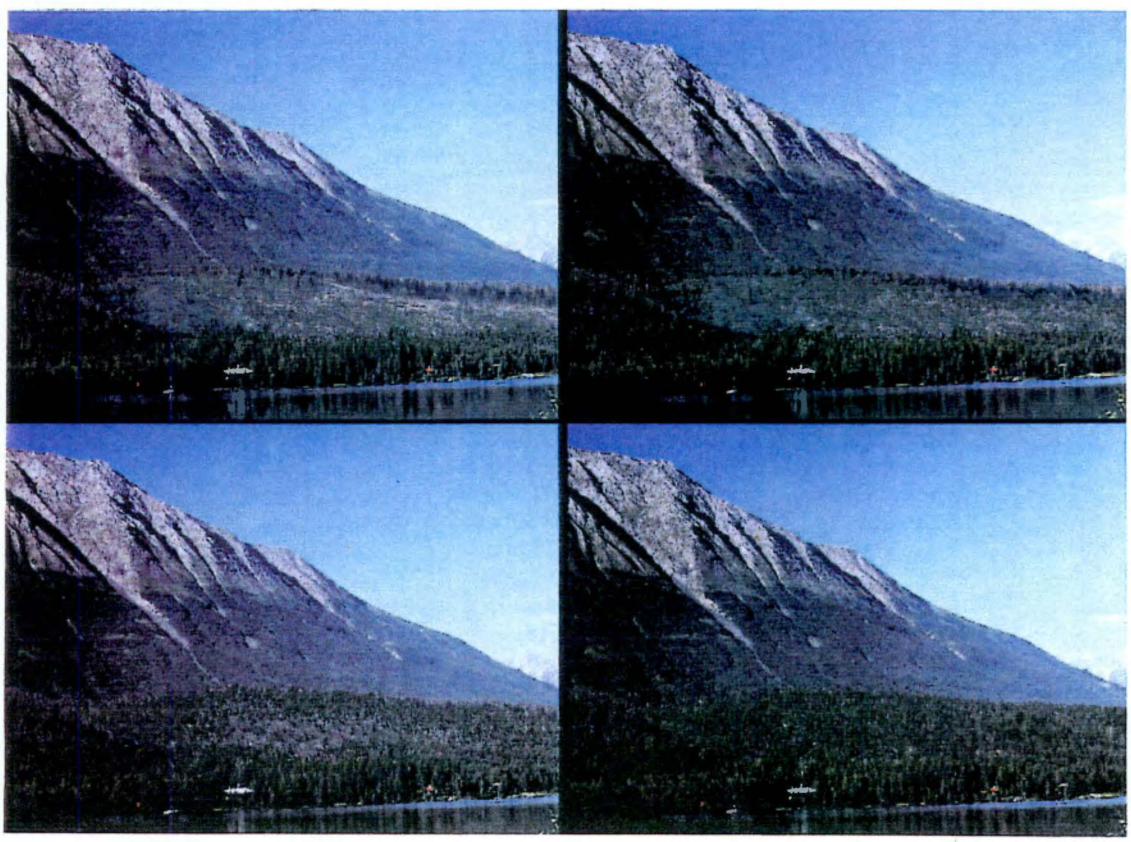


Plate 9a

Kenai Lake/Snug Harbor - Scene AI 1532
5, 10, 20, 50 year scale

Simulations show effects of site treatments following summer salvage removal of dead trees. Plate 8a shows natural regeneration after moderate ground disturbance from salvage removal operations. Plate 8b shows the effects of intense mechanical scarification after salvage removal to stimulate natural regeneration.

Plate 9b



Summary

A total of 48 digital-video simulation images were developed for the 1990 study and 24 new simulations were added for the 1991 study, resulting in 72 different simulation images. Two primary types of simulation sequences were developed: *retrospective* scenarios depicting the historic progression of bark beetle impacts over a 12 year period; and *restoration* scenarios showing alternative futures over a 50 year period following *no treatment* contrasted with one or more forest regeneration *treatment* scenarios.

All of the simulations were selected and developed in close interaction with forestry and pest management experts familiar with the Kenai Peninsula areas represented. Images were repeatedly evaluated and modified until the experts agreed that a high level of accuracy in the representation of the targeted forest conditions had been achieved. Base scenes and the simulation sequences developed for each are presented and briefly described in the preceeding color plates.

PERCEPTUAL ASSESSMENT

The simulation sequences described above formed the basis for the assessment of public perception of the effects of the bark beetle outbreak, and of possible forest management reactions. All responses in the 1990 assessment were collected in interviews with selected individual residents of, or visitors to bark beetle affected areas on the Kenai Peninsula. Two different presentation formats were used: sequences of single scenes were viewed and rated on a 10-point *scenic beauty* scale; and pairs of four-scene displays, each depicting alternative future scenarios for a given base scene, were presented and respondents were required to choose which set of future conditions provided the *best overall scenic quality*. The single scene format was repeated for color slides, prints and digital video images for different subsets of the 1990 respondents. The four-scene format was presented only in the form of color prints to a small sample in the 1990 study and to all respondents in the 1991 study.

Individual Scenes

For the single-scene format four sets of 63 forest scenes each were selected for presentation to respondents. Within each 63-scene set 51 scenes were common to all sets, and included a sample of scenes typical of the study area, as well as two retrospective "greening" sequences (four versions each of Jean Lake and Kenai Lake/South of Snug Harbor). The remaining 12 scenes were unique to each set, and were composed of a sample of the experimentally manipulated sequences (simulations of projected future conditions) for the other four base scenes.

Generally no more than three versions (simulations) of any given base scene were included in any one set of scenes, and these were always distributed among the other scenes in each presentation. Each of the 63-scene sets was organized into three different random orders, with each order being assigned randomly to individual respondents.

The goal of this "mixed" presentation procedure was to make the scene presentations as representative as possible of the conditions typically encountered by a forest visitor. On any given visit to the Kenai Peninsula study area a visitor would be expected to see a variety of different forest scenes, and to encounter several different levels of spruce bark beetle impact, but no specific scene would exhibit multiple levels of insect impact during a single visit.

Most of the participants in the 1990 study rated the *natural scenic beauty* of individual scenes representing a wide range of forest and insect damage conditions. Approximately equal numbers of participants were shown the scenes as color prints (bound in "photo-album" books), projected color slides or as displays on a video monitor. Respondents reported their judgements for each scene using a 10-point rating scale ranging from 1 (very low scenic beauty) to 10 (very high scenic beauty). Ratings were subsequently transformed to *Scenic Beauty Estimates* (SBEs), a standardized interval scale index that adjusts for arbitrary differences in the way individual respondents used the rating scale.[5]

As is typical for similar environmental perception studies, there was very high consensus in the scenic beauty ratings within each of the participant groups sampled. Internal reliability coefficients ranged from .88 to .96 (median = .93) within each of the twelve set-by-presentation medium (slides, prints, video) groups. These reliability measures estimate statistically the expected agreement between the ratings of the tested group and those of any other group that might be selected at random from the same population of respondents; perfect agreement would be indicated by a coefficient of 1.00.

No significant differences were found in ratings of the common base scenes between the different presentation sets, nor among the random orders within each set. Correlations of ratings of common scenes among the four groups of participants judging the different presentation sets ranged from .86 to .90 for visitors and from .87 to .95 for Alaska residents (again, a correlation of 1.00 would indicate perfect agreement between the groups).

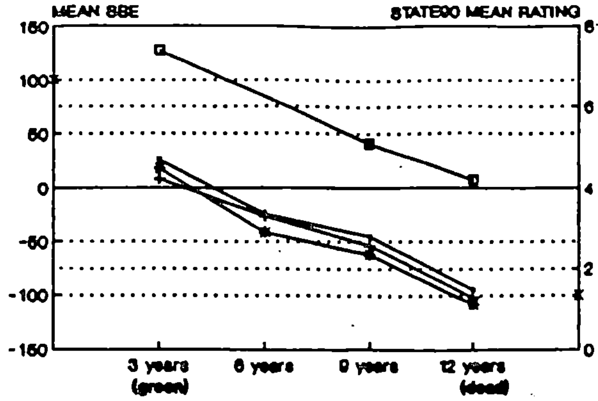
Comparison of scenic beauty judgements across the three presentation media (slides, prints and video) also indicated nearly perfect agreement. Correlation coefficients based on the ratings of the scenes that were common to all presentation sets and participant groups (n = 43) ranged from .93 to .97.

By all these indications there was a very high level of consensus in perceived scenic beauty among the tested groups, and a strong indication that essentially the same results would be expected for any other groups of similar people that might be assessed, as well as for alternative presentation formats. Further, there is substantial environmental perception literature confirming that public scenic beauty judgements based on color slides agree very closely with direct judgements made on-site in the depicted environments. Thus, the results of the studies reported here can confidently be generalized to the direct viewing conditions typically experienced by visitors to the represented forest areas.

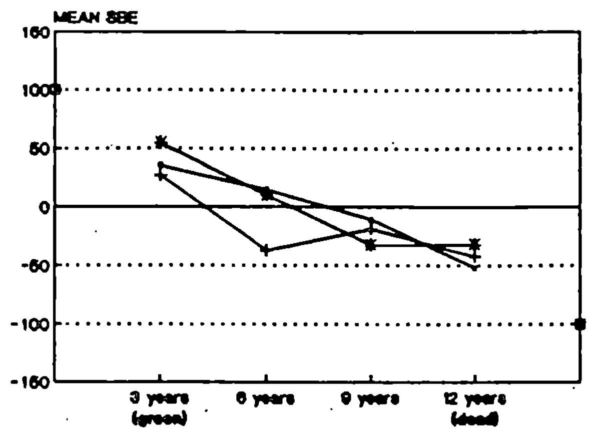
Comparison of Residents and Visitors

The scenic beauty judgements of residents and visitors were in very good agreement, regardless of the presentation format used. Overall, the correlations between resident and

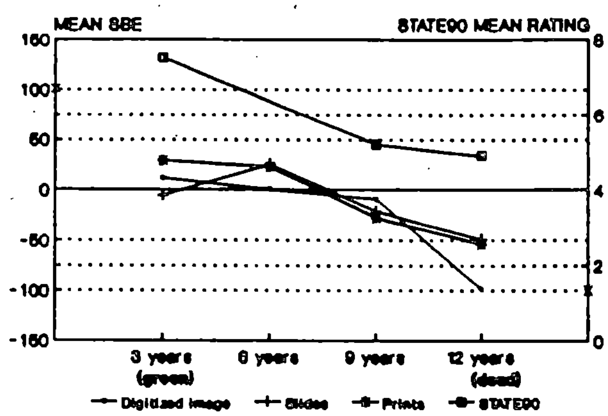
Individual Scenes - Retrospective
AI1319 - Jean Lake



AI1532 - Kenai Lake/Snug Harbor



AI0617 - Kenai River/Schooner Bend



DI n=135 S n=84 P n=144 STATE90 n=103

visitor ratings was .90. As a further test of the consistency of scenic beauty judgements across different public groups, samples of undergraduate college students at the University of Arizona and the University of Illinois (most of whom had never visited Alaska) also rated the scenes. Ratings by the two college student samples were in very good agreement with each other ($r = .93$), and with the visitors sampled on-site in Alaska ($r = .89$ and .90 for Arizona and Illinois samples, respectively). Correlations between the student samples and the Alaska residents were somewhat lower (both = .73), but still indicated substantial agreement.

The Alaska State survey also included a replication of the perceptual assessment for some of the forest scenes. Color prints of 16 of the 1990 study scenes (including depictions of naturally occurring and computer simulated insect impacts) were mailed to a subset of the randomly sampled respondents, and they subsequently reported scenic beauty ratings for the scenes in a telephone interview. Ratings exactly paralleled those found in the 1990 study. Thus, scenic beauty perceptions were not only shown to be consistent between residents and visitors over different presentation formats, but they were replicated by a random sample of south central Alaska residents, justifying substantial confidence in the generality of the findings summarized in the next section.

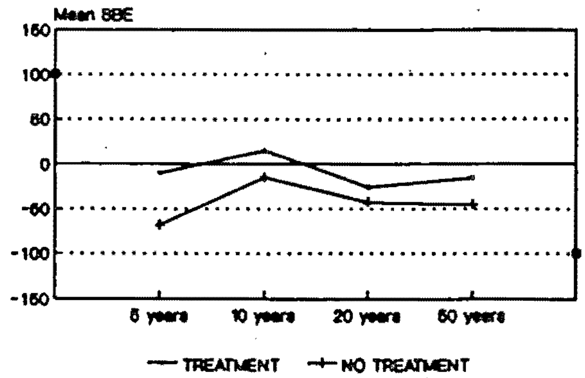
Scenic Beauty Perceptions

The results of the 1990 perceptual assessment, based on individual scene judgements, clearly and consistently showed that scenic beauty values declined significantly as the proportion of bark-beetle killed trees visible in the scene increased. When insect-caused mortality was concentrated in the mid-ground of the scene (Jean Lake and Kenai River/Schooner Bend scenes, Plates 1b, 3 and 4), perceived scenic beauty decreases were especially pronounced. This pattern obtained across unaltered scenes (which included scenes with varying amounts of insect impacts), and was strongly confirmed by the judgement patterns for the simulated scenes where insect impact was systematically manipulated.

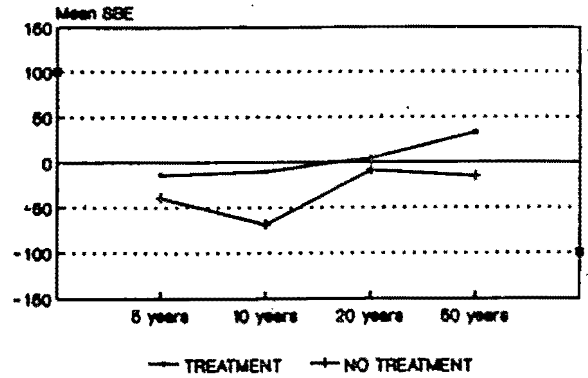
The Cooper Creek Campground scene (Plate 5) depicted a closer, more confined view including only a few bark beetle killed trees, and scenic judgements were somewhat less sensitive to the depicted changes in forest conditions. Insect effects were least noticeable in the most distant scene, the view toward Cooper Creek from Resurrection Pass Trail (Plate 6), and scenic beauty judgements were understandably less sensitive for this scene. The Kenai Lake views (/Snug Harbor and /South of Snug Harbor, Plates 2, 7, 8 and 9) evidenced intermediate levels of scenic beauty sensitivity to the beetle and forest management changes depicted.

For the simulated scenarios representing the effects of various forest management actions, several major trends were revealed. First, for the retrospective infestation *vs* protective thinning scenario (Kenai River/Schooner Bend, Plate 3), the individual scenes depicting the expected effects of protection by *thinning* were consistently rated higher than the associated scenes from the *no treatment* scenario. Second, ratings of the scenes from the alternative restoration treatment scenarios indicated a consistent overall preference for *treatment* alternatives that accelerated recovery to forested conditions. While these trends were evident in the single-scene ratings, whether presented as video, prints or slides,

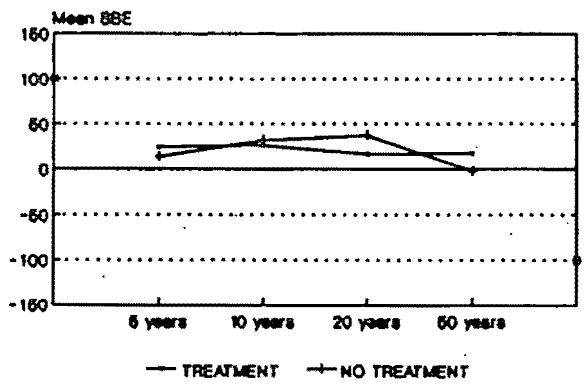
Individual Scenes - Restoration
AI0614 - Cooper Creek Campground



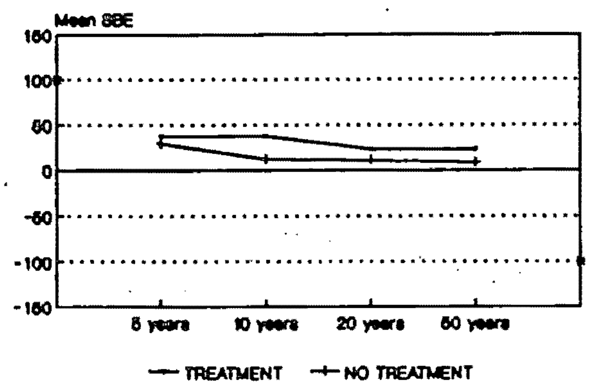
Individual Scenes - Restoration
AI0617 - Kenai River/Schooner Bend



Individual Scenes - Restoration
AI0714 - Cooper Creek/Res. Pass Trail



Individual Scenes - Restoration
AI1532 - Kenai Lake/Snug Harbor



relative preferences for the various forest management alternatives were most clearly revealed in the four-scene, forced choice format discussed in the next section.

Preferred Future Forest Conditions

Some of the residents sampled in the 1990 study and all of the 1991 participants made forced choices between pairs of four-scene sets depicting future conditions expected to result from different possible forest management actions. The four-scene sets were all presented as color prints, with four individual prints arrayed on an 8 x 10 inch page. Most of the individual scenes were the same as those presented in the single-scene format discussed above.

Each of the paired sets presented two different four-scene scenarios (on facing pages of a photo-album book) for a given base scene, e.g., the scenes in Plate 3a *vs* those in 3b. Thus, sets were paired so that each four-scene member of a pair depicted a different "future" for a given base scene. The pairs were bound into photo-album books, with the order of pairs in each book determined by one of two random sequences. Both retrospective and future forest conditions were simulated for each base scene, as described above, and illustrated in the color Plates.

In the 1990 study, each participant made choices between *treatment* and *no treatment* restoration scenarios for each of the four base scenes. The four scenes in each set consisted of visual simulations of a given base scene as the expert panels expected it to look 5, 10, 20 and 50 years following the postulated treatment or no-treatment scenarios. For all four of the base scenes, the *treatment* scenario depicted future forest conditions expected to result from a salvage removal of dead spruce overstory (clear cut), followed by site-preparation burning to encourage spruce regeneration. The *no treatment* scenario depicted the projected consequences of a postulated wildfire (occurring at year zero) followed by natural regeneration, resulting in predominately grass and brush with some hardwood overstory. These scene sets are presented in Plates 3 through 7.

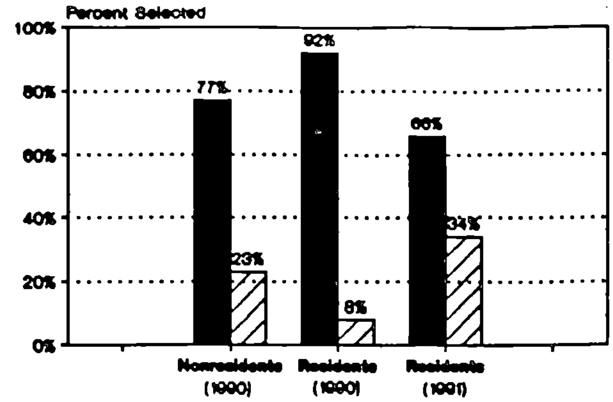
The final pair presented the two retrospective scenarios for the Kenai River/Schooner Bend scene (Plate 3). One four-scene set depicted the progressive stages of bark beetle infestation (from approximately 1978) based on historic data, with the final scene being the unmanipulated (digitized) picture of the scene with virtually all of the spruce dead (1990). The alternative four-scene set depicted the expected progression of the scene over the same years, based on the postulated 50% thinning treatment.

The results of the paired-comparisons among the four-scene sets in the 1990 study were consistent with the individual scene assessments. For the retrospective scenarios, the *thinning* option was consistently preferred over the *no treatment* infestation scenario.

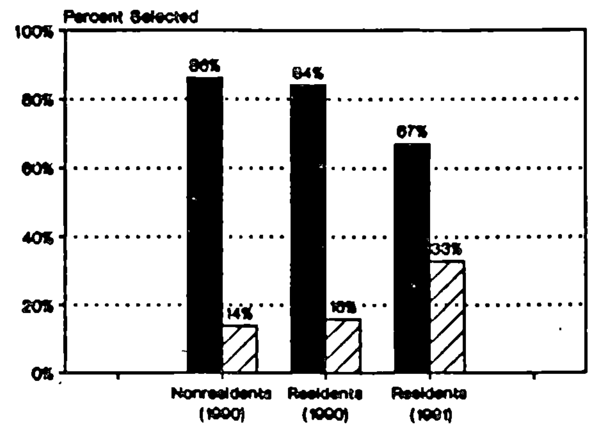
For the restoration alternatives, the *treatment* scenarios, which more quickly and completely restored a predominately spruce forest, were consistently preferred over the *no treatment* scenarios, where recovery was slower and resulted in more grass, brush and hardwoods.

The results of the 1991 paired comparisons mirrored the 1990 findings for the same scenarios. In addition, a more detailed study was conducted comparing four different management options for the Kenai Lake/Snug Harbor scene. Comparisons among the

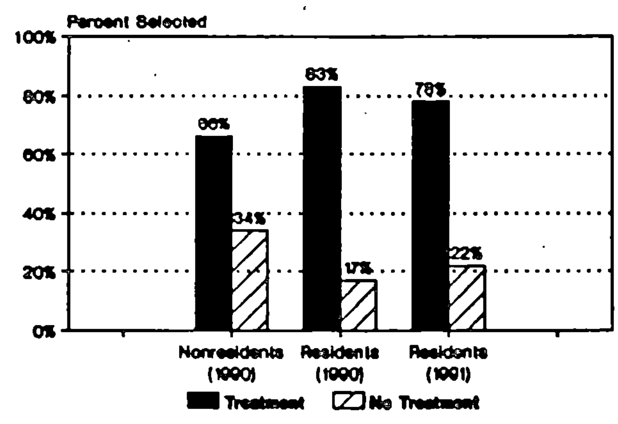
Preferred Future Forest Conditions
Cooper Creek Campground



Kenai River/Schooner Bend

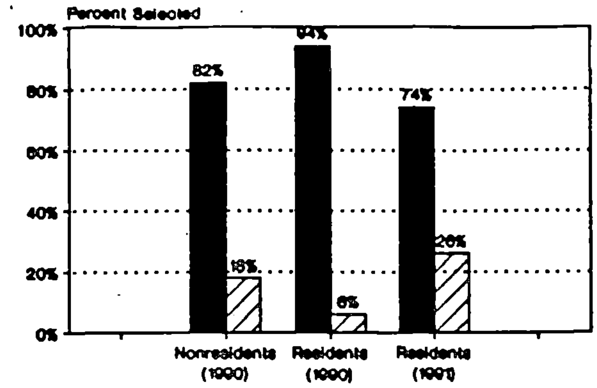


Cooper Creek from Res. Pass Trail

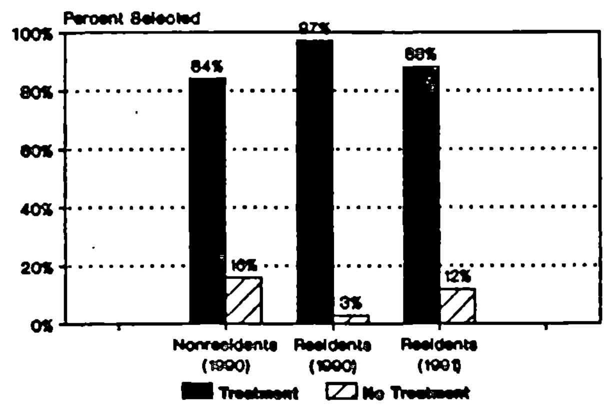


AK90 NR n=70 R n=45 AK91 n=110

Preferred Future Forest Conditions
Kenai Lake/Snug Harbor

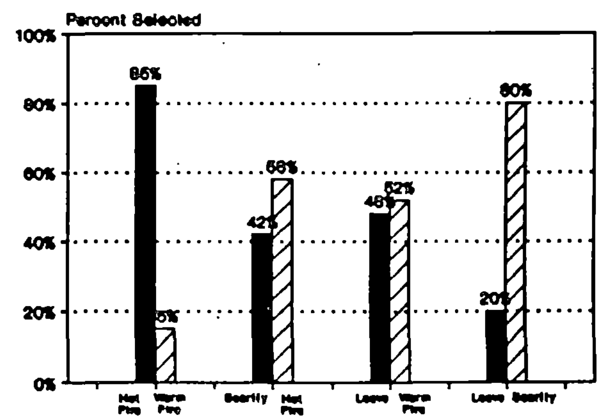


Kenai River/Schooner Bend (Retrosp.)



AK90 NR n=70 R n=45 AK91 n=109

Kenai Lake/Snug Harbor (1991)



AK91 H/W & L/S n=110 S/H n=49 L/W n=56

alternative forest restoration options, following a clearcut of the dead spruce, revealed that the strongest preference was for the *very hot fire* option (where felled dead trees were left to burn). The second most preferred option was *mechanical scarification*, followed closely by *moderately hot fire* (felled trees removed before burning), which was only slightly favored over the no-treatment *leave* option. For the one exploratory near-view scene, the *thinning protection* treatment was consistently preferred over the *no treatment* option.

Summary

The expressed preferences among the four-scene scenarios were consistent with the results of the single-scene assessments. The retrospective simulation of *thinning* spruce prior to infestation was rated higher and chosen more often than the *no treatment* option which resulted in large numbers of dead spruce. The individual scene ratings and choices among alternative restoration scenarios indicated a clear preference for *treatment* options that accelerated the recovery of forest cover, especially those, such as *hot fire* and *mechanical scarification*, that restored a significant cover of spruce. In short, respondents preferred to keep forests green if possible and, when significant numbers of trees were already dead, they preferred scenarios that featured faster recovery of forest cover, especially spruce.

An Important Caveat

While the results of the perceptual assessment were quite clear, it is important to acknowledge two important limitations on their interpretation. First, the "future forest conditions" represented in the computer simulations were based on the best available forest data and expert consensus regarding the most likely outcomes of the management alternatives considered. Still, human ability to predict complex biological processes is significantly limited, and many important factors (such as climate variations, wildfires, etc) can neither be predicted nor controlled. It follows that the specific details of the conditions depicted in the simulations represent "average" conditions based on the experts' "best estimates," and should not be viewed as absolutely certain outcomes.

Finally, the perceptual assessments pertain only to expressed preferences for the *visual* outcomes of the alternative management options evaluated. Many important issues, such as the economic costs of achieving the outcomes and the environmental consequences associated with each, cannot be directly represented by visual simulations, and these factors undoubtedly have significant effects on public reactions to forest management actions. Some of these non-visual issues were more directly addressed in the verbal portion of the assessment, described below.

ACCEPTABILITY OF ALTERNATIVE MANAGEMENT POLICIES

Following the forced-choice evaluations of alternative future forest conditions, some of the respondents in the 1990 study and all of the 1991 respondents answered questions about bark beetle-related forest management policies. Issues addressed in this part of the assessment were identified through individual interviews with forest and pest management specialists in the US, State and local Bureau forest management agencies, local residents, tourist facility operators and recreators and tourists visiting facilities in the study area. The specific statements and format for the assessment were evaluated and refined in a pilot test on a sub-set of the 1990 respondents.

The management policy section of the assessment was introduced by a general description of the life cycle of the spruce bark beetle and how it attacks and kills trees. The outbreak on the Kenai Peninsula was described, including an oblique aerial photograph of a severely affected area just north of the Kenai River near Cooper Landing.

The policy assessment was divided into five sections, each preceded by a brief description. Individual sections included questions pertaining to the acceptability of management policies in different contexts, including:

1. **general policies** regarding whether to allow the outbreak to follow its natural course or to actively try to stop it;

2. **prevention** of the conditions that may lead to outbreaks;

3. **protection** of trees in threatened areas once an outbreak is already underway;

4. **restoration** of forest areas that have already been severely affected by an outbreak; and

5. questions pertaining to **expectations** regarding the future spread of the current Kenai Peninsula outbreak.

A copy of the complete assessment instrument, including introductory information and instructions is provided in the attatched Appendix to this report.

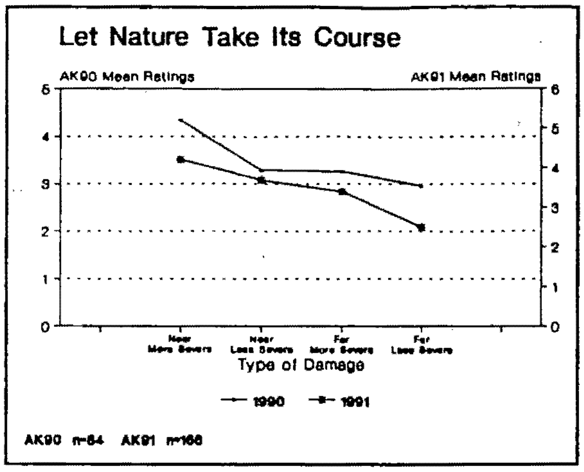
General Policies

This section sought to determine in general the circumstances under which respondents would favor not taking any explicit management action in response to the bark beetle infestation. The introductory statement for this section was:

One response to the spruce bark beetle outbreak is to accept it as a natural process and to just "let nature take its course." In remote areas this may be the only possible response. In some Parks and Wilderness Areas it may be the only alternative allowed by law. Where managers have a choice, the best policy is to let nature take its course, so long as the area is:

Four situations were described which differed in the severity of the beetles' effects on the forest and where the effects occurred relative to human developments. *More severe* effects were represented as areas where most of the spruce trees would be killed and "only grass and brush is expected to grow back." *Less severe* effects specified less tree mortality and that "new trees are expected eventually to grow back." The location of the effects was described as *near* or *far away* from homes and recreation areas.

For both residents and visitors in the 1990 study, and for the residents in the 1991 study, the greatest willingness to **let nature take its course** was for areas described as *far away* from developments where damage was described as *less severe*. There was split agreement and disagreement for this policy in *far away/more severe* and *near/less severe* conditions. The majority of respondents disagreed strongly with the **let nature take its course** policy for areas *near* developments where damage was described as *more severe.*



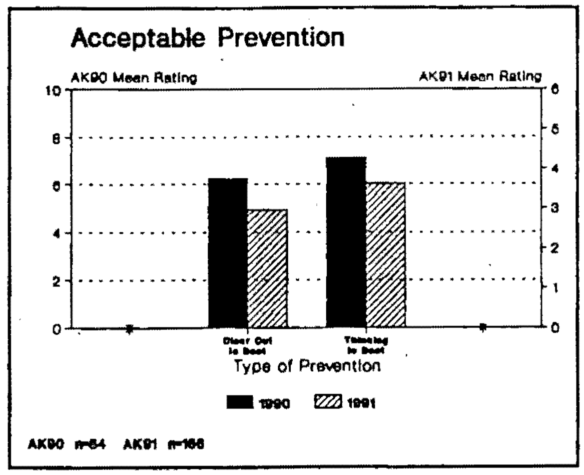
Prevention Before an Outbreak

This section focussed upon actions that might be taken in forest areas that are not currently infested, but are threatened by bark beetle infestation. In particular, this section addressed the acceptability of vegetation management options, such as thinning or clear cutting susceptible spruce stands.

The text that introduced this section was:

One method for protecting forest areas that are threatened by the bark beetle outbreak is to remove about half of the trees. This is intended to reduce the number of places for the beetles to breed and to help the remaining trees grow more vigorously so that they are better able to resist beetle attacks.

There was substantial agreement that removing some trees (about 50%) is an effective and acceptable method for protecting threatened stands. Consistent with the Alaska State survey, residents in both the 1990 and 1991 studies indicated that *thinning* was the most preferred method for tree removal. In both studies there was generally less agreement with *clear cutting small patches*, though about 22% of the 1990 resident sample rated this option as "completely acceptable," and 15% of the 1991 sample "strongly agreed" with this approach.



Respondents in the 1991 study agreed that *cut trees should be sold to private companies*, and that cutting and revegetation treatments should be implemented even if *selling the trees will only pay for part of the costs*.

Protection During an Outbreak

The focus of this section was on forest areas currently involved in an active bark beetle infestation. Based on available pest management options in these circumstances, the only management alternative offered was to spray insecticides. The questions posed addressed the particular conditions under which various spraying policies would be approved.

The introductory statement was:

During a bark beetle outbreak it is possible to protect selected trees by spraying environmentally approved insecticides directly on the bark. Spraying costs about 5 to 10 dollars per tree and lasts for up to three years.

The use of insecticides, even when presented as "environmentally approved," produced very divided responses. The 1990 study yielded a pattern of widely split opinion, with slightly more residents finding insecticide spraying "completely acceptable" (21%) as compared to "completely unacceptable" (14%). Visitors showed a much stronger pattern for this question, with only 2% indicating completely acceptable and 30% completely unacceptable. In the 1991 study 44% strongly or moderately agreed vs 30% strongly or moderately disagreeing that insecticides *are perfectly safe for use around homes and recreation areas*; the middle 25% tended more to mild agreement.

Interestingly, the Alaska State survey found a pattern of greater acceptability for *encouraging property owners to use insecticides* the farther the respondent was from the affected sites; there was 65% approval by residents in the affected areas, 72% by residents of other (unaffected) Kenai Peninsula areas, and 80% by Anchorage residents. At the same time, only 39% of Kenai residents favored the use (by the State) of insecticides to protect trees in campgrounds. The indication is that insecticide use evokes strong reactions, and involves more than one dimension of public concern.

The more detailed pattern of responses provided by the 1991 study indicated that insecticides were generally accepted as the most effective protection method. Defining "agreement" as a rating of 1 through 4, and "disagreement" as ratings 7 through 10), a larger proportion (47%) of 1991 respondents agreed that *spraying insecticides is the best way to protect large trees*, with 36% disagreeing. Only 22% agreed that spraying makes trees *essentially 100% safe from bark beetle attack* vs 42% who disagreed. Objections to insecticides were based on their potential harm to *other insects and animals* (40% vs 30%) and because they are *potentially dangerous to humans* (42% vs 30%). At the same time 57% indicated they would be *willing to use environmentally approved insecticides to protect important trees near your home* as apposed to 31% who would not.

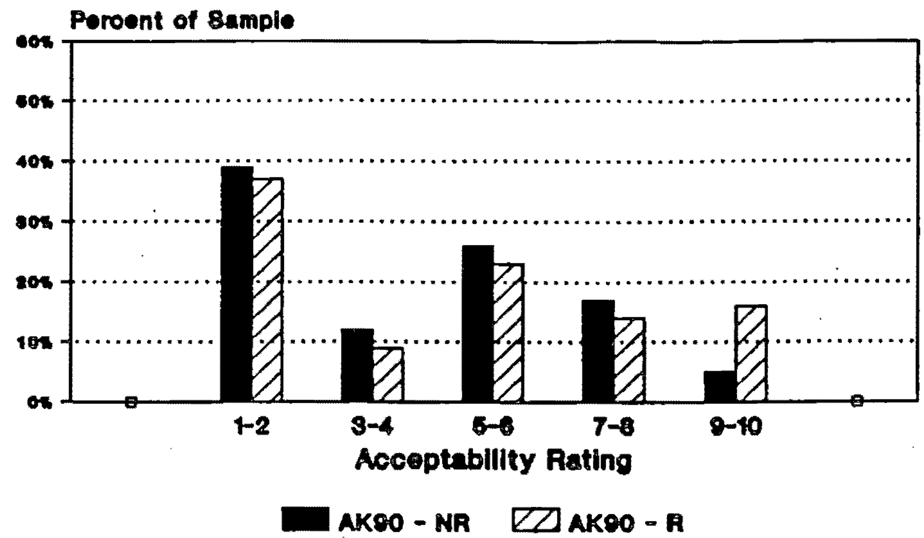
Restoration After an Outbreak

For many parts of the Kenai Peninsula the primary concerns are no longer prevention or even protection, but **restoration** of large areas of forest already severely affected by the bark beetle infestation. The introduction to this section of the policy assessment stated:

After a major beetle outbreak, a primary concern for forest areas that are frequently visited or seen by people is with how to treat the large areas of dead trees. Often more than 90% of the spruce trees are dead. New spruce trees need bare soil and sunlight to get started, and they need protection against competing grasses and brush for the first few years. The best treatment for beetle-affected forest areas is:

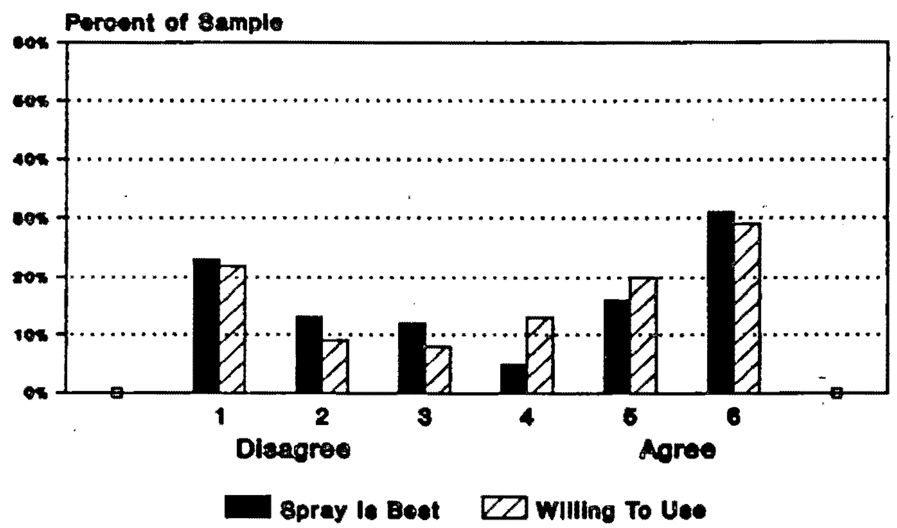
Options offered in this context included methods of dealing with the large numbers of dead trees (*leaving the forest undisturbed*,

Protection During An Outbreak
1990 Sample



R n=84 NR n=67

Protection During An Outbreak
1991 Sample



AK91 n=166

cutting and leaving or *cutting and removing* the dead trees), and with alternative methods of regenerating the forest. Alternatives for getting new trees to grow on affected sites primarily involved reducing competition from grass and brush by use of fire, *very hot* or *moderately hot*, *scraping the ground bare in some areas* (mechanical scarification) or *applying environmentally approved herbicides*.

In the 1991 study there was strong support for "doing something," as apposed to leaving bark beetle affected areas untreated. Less than 1% strongly agreed with a policy of *leaving the forest undisturbed, and allowing it to recover as best it can*. This result is consistent with responses to the *allow nature to take its course* options in the 1990 study and as repeated in the General Policy section of the 1991 study, where treatment of severely damaged areas near developments was consistently strongly favored. *Cut, remove and burn* was the most popular restoration option for Alaska residents in both the 1990 and 1991 studies. In response to a similar set of options, 77% of Kenai Peninsula residents participating in the Alaska State survey favored *cutting and removing the dead trees*, and 67% favored *cutting, burning and revegetating damaged areas along highways*, compared to 29% favoring *leave them as is*.

For areas near homes only 13% of Kenai residents favored the leave as is option. Thus, residents in all three studies generally favored cut and burn options for rehabilitating stands, especially when the trees are removed prior to the burn. Danger of wildfire was not a sufficient reason to preclude burning for most 1991 respondents, 47% disagreed with the policy that burning *should not be allowed because of the danger of starting wildfires* vs 31% who agreed.

Reactions to the herbicide options, like those to insecticide spraying, were widely split with about as many strongly agreeing as strongly disagreeing. In the State survey respondents preferred scraping or the use of mats (an option not offered in either the 1990 or 1991 studies) over chemical treatment (herbicide), whether used with or without fire. Only 23% of 1991 respondents agreed that the side effects of burning *have as bad an effect on the environment as herbicides*, while 44% disagreed. There was, however, a strong split in opinion regarding a complete prohibition against the use of herbicides; 26% of respondents strongly agreed that *herbicides should not be used under any circumstances*, matched by another 26% who strongly disagreed with that prohibition.

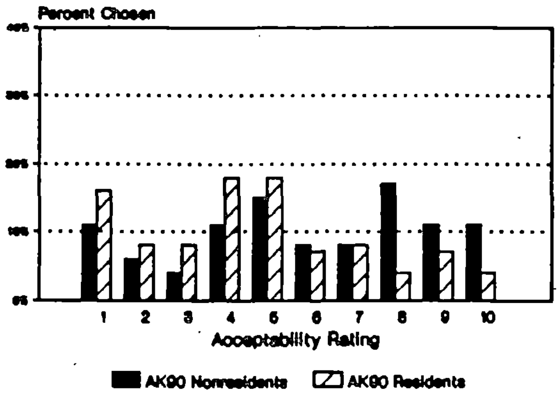
Expectations

This final section of the policy acceptability assessment addressed expectations for the future spread of the bark beetle outbreak. The goal of this section was to determine the extent to which respondents perceived the outbreak as a continuing threat, and whether they believed it might have serious consequences for their own communities. The context for this part of the assessment was set by:

The spruce bark beetle outbreak has now affected over 200,000 acres on the Kenai Peninsula. Biological surveys indicate that the outbreak may be continuing to spread.

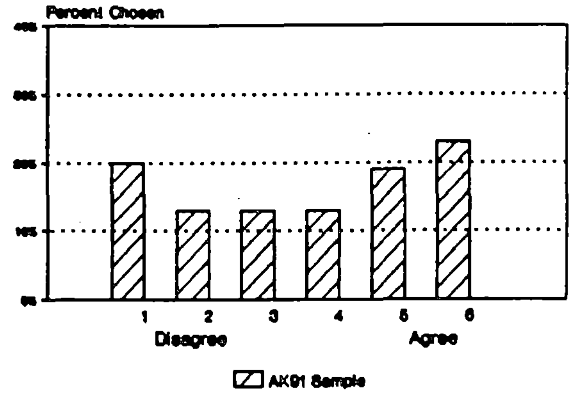
Three statements that followed addressed the likelihood of the outbreak spreading to *other areas on the Kenai Peninsula*, *to the area where you live* and the expected severity of effects should the outbreak spread, *you would <u>not</u> expect more than half of the spruce trees to be lost*.

Restoration - Cut/Leave/Burn - 1990



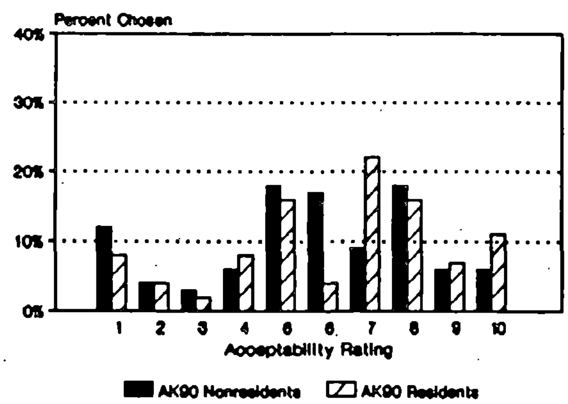
NR n=66 R n=44

Restoration - Cut/Burn - 1991



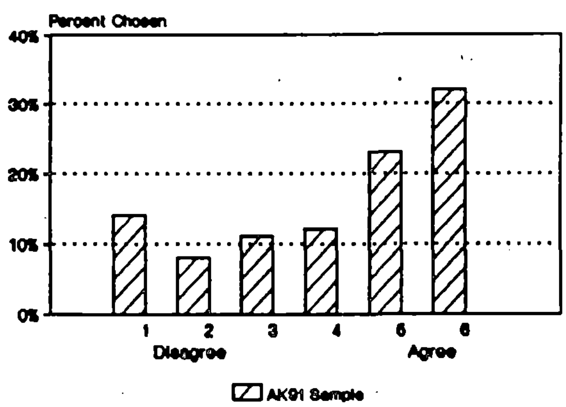
n=79

Restoration - Cut/Remove/Burn - 1990



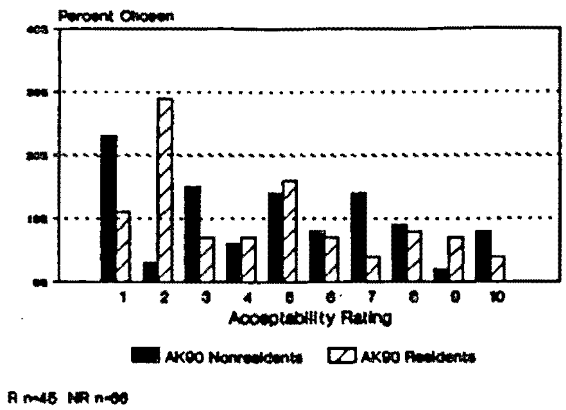
R n=45 NR n=66

Restoration - Cut/Remove/Burn - 1991

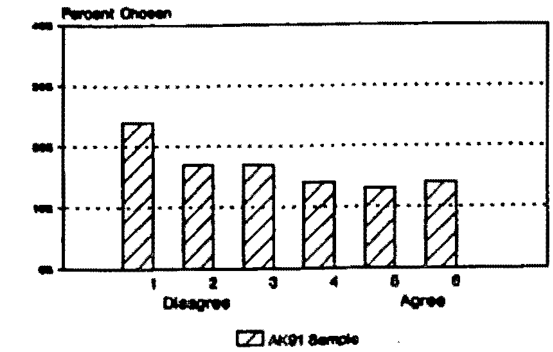


n=73

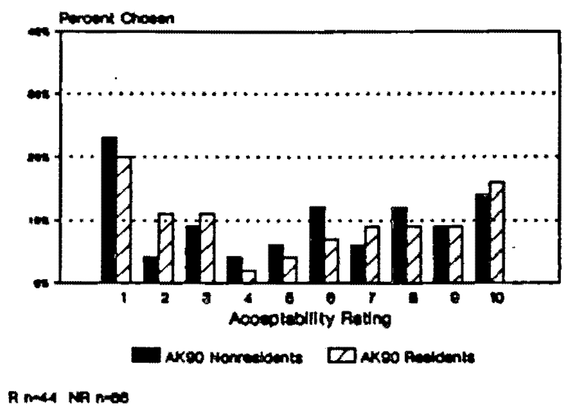
Restoration - Cut/Scrape - 1990



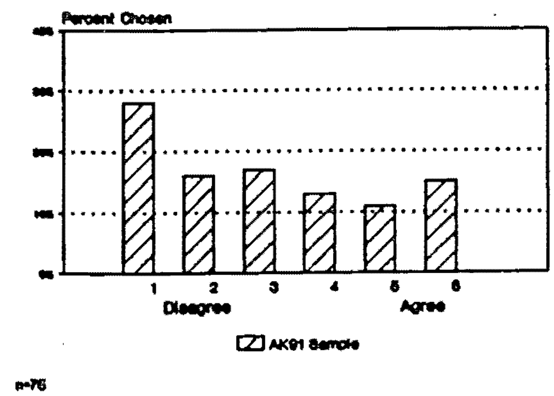
Restoration - Cut/Scrape - 1991



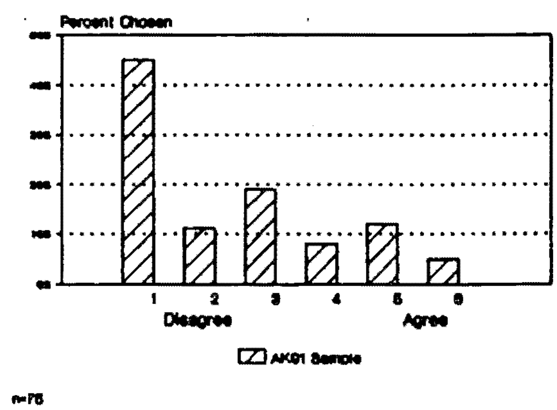
Restoration - Cut/Herbicide - 1990



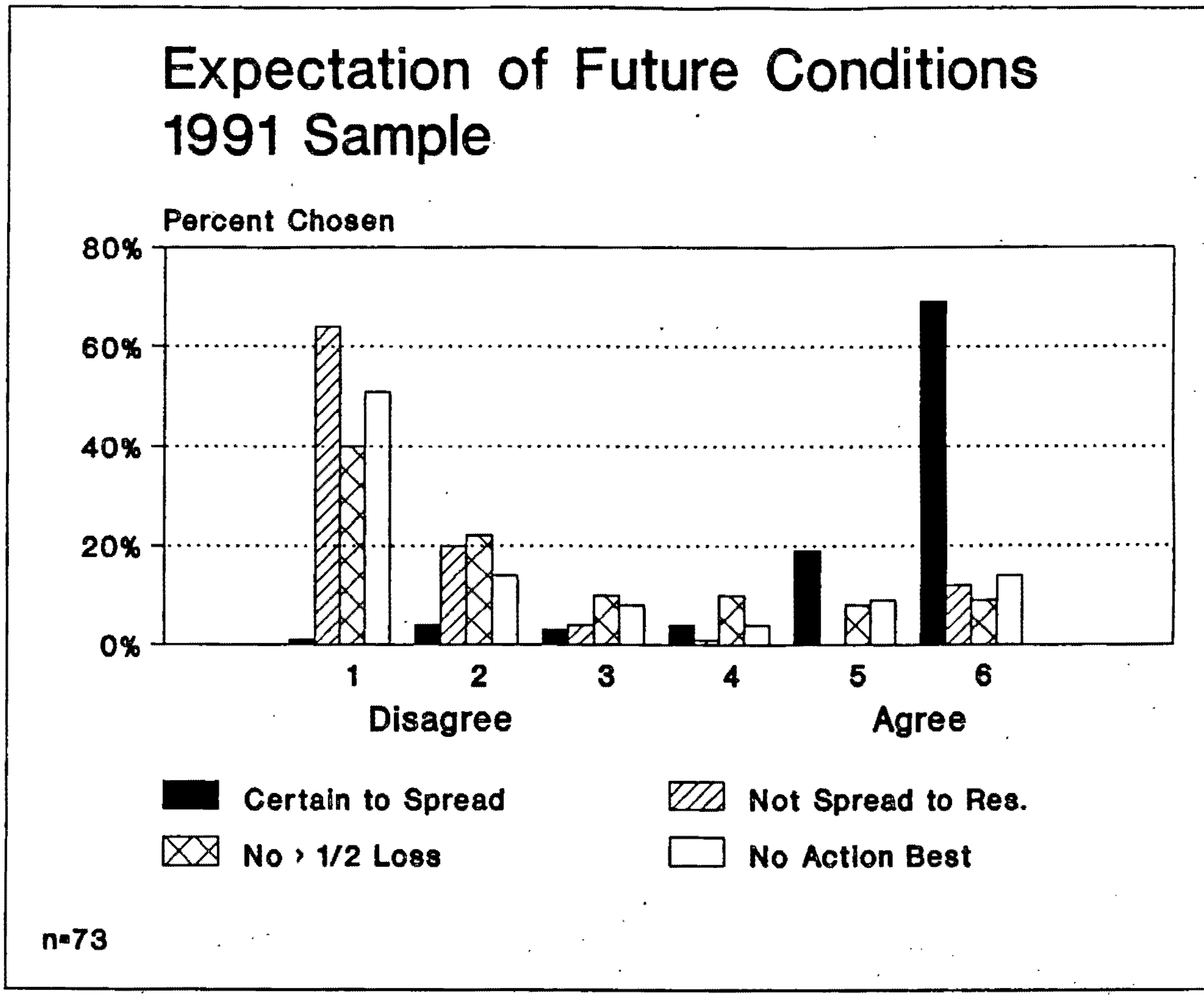
Restoration - Cut/Herbicide - 1991



Restoration - Leave Undisturbed - 1991



The residents sampled in the 1991 study were quite certain that the outbreak *will continue to spread* (89% agreed), that it *will spread to their own properties* (83%), and that substantial damage will result when it does spread to their area; 62% agreed that *at least half of spruce trees will die* in affected areas.



The final statement in the assessment attempted to reach the "bottom line:" *All things considered, you would rather allow most of the spruce trees in your area to be killed by bark beetles than to have the forest treated by cutting and spraying insecticides.*

Overall, 66% of the residents sampled in 1991 disagreed with the policy indicated by this statement.

Summary

A number of consistent policy preferences emerged across the two studies reported. First, there was agreement that some management intervention is preferable to "letting nature take its course," especially for areas near developments when damage is severe. The most preferred ***prevention*** treatment was *thinning* (about 50%) stands in threatened areas, with *clear cutting small patches* garnering less support.

The only ***protection*** option offered was spraying approved insecticides, which produced strongly divided responses. The majority of residents in both the 1990 and the 1991 studies were almost equally split between strong agreement and strong disagreement. This split pattern was repeated for the associated items referring to the effectiveness and safety of insecticide use. Visitors in the 1990 study tended to more strongly oppose the use of insecticides.

There was much greater consensus regarding ***restoration*** options. Generally, there was strong agreement across studies and respondent groups that some active rehabilitation effort should be undertaken in areas of severe beetle damage, and the *cut, remove and burn* alternative was consistently preferred over other options. As with insecticide use, the application of herbicides met with responses that were approximately equally split between strong agreement and strong disagreement; the majority of the 1991 respondents were divided equally between strong agreement and strong disagreement with a complete ban on the use of herbicides.

The observed relationships between the observed patterns of support and non-support for alternative forest management policies and the perceptual preferences expressed by the same groups of respondents reveals a potential dilemma. The forest conditions most preferred in the perceptual assessment--where possible, retain green forests dominated by mature spruce, or where damage has already occurred, re-establish green spruce as quickly as possible--are most readily achieved by management policies that were the least acceptable, or that resulted in strongly split opinion, such as the application of insecticides or herbicides. Thus, the future forest conditions most consistently preferred perceptually may be in conflict with the management options most consistently preferred for achieving those conditions. The next section directly addresses the relationships between individual respondent's preferred perceptual *ends*, and their support for the implied management *means*.

PREFERRED ENDS <u>VS</u> ACCEPTABLE MEANS

The conflict between preferred future forest conditions and acceptable management strategies noted above is based on comparisons among average responses over all respondents. Even with this overall pattern of conflict it is possible that individual respondents could hold consistent perceptual and policy preferences; those who strongly prefer green forest conditions might be more tolerant of management practices required to achieve and maintain those conditions, and *vice versa*.

To further investigate this important relationship, and to further articulate the patterns of agreement and disagreement with the management policies assessed in the 1991 study, a **factor analysis** was conducted.[6] This analysis allows the discovery of consistent patterns of responses across the different policy questions, and provides a better basis for determining the relationships between individual perceptual and policy preferences.

Policy Factors

The analysis revealed several important "factors," defined by consistent patterns in respondents' support (or non-support) for specific sets of management policies. By far the strongest factor (accounting for 37% of the variation in respondents' reactions to the policies offered) was defined by the degree of support (or non-support) for the use of insecticides and herbicides. Respondents scoring high on this ***chemical treatment*** factor tended to support the use of insecticides and herbicides, while those scoring low on the factor tended to be opposed to such treatments. The high end of this factor was associated with strong disagreement (and the low end by strong agreement) with the policies of:

...leaving the (damaged) forest undisturbed; and
...allow most of the spruce trees in your area to be killed by bark beetles (rather) than have the forest treated by cutting and spraying insecticides.

At the same time, the ***chemical treatment*** factor was characterized by stronger agreement (disagreement) with policy statements relating to the use of insecticides for protecting threatened forest areas:

Spraying insecticides is the best way to protect large trees near homes...;
Trees that are sprayed with approved insecticides are essentially 100% safe from bark beetle attack;
Environmentally approved insecticides are perfectly safe...; and
I would be willing to use environmentally approved insecticides...;

while disagreeing (agreeing) with statements that

Insecticides should not be used ... because other insects and animals might be harmed; and
... approved insecticides should not be used because they are potentially dangerous to humans.

With regard to rehabilitation of forest areas already damaged, this factor was defined by stronger agreement (disagreement) with

cutting and removing the dead trees and applying environmentally approved herbicides,

and disagreement (agreement) with

Herbicides should not be used under any circumstances because of possible contamination of the environment.

Following the ***chemical treatment*** factor were four much weaker factors, which achieved minimal statistical criteria for consideration. The second factor (explaining 14% of variance) also involved the degree of support for chemical treatment options, but was primarily defined by the degree to which the continuing bark beetle outbreak was perceived as a ***threat***. Respondents contributing high scores on this factor tended to support chemical treatments, but judged that there was little threat that the bark beetle outbreak would actually continue to spread. The high end of the ***threat*** factor was associated with stronger agreement that:

There is very little chance that the bark beetle outbreak will spread to the area where you *live*; and

... *if the outbreak does spread to your area, you would not expect more than half of the spruce trees to be lost*.

In addition, the ***threat*** factor included agreement with statements indicating that insecticide spraying is *100 % effective* for protecting threatened trees, and *removing trees* (e.g., thinning) is not effective. For rehabilitation *cutting and removing dead trees and applying herbicides* is preferred, while burning is judged to have *as bad an effect on the environment as herbicides*, and burning *should not be allowed because of the danger of starting wildfires*.

The third factor (explaining 13% of variance) was complex, defined by agreement (disagreement) that the outbreak was *certain to spread* coupled with disagreement with "allowing nature to take its course" (except when damage was *less severe* and *far away* from developments). This factor was also associated with preferences for rehabilitating damaged areas by *cut, remove and scrape* treatments and by opposition to burning because of the *danger of starting wildfires*.

The fourth and fifth factors were very weak (explaining 9% and 7% of variance, respectively), but do suggest other patterns of response to the policy options assessed. Factor four was characterized by agreement that the outbreak was *certain to spread*, coupled with support for protecting threatened forest areas by *clear cutting small patches* and for cutting trees on public lands *even if selling the trees will only pay for part of the costs*.

The final factor, which had minimal statistical power, was defined by acceptance that the outbreak will spread to the respondent's area and will do substantial damage (indicated by disagreement with *little chance that the bark beetle outbreak will spread*, and with *not expect more than half of the spruce trees to be lost*), but a willingness to let nature take it's course *near to homes and recreation areas, even when the damage to the forest is more severe*. For areas already severely damaged, the rehabilitation option associated with this factor was *cutting and removing the dead trees and then burning the site with a moderately hot fire*.

Relationships with Perceptual Preferences

To be consistent, respondents whose expressed perceptual preferences indicated a desire to keep threatened spruce forests green, or to have beetle impacted forests restored quickly, should have also supported forest management actions that can effectively achieve those ends (e.g., preventative cutting, insecticide spraying and herbicide use). Alternatively, individuals who disagreed with these forest management approaches should have been more accepting of the visual impacts of bark beetle infestations in forest scenes. To investigate these relationships individual respondent's scores on the management policy factors described above were related to their perceptual preferences as expressed in the four-scene forced choice section of the assessment.

An aggregate measure of perceptual preferences was computed for each respondent as the percentage of choices in which the ***treatment*** scene-set was selected over the ***no-treatment*** set. This measure of preference for treatment-produced forest conditions was related in a multiple linear regression analysis to the five management policy factors described in the preceding section.

Factor Loadings by Policy Item*

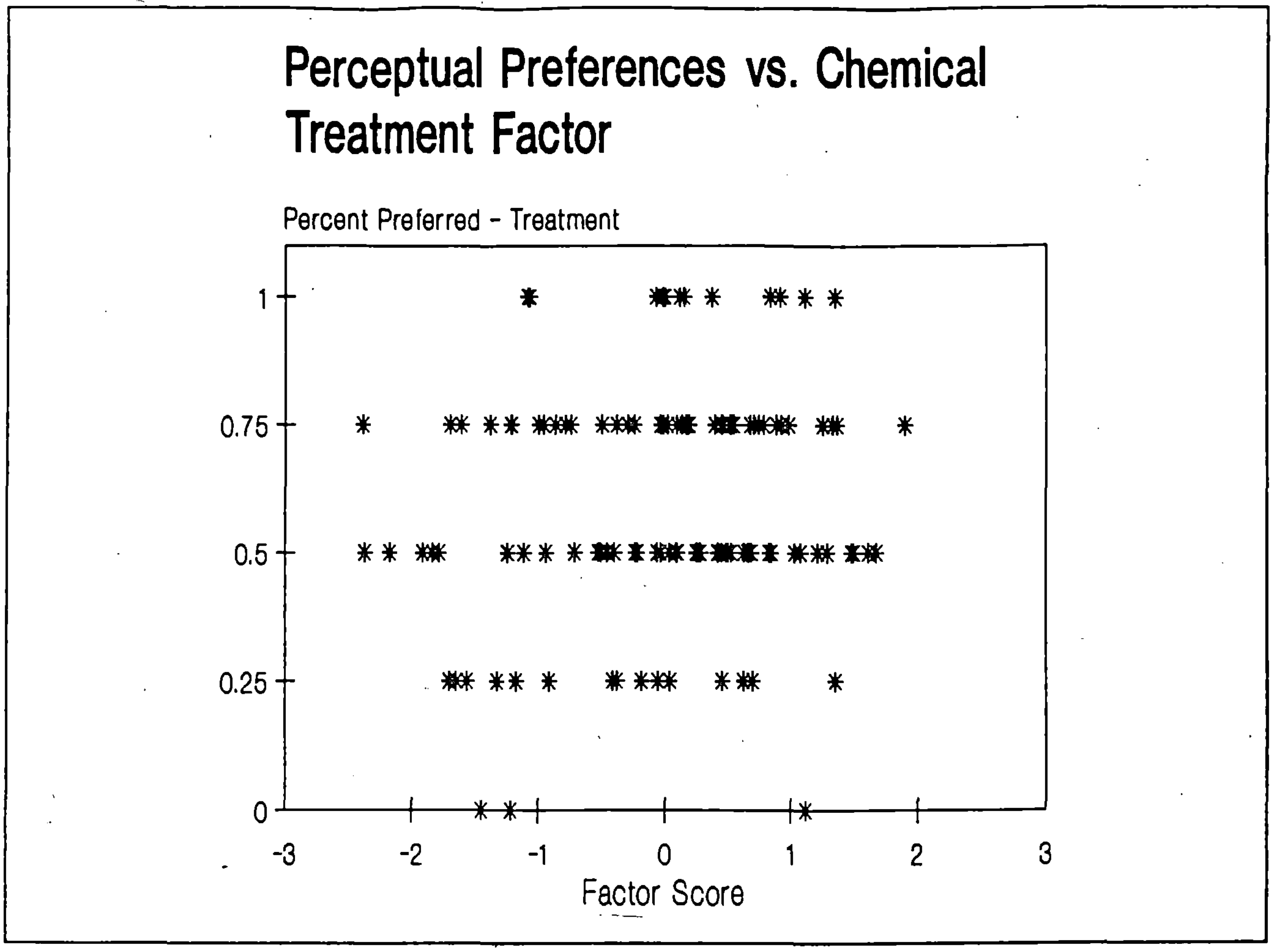
Item #	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
1	.001	-.042	.045	.171	-.166
2	-.134	.024	**-.433**	.252	.070
3	-.142	-.028	**-.403**	.305	.216
4	-.157	.176	**-.452**	.149	**.506**
5	.145	-.098	.331	.279	.023
6	.012	**.402**	-.069	.063	-.104
7	.210	.190	.258	**.386**	-.205
8	-.061	.208	.263	-.069	.293
9	.259	.177	.126	.194	-.086
10	.291	-.178	.084	**.430**	-.037
11	.054	.203	.109	.187	.148
12	**.761**	.135	-.094	-.189	-.071
13	**.558**	**.453**	-.055	.033	.117
14	**.698**	.249	-.183	.090	.058
15	**-.639**	.149	.236	.246	-.039
16	**.794**	.097	-.063	.053	-.026
17	-.259	.051	.114	.044	.128
18	**-.767**	.117	.106	.145	-.075
19	**.418**	.062	.126	.112	.211
20	.336	-.058	.128	.296	**.383**
21	-.036	.244	**.415**	-.078	.053
22	**.504**	**.401**	.085	-.034	.187
23	**-.606**	.174	-.268	.070	.040
24	**-.724**	.015	.198	.074	.221
25	-.395	**.487**	.229	-.262	.125
26	-.285	**.484**	**.396**	-.063	.018
27	.241	-.277	**.434**	**.398**	-.043
28	-.023	**.581**	-.200	.114	-.284
29	-.058	.398	-.246	.213	**-.361**
30	**-.628**	.097	-.228	.227	-.054

* Complete text for Items in attatched Appendix.

The analysis revealed no statistically significant relationships between individual's perceptual preferences and their support (or non-support) for any of the management policy factors, individually or in combination. That is, preferences for the perceptual *ends* were independent of the acceptance of the management *means* most likely to achieve those ends. Further analysis also revealed no consistent differences among the respondent groups sampled (the various Kenai Peninsula resident groups participating in the study) in either perceptual preferences, support for the policy factors or in the relationships between perceptual preferences and patterns of policy support.

Summary

Factor analysis of the agreement and disagreement with the various forest management policies assessed revealed several coherent patterns. The strongest pattern was represented by the ***chemical treatment*** factor. The high end of this factor was defined by higher levels of support for active forest treatments, particularly for the use of insecticides and herbicides, which were accepted as safe and effective methods for prevention, protection, and restoration of the forest. The ***chemical treatment*** factor provided the strongest divisions among the Kenai Peninsula and Anchorage residents who



participated in the 1991 study, but each community represented in the study had effectively equal numbers of individuals at each end of this scale.

The other policy support patterns discovered in the analysis were considerably weaker. A *threat* factor was primarily characterized at the high end by the judgement that the bark beetle outbreak would not spread and would not have very serious consequences if it did. Respondents who scored high on the third factor tended to accept the bark beetle outbreak as a continuing threat, but restricted their support of forest rehabilitation actions to mechanical scarification because of a fear that burning would start wildfires.

The final two factors were both defined by acceptance of the bark beetle as a continuing threat, but those scoring high on the first of these factors tended to support logging as a management approach (including clear cutting and selling trees at a loss), while the weaker of these last two factors was associated with the willingness to accept the consequences of the outbreak and to allow nature to take its course. As for the first factor, there were no consistent patterns of differences among the communities sampled in their scores on these factors.

CONCLUSIONS

The spruce beetle outbreak on the Kenai Peninsula was almost universally recognized as a serious problem by residents of the area. *Increased fire danger* and *loss of scenic beauty* were identified as the most important effects of the bark beetle infestation. Most respondents believed that the outbreak will continue to spread and that their own properties will be significantly affected.

For tourists and visitors to the affected areas sight-seeing was by far the most frequent activity, and the quality of natural scenery was consistently reported as the most important factor affecting their enjoyment of their trip. Clearly, the visual impacts of the bark beetle outbreak are of great concern to both residents and visitors to the Kenai Peninsula, and should be a key consideration in any forest management decisions for the area.

Perceptual Preferences

The assessment of the perceived effects of the beetle outbreak on forest scenery, based primarily on computer video simulations, revealed several consistent patterns. First, whether presented as color slides, color prints or as video images, the greater the proportion of beetle killed trees in a forest scene the lower the rated scenic beauty. This pattern obtained for residents and visitors alike. Second, a hypothetical preventative thinning treatment was consistently preferred to a (retrospective) no treatment infestation scenario which allowed virtually all of the spruce to die. Finally, for forest areas where bark beetle impacts were already severe, respondent's preferred the visual conditions produced by rehabilitation strategies that resulted in more rapid regeneration of forest cover.

The consistency of responses from different respondent groups (residents, visitors and two college student samples), and between the different presentation media employed, strongly supports the conclusion that the results of the perceptual assessments provide a valid basis for predicting the perceptions of residents and visitors who view similar forest scenes directly. The visual impacts of the spruce bark beetle outbreak do significantly affect the quality of resident and visitor experience.

Support for Management Alternatives

The acceptability of alternative forest management responses to the bark beetle outbreak were assessed separately by a series of verbal statements. In areas likely to be seen or visited by people, areas near homes and developed recreation areas, the majority of residents in both the 1990 and the 1991 studies preferred some form of treatment over "allowing nature to take its course." The particular treatment options preferred depended upon the stage of the outbreak.

Prevention in threatened areas: The preferred treatment was to thin threatened spruce stands (by approximately 50%). This preference obtained even though respondents understood that large trees should be taken first and that the costs of treatment (which should include replanting trees) might exceed the revenues likely to result from selling the cut trees.

Protection during an outbreak: Opinion was most divided here, especially with regard to the possible roles of insecticide spraying. At one extreme were individuals who viewed sprays as less than 100% effective, potentially harmful to animals and dangerous to people. Based on these views, they disagreed with use of "environmentally approved insecticides." None-the-less, many of these same respondents indicated that they would use insecticides to protect high valued trees on their own property. At the other extreme was a group of respondents who agreed that sprays are "the best method" for protection. However, many of these respondents did not believe sprays to be "100% effective," and they tended to be divided on whether spraying was "too expensive for most private property owners."

Restoration after an outbreak: The clear message here was **Do Something!** Preferred actions included cut and remove dead trees (even if selling them will recover only part of the costs), then burn the site to aid in the re-establishment of a spruce forest. Danger of wildfire caused by site preparation burning was generally not viewed as a sufficient concern to preclude fire as a treatment option. Scraping the ground was not widely accepted as a regeneration method, though it did appeal to a minority who were concerned that burning treatments might cause wildfires. The use of herbicides, paralleling the results for insecticide spraying, produced wide splits in opinion, and herbicides were generally less preferred than burning.

Ends vs Means

The analysis of individual respondent's perceptual preferences and the management policies they supported revealed no significant relationships. Perceptual preferences and support for management policy options were assessed separately, so the visually presented *ends* were never directly associated or paired with the management *means* which they most likely implied. This opportunity to "have your cake and eat it too" is not unlike the situation created by most of the public participation activities typically associated with forest management planning.

In the "real world," of course, any given set of forest conditions is necessarily associated with a particular, limited set of management options--forest condition ends are generally not separable from their forest management means. In the context of the spruce bark beetle outbreak on the Kenai Peninsula, for example, the combination of maintaining a dense mature spruce forest and adopting a policy of "allowing nature to take its course" is not a realistic option.

In bark beetle threatened areas, cutting some of the spruce trees now (thinning or patch cutting) may be the only cost-effective way to prevent all the trees from being lost later. The use of insecticides and herbicides is clearly controversial and can be relatively expensive. However, chemical treatments are often the only viable means of protecting threatened high-value trees in campgrounds and near residences, or of insuring regeneration of spruce on important sites where forests have been destroyed by bark beetle infestation.

Implications for Management

The assessment studies reported here, along with the results of the Alaska State telephone survey, provide important insights into public perceptions and values regarding Kenai Peninsula forests and forest management policies. Residents are acutely aware of the bark beetle outbreak, and they expect it to continue to spread. Residents and visitors alike are perceptually sensitive to the visual impacts of the bark beetle outbreak, and they are concerned with an array of scenically-based forest values that may be adversely affected.

The highest level of concern is for severely affected forests near residential and recreation developments. Any forest management strategy that is responsive to public values and concerns must address visual impacts of the spruce bark beetle outbreak. At the same time, many forest management actions themselves have visual impacts (especially vegetation management alternatives) which must be taken into account; it is important that the management "cure" not produce visual effects that are worse than the bark beetle "disease."

There is a general consensus that some active forest management response is needed and desired. However, there is considerably less consensus regarding what that response should be. Respondents were particularly divided on the acceptability of using insecticides to protect threatened forest strands or of using herbicides to help regenerate spruce on stands already heavily damaged.

There was inconsistency between the perceptually preferred future forest conditions and the acceptability of forest management practices most likely required to achieve those conditions. This inconsistency derives in part from the fact that perceptual and management policy preferences were assessed separately. There was also an indication, however, that respondent's knowledge and/or beliefs about the various management options may not be sufficient for them to make meaningful means-ends trade offs. For example, a significant number of respondents did not believe that insecticides can provide complete protection (for a three year period) against bark beetle attach. Also, even though both were described as "environmentally approved," significant numbers of respondents apparently were not convinced that insecticides or herbicides are safe. If chemical treatments are thought to be less effective and less safe than they actually are, it is unlikely that the public could properly assess their relative costs and benefits as responses to the bark beetle outbreak.

Overcoming the means-ends dilemma will require attacks on several fronts. First, a concerted "environmental education" effort directed at the concerned publics would seem to be indicated. This would require that the scientific community, in and outside the Forest Service and forestry professions, reach a consensus on the effectiveness and safety of chemical treatment options for protecting beetle-threatened forest stands and for regenerating stands already impacted. Then, this consensus must be effectively communicated to the public. Second, the public should be presented with meaningful forest condition-management policy options; in effect they must be allowed to choose among future forest conditions packaged together with the management policies required to achieve those conditions.

Future Research Directions

Computer visual simulation technology was demonstrated to be very effective in communicating the important visual impacts of the spruce bark beetle outbreak. Visualizations also provided concrete comparisons with the visual effects of alternative management actions that might be required to protect or rehabilitate affected forest stands. Respondents were willing and, apparently quite able, to make consistent choices among alternative future forest conditions that involved changes over as much as a 50-year time period.

Responses to the verbally presented management alternatives produced consistent and coherent patterns of response; the ***chemical treatment*** factor provided the strongest basis for distinguishing among respondent's policy choices. However, there were no consistent relationships between the perceptual *ends* that were preferred and support for the management *means* most likely required to achieve the desired forest conditions.

Based on the outcomes of the two studies reported here, additional efforts are indicated in two important areas. First, visual simulations of alternative future forest conditions should be improved by strengthening the links between forest data, both from inventories and as projected by biological models, and the detailed features of the digital video image representations of those data. Data visualization technology is improving very rapidly, and more refined and consistent algorithms for translating quantitative data into concrete visual representations are being developed. Of equal importance to valid visual simulations are efforts to improve the biological bases for more precisely predicting future forest conditions, including details of the spatial and temporal distributions of projected forest changes.

Second, better formats should be developed for presenting visual simulations together with descriptions and other information about the forest management activities that the achievement and maintenance of those conditions imply. The metric conjoint analysis paradigm[7] and mathematical modeling techniques developed within the marketing research and consumer decision analysis fields offer promising approaches in this regard.

FOOTNOTES

[1] State of Alaska, Department of Natural Resources, Division of Forestry (1992) *Forest health management plan for the western Kenai Peninsula and Kalgin Island.* 40 p.

[2] Daniel, T.C., B. Orland, A. Lynch, J. Hetherington and J. La Fontaine (1990) Integration of GIS and video imaging technology for data-driven visual simulations. In J. Greer (Ed.) *Protecting natural resources with remote sensing.* American Society for Photogrammetry and Remote Sensing, Bethesda, MD, 1990.

[3] Kruse, J. and R. Pelz (1991) *Developing a public consensus on the management of spruce bark beetle on the Kenai Peninsula.* Institute of Social and Economic Research, University of Alaska, Anchorage, AK, 36 p.

[4] Orland, B. (1988) Video imaging: a powerful tool for visualization and analysis. *Landscape Architecture*, 78(4), 78-88.

Orland, B. (1991) Digital image processing aids for visual simulation of forest management practices. In T. Daniel and I. Ferguson (Eds.) *Integrating research on hazards in fire-prone forest environments*, US Man and the Biosphere Program, US Department of State, Washington, DC. 73-83.

[5] Daniel, T.C. and R.S. Boster (1976) *Measuring landscape aesthetics: the Scenic Beauty Estimation Method.* USDA Forest Service Research Paper RM 167, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 66 p.

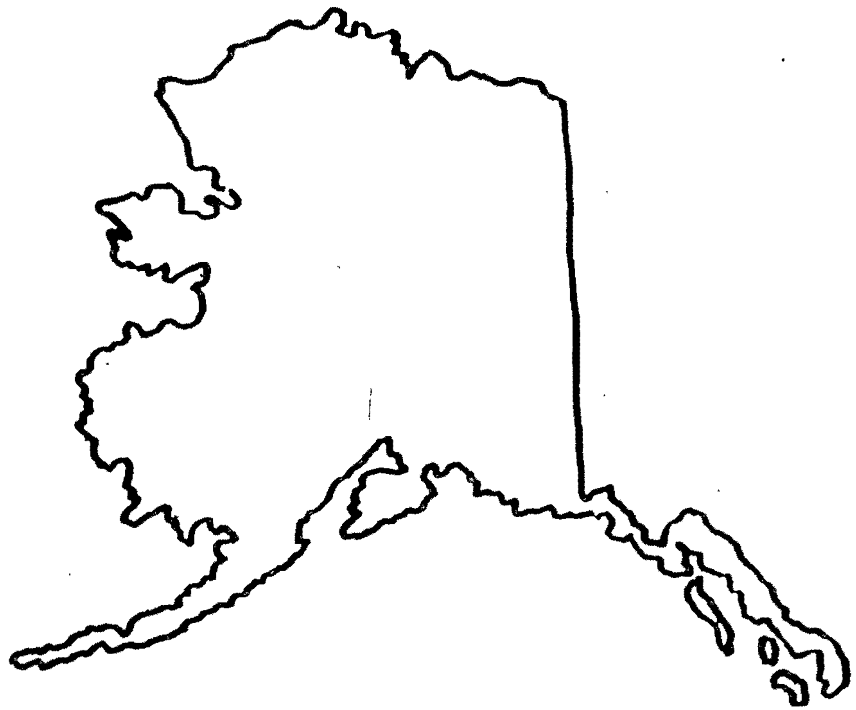
[6] Gorsuch, R.L. (1983) *Factor analysis*, 2nd Edition, Hillsdale, NJ: Lawrence Earlbaum Associates.

[7] Louviere, J.J. (1988) *Analyzing decision making: metric conjoint analysis.* Sage University Paper series on Quantitative Applications in the Social Sciences, Beverly Hills, CA: Sage Publications. 95 p.

Appendix

Copy of 1991 Assessment Instrument

Environment Perception Assessment
Alaska



ENVIRONMENT PERCEPTION LABORATORY
UNIVERSITY OF ARIZONA

IMAGING SYSTEMS LABORATORY
UNIVERSITY OF ILLINOIS

ENVIRONMENT PERCEPTION ASSESSMENT

The purpose of this study is to investigate public perceptions of the effects of the spruce bark beetle outbreak on the Kenai Peninsula, and to determine what forest management actions are most acceptable to residents of beetle-affected or beetle-threatened areas.

Forests in Alaska are important for many reasons--wildlife, timber, oil and minerals, wilderness and outdoor recreation, and natural scenic beauty to name only a few.

In this study we are interested in the publics' perceptions of the spruce bark beetle outbreak on the Kenai Peninsula. In some places the beetles have already killed most of the trees, and the question is how the affected forests will recover. In areas where the beetle outbreak is now threatening to spread, the question is whether we should attempt to protect the forest and, if so, how.

Responding to the bark beetle outbreak requires the cooperation of a number of federal, state and local government agencies as well as many private land owners. The beetles do not recognize jurisdictions or property boundaries.

It is very important, therefor, that the perceptions and concerns of people who live, work and recreate in the affected areas be considered in decisions about how to respond to the beetle outbreak.

This booklet presents sets of pictures showing how several forest areas could look in the future. The pictures were created with the help of a computer. The conditions shown are based on information about forest conditions and growth patterns, including the effects of bark beetles and forest management actions. You will be asked to judge which of the forest conditions shown you would most prefer. There will also be some questions about the effects of the bark beetle outbreak and about some of the possible ways of dealing with it.

Thank you very much for your help.

FOREST RECOVERY AFTER BEETLE ATTACK

The following sets of pictures show how bark beetle-attacked areas in Kenai Peninsula forests could look in the future. The areas shown have all been affected by the spruce bark beetle outbreak, and now over 90% of the spruce trees are dead.

Pictures are arranged four to a page in this pattern:

5 YR	10 YR
20 YR	50 YR

Each page shows how the scene would be expected to look **five**, **ten**, **twenty** and **fifty years** in the future if certain forest management actions were taken. Each forest area is represented by two pages of scenes, each depicting the expected results of a different forest management approach. Actions might range from simply allowing nature to take its course (no action) to cutting and removing all of the dead trees and planting a new forest. Several of the pages show the effects of fire, either "prescribed" fire used as a management tool, or wildfire.

Some actions result in poorer results in the short term, but better results in the longer term. Other management options may do better in the short term, but not so well in the longer term.

There are fourteen pairs of scene pages. Each pair shows the expected results of two different management actions for the same forest area. We are interested in your judgement of which page of scenes in each pair represents the **best overall scenic quality.**

Please quickly look through all of the pages of scenes, then evaluate each pair of pages one at a time. For each pair, select which page (**A** or **B**) represents the best overall results for the forest area shown.

Record your choice for each pair by circling the appropriate letter (**A** or **B**) on the answer sheet provided.

PROTECTING THREATENED FOREST AREAS

All of the sets of scenes in the previous pages showed views of forest areas that have already been severely affected by spruce bark beetles. The following two pairs of scene sets show possible future conditions for two forest areas that are just beginning to be attacked by beetles.

As in the previous pages, the scenes represent conditions **3, 6, 9** and **12 years** in the future. In the two forest areas shown, most of the spruce trees are currently alive and uninfested by bark beetles. However, both areas are in the path of a spreading beetle outbreak.

Pictures are arranged four to a page in this pattern:

3 YR	6 YR
9 YR	12 YR

The set of four scenes on each page shows how one forest area is expected to look in the future as a result of taking particular management actions now. Possible actions range from allowing the beetle outbreak to take its own course, perhaps only cleaning up dead and fallen trees later, to thinning out some of the threatened trees and spraying some with environmentally approved insecticides.

Please look at the scenes and then select the page in each pair which represents the **best overall visual quality.** As for the previous sets, mark your choices on the answer sheet by circling the letter (**A** or B) to indicate which page in each pair provides the best overall visual results.

FOREST MANAGEMENT APPROACHES

On the following pages are 30 statements regarding different aspects of the spruce bark beetle outbreak on the Kenai Peninsula and possible forest management responses. Please read each statement and determine how much you would agree or disagree with it.

Record your answers on the answer sheet provided, by marking the appropriate box from

Strongly Agree to **Strongly Disagree**

The statements are divided into five sets. Each set of statements is preceded by a short introduction.

One response to the spruce bark beetle outbreak is to accept it as a natural process and to just "let nature take its course." In remote areas this may be the only possible response. In some Parks and Wilderness Areas it may be the only alternative allowed by law. Where managers have a choice, the best policy is to let nature take its course, so long as the area is:

1. far away from homes and recreation areas, but only when the damage to the forest is less severe, and new trees are expected to eventually grow back in the area.

2. far away from homes and recreation areas, even when the damage to the forest is more severe, and only grass and brush is expected to grow back in the area.

3. near to homes and recreation areas, but only when the damage to the forest is less severe, and new trees are expected to eventually grow back in the area.

4. near to homes and recreation areas, even when the damage to the forest is more severe, and only grass and brush is expected to grow back in the area.

One method for protecting forest areas that are threatened by the bark beetle outbreak is to remove about half of the trees. This is intended to reduce the number of places for the beetles to breed and to help the remaining trees grow more vigorously so that they are better able to resist beetle attacks.

5. Bark beetles prefer to attack larger more mature spruce trees, so it is best to remove the larger trees first.

6. Removing trees from beetle-threatened areas is generally not effective in protecting the remaining trees.

7. Clear cutting small patches is the best way to remove trees and protect spruce forests.

8. Thinning, by removing a few trees here and there, is the best way to remove trees and protect spruce forests.

9. When trees are removed to protect public forests from beetles, the cut trees should be sold to private companies.

10. Managers should cut trees on public lands to help protect beetle-threatened forests, even if selling the trees will only pay for part of the costs.

11. If trees are to be cut on public lands, all logging roads should be closed and disturbed areas should be replanted.

During a bark beetle outbreak it is possible to protect selected trees by spraying environmentally approved insecticides directly on the bark. Spraying costs about 5 to 10 dollars per tree and lasts for up to three years.

12. Spraying insecticides is the best way to protect large trees near homes and important recreation areas.

13. Trees that are sprayed with approved insecticides are essentially 100% safe from bark beetle attack.

14. Environmentally approved insecticides are perfectly safe for use around homes and recreation areas.

15. Insecticides should <u>not</u> be used to protect trees from bark beetles because other insects and animals may be harmed.

16. I would be willing to use environmentally approved insecticides to protect important trees near my home.

17. Spraying approved insecticides to protect trees from beetles is too expensive for most private property owners.

18. Approved insecticides should not be used because they are potentially dangerous to humans.

After a major beetle outbreak, a primary concern for forest areas that are frequently visited or seen by people is with how to treat the large areas of dead trees. Often more than 90% of the spruce trees are dead. New spruce trees need bare soil and sunlight to get started, and they need protection against competing grasses and brush for the first few years. The best treatment for beetle-affected forest areas is:

19. cutting down the dead trees and then burning the site with a very hot fire to clear the ground and kill competing grass and brush.

20. cutting and removing the dead trees and then burning the site with a moderately hot fire to partially clear the ground and temporarily reduce competing grass and brush.

21. cutting and removing the dead trees and mechanically scraping the ground bare in some areas to temporarily reduce competing grass and brush.

22. cutting and removing the dead trees and applying environmentally approved herbicides to temporarily reduce competing grass and brush.

23. leaving the forest undisturbed, and allowing it to recover as best it can.

24. Herbicides should not be used under any circumstances because of possible contamination of the environment.

25. Burning produces smoke and other by-products that could have as bad an effect on the environment as herbicides.

26. Burning forest sites should not be allowed because of the danger of starting wildfires.

The spruce bark beetle outbreak has now affected over 200,000 acres on the Kenai Peninsula. Biological surveys indicate that the outbreak may be continuing to spread.

27. It is almost certain that the outbreak will spread to other areas on the Kenai Peninsula.

28. There is very little chance that the bark beetle outbreak will spread to the area where you live.

29. Even if the outbreak does spread to your area, you would not expect more than half of the spruce trees to be lost.

30. All things considered, you would rather allow most of the spruce trees in your area to be killed by bark beetles than to have the forest treated by cutting and spraying insecticides.

Eval of Public Knowledge about SBB (Eriksen Survey)

Alaska Division of Forestry
ATTN: Jim Peterson &
Dave Wallingford

March 15, 1991

Dave and Jim,

As you requested, I have broken down the survey results in order to provide you with additional information. I have included the breakdown of results for questions submitted by both of you. If you have any other requests, I would be happy to oblige.

I have also included the results and conclusions section of my project, as well as my recommendations for a public relations/education campaign. As you will note, these recommendations are not extremely detailed, as I had no idea how much money could be available. I would appreciate the chance to give you a more detailed proposal, should the Division decide to go ahead with such a project.

I spoke with Jack Cruz from ISER the other day and would be interested in the results of his survey. He also indicated that he might need further breakdowns of my information and within reasonable time limits, I will do my best to provide them.

Please call if you have need for further information.

Sincerely,

Kris Eriksen

Kris Eriksen

AN EVALUATION OF PUBLIC KNOWLEDGE ABOUT SPRUCE BEETLE INFESTATION ON THE KENAI PENINSULA

Presented by
The Eriksen Group

27.How serious do you think the spruce beetle problem is? (of 8)

5	62.5%	Very serious	0	0%	DON'T KNOW
2	25%	Somewhat serious.	0	0%	REFUSE
1	12.5%	Not serious at all			

29.Do you feel the problem effects you directly?

5	62.5%	YES.	0	0%	DON'T KNOW
3	37.5%	NO.	0	0%	REFUSE

31.In what way does the problem affect you indirectly? (of 2)

2	100%	It could spread to the area where I own property
0	0%	It could spread to the area where I live
0	0%	It could affect my place of work or the work I do
0	0%	It makes the trees along the road unsightly
0	0%	Could be harmful to children
0	0%	I care about the environment
0	0%	Outdoor activities are less fun without trees/ want trees around
0	0%	Beetle kill trees are a fire hazard
0	0%	It has an effect on the economy
0	0%	It has a positive affect - I get firewood from it
0	0%	It has a negative affect - I have infested firewood
0	0%	It could make people not want to move down here
0	0%	DON'T KNOW
0	0%	REFUSE

32.How would you <u>prefer</u> to get future information about spruce beetle? (of 8)

1	12.5%	Newspaper	0	0%	Community/friend/rumor
0	0%	Public meetings	5	62.5%	Direct mail
0	0%	Radio	0	0%	Advertising
2	25%	Television	0	0%	Toll free line / get it myself
0	0%	Workplace	0	0%	All methods
0	0%	DON'T KNOW	0	0%	Already know what to do
0	0%	REFUSE	0	0%	Kenai Borough

HOMER SURVEY RESULTS - 82

8. Have you heard anything about the spruce beetle problem in Alaska?

72	87.8%	YES
10	12.2%	NO

9. Do you want to know anything about the spruce beetle problem? (of 10)

7	70%	YES
3	30%	NO

14. Is your home in an area that is infested? (of 72)

20	27.8%	YES	6	8.3%	DON'T KNOW
46	64%	NO	0	0%	REFUSE

15. Do you own land or a second home in an area that is infected with spruce beetle?

4	5.6%	YES	4	5.6%	DON'T KNOW
64	88.9%	NO	0	0%	REFUSE

16. Please tell me what you think is the <u>most effective</u> method you may have heard about for ***controlling*** the spread of spruce beetle.

5	6.9%	SPRAY PESTICIDES
18	26.9%	CUTTING & BURNING INFESTED TREES
1	1.4%	KEEPING HEALTHY TREES HEALTHY
1	1.4%	CUTTING TREES OVER 12 INCHES IN DIAMETER
16	22.2%	CLEAR AWAY FRESH CUT, FALLEN TREES
0	0%	USE ATTRACTANTS ON SPECIFIC TREES TO DRAW BEETLES AWAY
19	26.4%	HAVEN'T HEARD OF ANY
0	0%	CLEAR CUTTING
0	0%	LEAVE IT ALONE TO RUN ITS OWN COURSE
0	0%	PUT STERILE BUGS OUT
0	0%	CUT A FIRE LINE TO WIDE FOR THE BUGS TO CROSS/ CONTAIN THEM
0	0%	WHATEVER KILLS TO BEETLES IN OKAY
12	16.7%	DON'T KNOW
0	0%	REFUSE

17. If you knew about spruce beetles and methods for controlling beetle populations on your homesite or property, would you use them?

66	91.7%	YES	4	5.6%	DON'T KNOW
2	2.8%	NO	0	.0%	REFUSE

18. Why not? (of 2)

0	0%	I won't use pesticides
0	0%	Don't want to cut tres on my property
1	50%	It doesn't affect me or my property
0	0%	I'll worry about it if it happens
0	0%	It should be left alone to run its course
0	0%	It would depend on the method
1	50%	DON'T KNOW
0	0%	REFUSE

19. If pesticides were available that killed only spruce beetle, would you use them <u>where you live</u> to control the infestation

48	66.7%	YES	16	22.2%	DON'T KNOW
7	9.7%	NO	1	1.4%	REFUSE

"SUB" QUESTIONS

Of the 56 people who answered "no" to the question "Have you heard anything about the spruce beetle problem in Alaska?", who are they and where do they live?

4. In what area do you live?

17	30.4%	Kenai/Nikiski	1	1.8%	Moose Pass	7	12.5%	Seward
13	23.2%	Soldotna	0	0%	Ninilchik	4	7.1%	Kasilof
0	0%	Cooper Landing	0	0%	Clam Gulch	0	0%	Hope
3	5.4%	Sterling	1	1.8%	Anchor Point	0	0%	No answer
0	0%	Deep Creek	10	17.9%	Homer			

5. What kind of work do you do?

0	0%	Local government	1	1.8%	Managers/officials
0	0%	State government	4	7.1%	Professionals/doctors/lawyers
0	0%	Federal government	2	3.6%	Construction / laborer
0	0%	Military	6	10.7%	Self employed
1	1.8%	Oil & gas	16	28.6%	House wife
3	5.4%	Clerical/retail/sales	14	25%	Unemployed/retired
2	3.6%	Fishing/timber/mining	1	1.8%	Student
6	10.7%	Service industries			
0	0%	DON'T KNOW			
0	0%	REFUSE			

6. How old are you?

1	1.8%	18 to 19	3	5.4%	52 to 61
13	23.2%	20 to 26	5	8.9%	62 to 71
6	10.7%	27 to 31	3	5.4%	Over 71
18	32.1%	32 to 41	0	0%	DON"T KNOW
6	10.7%	42 to 51	1	1.8%	REFUSED

Of the 233 people who said "no" to the question, "Is your home in an area that is infested with spruce beetle?", where do they live?

4. In what area do you live?

51	21.9%	Kenai/Nikiski	0	0%	Moose Pass	45	19.3%	Seward
47	20.2%	Soldotna	7	3%	Ninilchik	7	3%	Kasilof
0	0%	Cooper Landing	1	.04%	Clam Gulch	1	.04%	Hope
24	10.3%	Sterling	4	1.7%	Anchor Point	0	0%	No answer
0	0%	Deep Creek	46	19.7%	Homer			

Of the 52 people who chose "U.S. Forest Service" when asked "What government agency would you trust the most to have accurate information about the solutions to the spruce beetle problem?", where do they live?

4. In what area do you live?

10	19.2%	Kenai/Nikiski	2	3.8%	Moose Pass	11	21.2%	Seward
16	30.8%	Soldotna	0	0%	Ninilchik	0	0%	Kasilof
2	3.8%	Cooper Landing	1	1.9%	Clam Gulch	1	1.9%	Hope
5	9.6%	Sterling	1	1.9%	Anchor Point	0	0%	No answer
0	0%	Deep Creek	3	5.8%	Homer			

SOLDOTNA SURVEY RESULTS - 89

8. Have you heard anything about the spruce beetle problem in Alaska?
   76 88.8% YES
   13 14.6% NO

9. Do you want to know anything about the spruce beetle problem? (of 13)
   11 84.6% YES
   2 15.4% NO

14. Is your home in an area that is infested? (of 76)

16	21.1%	YES	13	17.1%	DON'T KNOW
47	61.9%	NO	0	0%	REFUSE

15. Do you own land or a second home in an area that is infected with spruce beetle?

6	7.9%	YES	8	10.5%	DON'T KNOW
62	81.6%	NO	0	0%	REFUSE

16. Please tell me what you think is the most effective method you may have heard about for ***controlling*** the spread of spruce beetle.

8	10.5%	SPRAY PESTICIDES
22	29%	CUTTING & BURNING INFESTED TREES
1	1.3%	KEEPING HEALTHY TREES HEALTHY
0	0%	CUTTING TREES OVER 12 INCHES IN DIAMETER
3	4%	CLEAR AWAY FRESH CUT, FALLEN TREES
1	1.3%	USE ATTRACTANTS ON SPECIFIC TREES TO DRAW BEETLES AWAY
20	26.3%	HAVEN'T HEARD OF ANY
2	2.6%	CLEAR CUTTING
1	1.3%	LEAVE IT ALONE TO RUN ITS OWN COURSE
1	1.3%	PUT STERILE BUGS OUT
0	0%	CUT A FIRE LINE TO WIDE FOR THE BUGS TO CROSS/ CONTAIN THEM
1	1.3%	WHATEVER KILLS TO BEETLES IN OKAY
16	21.1%	DON'T KNOW
0	0%	REFUSE

17. If you knew about spruce beetles and methods for controlling beetle populations on your homesite or property, would you use them?

72	94.7%	YES	1	1.3%	DON'T KNOW
3	1.3%	NO	0	0%	REFUSE

18. Why not? (of 3)

1	33.3%	I won't use pesticides
0	0%	Don't want to cut tres on my property
0	0%	It doesn't affect me or my property
1	33.3%	I'll worry about it if it happens
1	33.3%	It should be left alone to run its course
0	0%	It would depend on the method
0	0%	DON'T KNOW
0	0%	REFUSE

19. If pesticides were available that killed only spruce beetle, would you use them where you live to control the infestation

57	75%	YES	12	15.8%	DON'T KNOW
7	9.2%	NO	0	0%	REFUSE

20. If pesticides were available that killed only spruce beetle, would you use it on your property, <u>other than where you live,</u> to control the infestation?

54	71.1% YES	12	15.8% DON'T KNOW
10	13.2% NO	0	.0% REFUSE

21. Would you support others use of pesticides to control spruce beetle even if you yourself did not need it?

55	72.4% YES	11	14.5% DON'T KNOW
10	13.2% NO	0	0% REFUSE

22. Would you cut your mature trees if it would prevent the beetle from infesting your property?

42	55.3% YES	14	18.4% DON'T KNOW
20	26.3% NO	0	0% REFUSE

23. If you wanted to prevent beetle infestation or get rid of it, would you be willing to cut and salvage the wood and create access on your property

49	64.5% YES	16	21.1% DON'T KNOW
11	14.5% NO	0	0% REFUSE

24. On your property, would you rather take preventative measures or wait and see if your property is infested and then cut and salvage the infested trees?

51	67.1%	Take preventative measures
14	18.4%	Wait and see, then cut and salvage
6	7.9%	Don't do anything
0	0%	Periodic testing
1	1.3%	Already have problem / need help now
4	5.3%	DON'T KNOW
0	0%	REFUSE

25. On state or borough land, would you prefer they take preventative measures or wait and see if land is infested and then cut and salvage the infested trees?

59	77.6%	Take preventative measures
10	13.2%	Wait and see, then cut and salvage
3	3.9%	Don't do anything
0	0%	Periodic testing
0	0%	Depends on the cost
0	0%	Depends on degree of risk
4	5.3%	DON'T KNOW
0	0%	REFUSE

26. You'd prefer the government take preventative measures. Which measure would you <u>*most*</u> prefer? (of 59)

10	17%	Spray pesticides
17	28.8%	Cut and salvage already infested trees
1	1.7%	Work to keep susceptible trees healthy
1	1.7%	Cut trees over 12 inches in diameter
1	1.7%	Clear away and burn fresh cut or fallen trees
2	3.4%	Use attractants on specific trees to draw beetles away
8	13.6%	All of the methods
0	0%	All of the methods except pesticides
1	1.7%	Clear cutting
0	0%	Cut fire line wide enough to control the spread
2	3.4%	Whatever is proven effective
0	0%	Whatever is safest
0	0%	Do sample testing
0	0%	Keep the trees well watered
13	22%	DON'T KNOW
0	0%	REFUSE

27.How serious do you think the spruce beetle problem is? (of 76)

56	73.7%	Very serious	7	9.2%	DON'T KNOW
11	14.5%	Somewhat serious.	0	0%	REFUSE
2	2.6%	Not serious at all			

29.Do you feel the problem effects you directly?

40	52.6%	YES.	2	2.6%	DON'T KNOW
34	44.7%	NO.	0	0%	REFUSE

31.In what way does the problem affect you indirectly? (of 28)

7	25%	It could spread to the area where I own property
4	14.3%	It could spread to the area where I live
0	0%	It could affect my place of work or the work I do
7	9.2%	It makes the trees along the road unsightly
1	3.6%	Could be harmful to children
2	7.1%	I care about the environment
2	7.1%	Outdoor activities are less fun without trees/ want trees around
2	7.1%	Beetle kill trees are a fire hazard
1	3.6%	It has an effect on the economy
0	0%	It has a positive affect - I get firewood from it
0	0%	It has a negative affect - I have infested firewood
0	0%	It could make people not want to move down here
2	7.1%	DON'T KNOW
0	0%	REFUSE

32.How would you prefer to get future information about spruce beetle? (of 76)

17	22.4%	Newspaper	0	0%	Community/friend/rumor
3	4%	Public meetings	37	48.7%	Direct mail
3	4%	Radio	0	0%	Advertising
11	14.5%	Television	2	2.6%	Toll free line / get it myself
0	0%	Workplace	1	1.3%	All methods
1	1.3%	DON'T KNOW	1	1.3%	Already know what to do
0	0%	REFUSE	0	0%	Kenai Borough

NINILCHIK SURVEY RESULTS-8

8. Have you heard anything about the spruce beetle problem in Alaska?

8	100%	YES			
0	0%	NO			

9. Do you want to know anything about the spruce beetle problem? (of 0)

0	0%	YES
0	0%	NO

14. Is your home in an area that is infested? (of 8)

1	22%	YES	0	0%	DON'T KNOW
7	67.3%	NO	0	0%	REFUSE

15. Do you own land or a second home in an area that is infected with spruce beetle?

0	0%	YES	0	0%	DON'T KNOW
8	100%	NO	0	0%	REFUSE

16. Please tell me what you think is the most effective method you may have heard about for ***controlling*** the spread of spruce beetle.

1	12.5%	SPRAY PESTICIDES
0	0%	CUTTING & BURNING INFESTED TREES
1	12.5%	KEEPING HEALTHY TREES HEALTHY
0	0%	CUTTING TREES OVER 12 INCHES IN DIAMETER
1	12.5%	CLEAR AWAY FRESH CUT, FALLEN TREES
0	0%	USE ATTRACTANTS ON SPECIFIC TREES TO DRAW BEETLES AWAY
4	50%	HAVEN'T HEARD OF ANY
0	0%	CLEAR CUTTING
0	0%	LEAVE IT ALONE TO RUN ITS OWN COURSE
0	0%	PUT STERILE BUGS OUT
0	0%	CUT A FIRE LINE TO WIDE FOR THE BUGS TO CROSS/ CONTAIN THEM
0	0%	WHATEVER KILLS TO BEETLES IN OKAY
1	12.5%	DON'T KNOW
0	0%	REFUSE

17. If you knew about spruce beetles and methods for controlling beetle populations on your homesite or property, would you use them?

7	87.5%	YES	0	0%	DON'T KNOW
1	12.5%	NO	0	0%	REFUSE

18. Why not? (of 1)

1	100%	I won't use pesticides
0	0%	Don't want to cut tres on my property
0	0%	It doesn't affect me or my property
0	0%	I'll worry about it if it happens
0	0%	It should be left alone to run its course
0	0%	It would depend on the method
0	0%	DON'T KNOW
0	0%	REFUSE

19. If pesticides were available that killed only spruce beetle, would you use them where you live to control the infestation

5	62.5%	YES	1	12.5%	DON'T KNOW
2	25%	NO	0	0%	REFUSE

20. If pesticides were available that killed only spruce beetle, would you use it on your property, <u>other than where you live,</u> to control the infestation?

5	62.5%	YES	1	12.5%	DON'T KNOW
2	25%	NO	0	0%	REFUSE

21. Would you support others use of pesticides to control spruce beetle even if you yourself did not need it?

5	62.5%	YES	2	25%	DON'T KNOW
1	12.5%	NO	0	0%	REFUSE

22. Would you cut your mature trees if it would prevent the beetle from infesting your property?

3	37.5%	YES	3	37.5%	DON'T KNOW
2	25%	NO	1	.3%	REFUSE

23. If you wanted to prevent beetle infestation or get rid of it, would you be willing to cut and salvage the wood and create access on your property ?

5	62.5%	YES	2	25%	DON'T KNOW
1	12.5%	NO	0	0%	REFUSE

24. On your property, would you rather take preventative measures or wait and see if your property is infested and then cut and salvage the infested trees?

6	75%	Take preventative measures
2	25%	Wait and see, then cut and salvage
0	0%	Don't do anything
0	0%	Periodic testing
0	0%	Already have problem / need help now
0	0%	DON'T KNOW
0	0%	REFUSE

25. On state or borough land, would you prefer they take preventative measures or wait and see if land is infested and then cut and salvage the infested trees?

6	75%	Take preventative measures
1	12.5%	Wait and see, then cut and salvage
0	0%	Don't do anything
0	0%	Periodic testing
0	0%	Depends on the cost
0	0%	Depends on degree of risk
1	12.5%	DON'T KNOW
0	0%	REFUSE

26. You'd prefer the government take preventative measures. Which measure would you <u>*most*</u> prefer? (of 6)

0	0%	Spray pesticides
1	12.5%	Cut and salvage already infested trees
1	12.5%	Work to keep susceptible trees healthy
0	0%	Cut trees over 12 inches in diameter
0	0%	Clear away and burn fresh cut or fallen trees
0	0%	Use attractants on specific trees to draw beetles away
1	12.5%	All of the methods
0	0%	All of the methods except pesticides
0	0%	Clear cutting
0	0%	Cut fire line wide enough to control the spread
0	0%	Whatever is proven effective
0	0%	Whatever is safest
0	0%	Do sample testing
0	0%	Keep the trees well watered
3	37.5%	DON'T KNOW
0	0%	REFUSE

20. If pesticides were available that killed only spruce beetle, would you use it on your property, <u>other than where you live,</u> to control the infestation?

47	65.3%	YES	16	22.2%	DON'T KNOW
8	11.1%	NO	1	.1.4%	REFUSE

21. Would you support others use of pesticides to control spruce beetle even if you yourself did not need it?

46	63.9%	YES	16	22.2%	DON'T KNOW
10	13.9%	NO	0	0%	REFUSE

22. Would you cut your mature trees if it would prevent the beetle from infesting your property?

31	43.1%	YES	22	30.6%	DON'T KNOW
19	26.4%	NO	0	0%	REFUSE

23. If you wanted to prevent beetle infestation or get rid of it, would you be willing to cut and salvage the wood and create access on your property ?

21	29.2%	YES	28	39%	DON'T KNOW
23	32%	NO	0	0%	REFUSE

24. On your property, would you rather take preventative measures or wait and see if your property is infested and then cut and salvage the infested trees?

47	65.3%	Take preventative measures
17	23.6%	Wait and see, then cut and salvage
5	7%	Don't do anything
0	0%	Periodic testing
0	0%	Already have problem / need help now
3	4.2%	DON'T KNOW
0	0%	REFUSE

25. On state or borough land, would you prefer they take preventative measures or wait and see if land is infested and then cut and salvage the infested trees?

55	76.4%	Take preventative measures
7	9.1%	Wait and see, then cut and salvage
1	1.4%	Don't do anything
0	0%	Periodic testing
1	1.4%	Depends on the cost
0	.0%	Depends on degree of risk
8	11.1%	DON'T KNOW
0	0%	REFUSE

26. You'd prefer the government take preventative measures. Which measure would you ***most*** prefer? (of 55)

16	22.2%	Spray pesticides
4	5.6%	Cut and salvage already infested trees
0	0%	Work to keep susceptible trees healthy
1	1.4%	Cut trees over 12 inches in diameter
15	20.8%	Clear away and burn fresh cut or fallen trees
0	0%	Use attractants on specific trees to draw beetles away
5	7%	All of the methods
2	2.8%	All of the methods except pesticides
0	0%	Clear cutting
0	0%	Cut fire line wide enough to control the spread
0	0%	Whatever is proven effective
1	1.4%	Whatever is safest
1	1.4%	Do sample testing
1	1.4%	Keep the trees well watered
9	12.5%	DON'T KNOW
0	0%	REFUSE

27.How serious do you think the spruce beetle problem is? (of 72)

52	72.2%	Very serious	7	5.8%	DON'T KNOW
9	12.5%	Somewhat serious.	0	0%	REFUSE
4	5.6%	Not serious at all			

29.Do you feel the problem effects you directly?

35	48.6%	YES.	2	2.8%	DON'T KNOW
35	48.6%	NO.	0	0%	REFUSE

31.In what way does the problem affect you indirectly? (of 21)

6	28.6%	It could spread to the area where I own property
1	4.8%	It could spread to the area where I live
0	0%	It could affect my place of work or the work I do
13	62%	It makes the trees along the road unsightly
0	0%	Could be harmful to children
0	0%	I care about the environment
0	0%	Outdoor activities are less fun without trees/ want trees around
0	0%	Beetle kill trees are a fire hazard
0	0%	It has an effect on the economy
0	0%	It has a positive affect - I get firewood from it
1	4.8%	It has a negative affect - I have infested firewood
0	0%	It could make people not want to move down here
0	0%	DON'T KNOW
0	0%	REFUSE

32.How would you prefer to get future information about spruce beetle? (of 72)

23	32%	Newspaper	0	0%	Community/friend/rumor
0	0%	Public meetings	27	37.5%	Direct mail
6	8.3%	Radio	2	2.8%	Advertising
6	8.3%	Television	5	7%	Toll free line / get it myself
0	0%	Workplace	0	0%	All methods
3	4.2%	DON'T KNOW	0	0%	Already know what to do
0	0%	REFUSE	0	0%	Kenai Borough

KASILOF SURVEY RESULTS -18

8. Have you heard anything about the spruce beetle problem in Alaska?

14	77.8%	YES
4	22.2%	NO

9. Do you want to know anything about the spruce beetle problem? (of 4)

3	75%	YES
1	25%	NO

14. Is your home in an area that is infested? (of 14)

7	50%	YES	0	0%	DON'T KNOW
7	50%	NO	0	0%	REFUSE

15. Do you own land or a second home in an area that is infected with spruce beetle?

1	7.1%	YES	0	0%	DON'T KNOW
13	92.9%	NO	0	0%	REFUSE

16. Please tell me what you think is the most effective method you may have heard about for ***controlling*** the spread of spruce beetle.

2	14.3%	SPRAY PESTICIDES
4	28.6%	CUTTING & BURNING INFESTED TREES
1	7.1%	KEEPING HEALTHY TREES HEALTHY
0	0%	CUTTING TREES OVER 12 INCHES IN DIAMETER
0	0%	CLEAR AWAY FRESH CUT, FALLEN TREES
1	7.1%	USE ATTRACTANTS ON SPECIFIC TREES TO DRAW BEETLES AWAY
2	14.3%	HAVEN'T HEARD OF ANY
0	0%	CLEAR CUTTING
0	0%	LEAVE IT ALONE TO RUN ITS OWN COURSE
0	0%	PUT STERILE BUGS OUT
0	0%	CUT A FIRE LINE TO WIDE FOR THE BUGS TO CROSS/ CONTAIN THEM
0	0%	WHATEVER KILLS TO BEETLES IN OKAY
4	28.6%	DON'T KNOW
0	0%	REFUSE

17. If you knew about spruce beetles and methods for controlling beetle populations on your homesite or property, would you use them?

13	92.9%	YES	1	7.1%	DON'T KNOW
0	0%	NO	0	0%	REFUSE

18. Why not? (of 0)

0	0%	I won't use pesticides
0	0%	Don't want to cut tres on my property
0	0%	It doesn't affect me or my property
0	0%	I'll worry about it if it happens
0	0%	It should be left alone to run its course
0	0%	It would depend on the method
0	0%	DON'T KNOW
0	0%	REFUSE

19. If pesticides were available that killed only spruce beetle, would you use them where you live to control the infestation

7	50%	YES	2	14.3%	DON'T KNOW
5	35.7%	NO	0	0%	REFUSE

20. If pesticides were available that killed only spruce beetle, would you use it on your property, <u>other than where you live,</u> to control the infestation?

7	50%	YES	2	14.3%	DON'T KNOW
5	35.7%	NO	0	.0%	REFUSE

21. Would you support others use of pesticides to control spruce beetle even if you yourself did not need it?

8	57.1%	YES	0	0%	DON'T KNOW
8	42.9%	NO	0	.0%	REFUSE

22. Would you cut your mature trees if it would prevent the beetle from infesting your property?

7	50%	YES	3	21.4%	DON'T KNOW
4	28.6%	NO	0	0%	REFUSE

23. If you wanted to prevent beetle infestation or get rid of it, would you be willing to cut and salvage the wood and create access on your property ?

6	42.9%	YES	4	28.6%	DON'T KNOW
4	28.6%	NO	0	0%	REFUSE

24. On your property, would you rather take preventative measures or wait and see if your property is infested and then cut and salvage the infested trees?

9	64.3%	Take preventative measures
3	21.4%	Wait and see, then cut and salvage
0	0%	Don't do anything
0	0%	Periodic testing
0	0%	Already have problem / need help now
2	14.3%	DON'T KNOW
0	0%	REFUSE

25. On state or borough land, would you prefer they take preventative measures or wait and see if land is infested and then cut and salvage the infested trees?

10	71.4%	Take preventative measures
0	0%	Wait and see, then cut and salvage
1	7.1%	Don't do anything
0	0%	Periodic testing
0	0%	Depends on the cost
0	0%	Depends on degree of risk
3	21.4%	DON'T KNOW
0	0%	REFUSE

26. You'd prefer the government take preventative measures. Which measure would you ***<u>most</u>*** prefer? (of 10)

1	10%	Spray pesticides
2	20%	Cut and salvage already infested trees
1	10%	Work to keep susceptible trees healthy
0	0%	Cut trees over 12 inches in diameter
0	0%	Clear away and burn fresh cut or fallen trees
1	10%	Use attractants on specific trees to draw beetles away
0	0%	All of the methods
1	10%	All of the methods except pesticides
0	0%	Clear cutting
0	0%	Cut fire line wide enough to control the spread
0	0%	Whatever is proven effective
0	0%	Whatever is safest
0	0%	Do sample testing
0	0%	Keep the trees well watered
4	40%	DON'T KNOW
0	0%	REFUSE

27.How serious do you think the spruce beetle problem is? (of 14)

11	78.6%	Very serious	0	0%	DON'T KNOW
3	21.4%	Somewhat serious.	0	0%	REFUSE
0	0%	Not serious at all			

29.Do you feel the problem effects you directly?

9	64.3%	YES.	0	0%	DON'T KNOW
5	35.7%	NO.	0	0%	REFUSE

31.In what way does the problem affect you indirectly? (of 5)

1	20%	It could spread to the area where I own property
0	0%	It could spread to the area where I live
0	0%	It could affect my place of work or the work I do
0	0%	It makes the trees along the road unsightly
1	20%	Could be harmful to children
0	0%	I care about the environment
0	0%	Outdoor activities are less fun without trees/ want trees around
1	20%	Beetle kill trees are a fire hazard
0	0%	It has an effect on the economy
0	0%	It has a positive affect - I get firewood from it
1	20%	It has a negative affect - I have infested firewood
0	0%	It could make people not want to move down here
1	20%	DON'T KNOW
0	0%	REFUSE

32.How would you <u>prefer</u> to get future information about spruce beetle? (of 14)

3	21.4%	Newspaper	0	0%	Community/friend/rumor
1	7.1%	Public meetings	5	35.7%	Direct mail
1	7.1%	Radio	0	0%	Advertising
4	28.6%	Television	0	0%	Toll free line / get it myself
0	0%	Workplace	0	0%	All methods
0	0%	DON'T KNOW	0	0%	Already know what to do
0	0%	REFUSE	0	0%	Kenai Borough

8. Have you heard anything about the spruce beetle problem in Alaska?

3	100%	YES
0	0%	NO

9. Do you want to know anything about the spruce beetle problem? (of 0)

0	0%	YES
0	0%	NO

14. Is your home in an area that is infested? (of 3)

2	66.7%	YES	0	0%	DON'T KNOW
1	33.3%	NO	0	0%	REFUSE

15. Do you own land or a second home in an area that is infected with spruce beetle?

1	33.3%	YES	0	0%	DON'T KNOW
2	66.7%	NO	0	0%	REFUSE

16. Please tell me what you think is the most effective method you may have heard about for ***controlling*** the spread of spruce beetle.

1	33.3%	SPRAY PESTICIDES
0	0%	CUTTING & BURNING INFESTED TREES
0	0%	KEEPING HEALTHY TREES HEALTHY
0	0%	CUTTING TREES OVER 12 INCHES IN DIAMETER
1	33.3%	CLEAR AWAY FRESH CUT, FALLEN TREES
0	0%	USE ATTRACTANTS ON SPECIFIC TREES TO DRAW BEETLES AWAY
1	33.3%	HAVEN'T HEARD OF ANY
0	0%	CLEAR CUTTING
0	0%	LEAVE IT ALONE TO RUN ITS OWN COURSE
0	0%	PUT STERILE BUGS OUT
0	0%	CUT A FIRE LINE TO WIDE FOR THE BUGS TO CROSS/ CONTAIN THEM
0	0%	WHATEVER KILLS TO BEETLES IN OKAY
0	0%	DON'T KNOW
0	0%	REFUSE

17. If you knew about spruce beetles and methods for controlling beetle populations on your homesite or property, would you use them?

3	100%	YES	0	0%	DON'T KNOW
0	0%	NO	0	0%	REFUSE

18. Why not? (of 0)

0	0%	I won't use pesticides
0	0%	Don't want to cut tres on my property
0	0%	It doesn't affect me or my property
0	0%	I'll worry about it if it happens
0	0%	It should be left alone to run its course
0	0%	It would depend on the method
0	0%	DON'T KNOW
0	0%	REFUSE

19. If pesticides were available that killed only spruce beetle, would you use them where you live to control the infestation

3	100%	YES	0	0%	DON'T KNOW
0	0%	NO	0	0%	REFUSE

CHAPTER VII
SUMMARY OF RESULTS

In this chapter, the researcher will describe the results of the data collection. A comparision will be made between each of the three hypothesis described in Chapter VI and the actual result from the surveys. Following those hypotheses will be a discussion of other results from the survey, which the researcher determined to be of importance.

Hypothesis 1

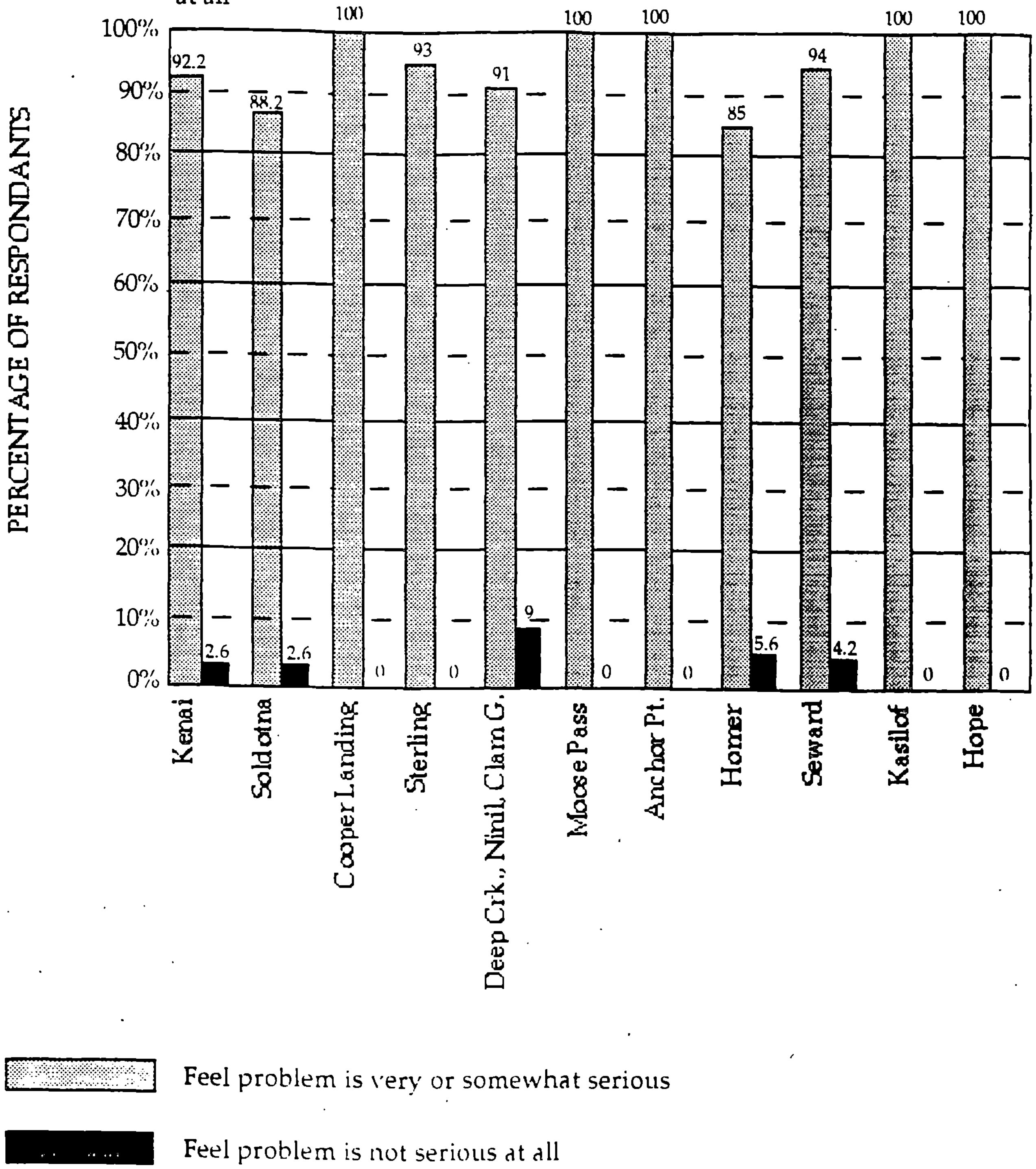
There is no significant difference in the attitudes of people in different areas toward the seriousness of the spruce beetle problem or in the impact they feel.

To address this hypothesis, the researcher included questions designed to determine where a person lived, how serious they thought the problem was and if they felt the problem affected them directly or indirectly, and if indirectly, to be more specific about how. These were questions 27 through 31.

Table 1A indicates respondant answers to question 27. Table 1B indicates respondant answers to question 28. Table 1C indicates respondant answers to question 29 & 30. Table 1D indicates respondant answers to question 31.

TABLE 1A

Do you think the problem is serious, somewhat serious or not serious at all



(Any missing percentage points can be attributed to "Don't know" or "Refuse" answers)

20. If pesticides were available that killed only spruce beetle, would you use it on your property, other than where you live, to control the infestation?

3	100%	YES	0	0%	DON'T KNOW
0	0%	NO	0	0%	REFUSE

21. Would you support others use of pesticides to control spruce beetle even if you yourself did not need it?

3	100%	YES	0	0%	DON'T KNOW
0	0%	NO	0	0%	REFUSE

22. Would you cut your mature trees if it would prevent the beetle from infesting your property?

2	66.7%	YES	0	0%	DON'T KNOW
1	33.3%	NO	0	0%	REFUSE

23. If you wanted to prevent beetle infestation or get rid of it, would you be willing to cut and salvage the wood and create access on your property ?

1	33.3%	YES	1	33.3%	DON'T KNOW
1	33.3%	NO	0	0%	REFUSE

24. On your property, would you rather take preventative measures or wait and see if your property is infested and then cut and salvage the infested trees?

3	100%	Take preventative measures
0	0%	Wait and see, then cut and salvage
0	0%	Don't do anything
0	0%	Periodic testing
0	0%	Already have problem / need help now
0	0%	DON'T KNOW
0	0%	REFUSE

25. On state or borough land, would you prefer they take preventative measures or wait and see if land is infested and then cut and salvage the infested trees?

2	66.7%	Take preventative measures
0	0%	Wait and see, then cut and salvage
0	0	Don't do anything
0	0%	Periodic testing
0	0%	Depends on the cost
0	0%	Depends on degree of risk
1	33.3%	DON'T KNOW
0	0%	REFUSE

26. You'd prefer the government take preventative measures. Which measure would you *most* prefer? (of 2)

1	50%	Spray pesticides
0	0%	Cut and salvage already infested trees
0	0%	Work to keep susceptible trees healthy
0	0%	Cut trees over 12 inches in diameter
0	0%	Clear away and burn fresh cut or fallen trees
0	0%	Use attractants on specific trees to draw beetles away
0	0%	All of the methods
0	0%	All of the methods except pesticides
0	0%	Clear cutting
0	0%	Cut fire line wide enough to control the spread
0	0%	Whatever is proven effective
0	0%	Whatever is safest
0	0%	Do sample testing
0	0%	Keep the trees well watered
1	50%	DON'T KNOW
0	0%	REFUSE

27.How serious do you think the spruce beetle problem is? (of 3)

3	100%	Very serious	0	0%	DON'T KNOW
0	0%	Somewhat serious.	0	0%	REFUSE
0	0%	Not serious at all			

29.Do you feel the problem effects you directly?

3	100%	YES.	0	0%	DON'T KNOW
0	0%	NO.	0	0%	REFUSE

31.In what way does the problem affect you indirectly? (of 0)

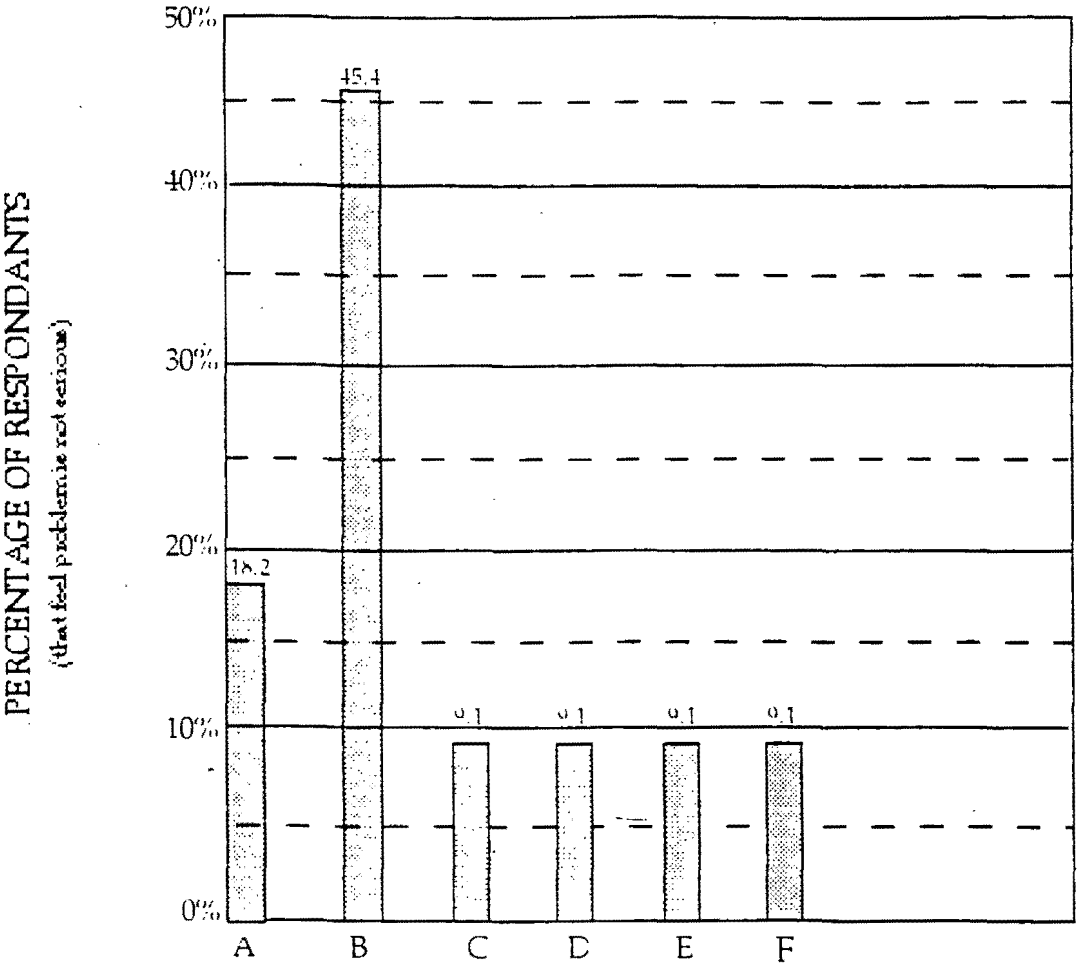
0	0%	It could spread to the area where I own property
0	0%	It could spread to the area where I live
0	0%	It could affect my place of work or the work I do
0	0%	It makes the trees along the road unsightly
0	0%	Could be harmful to children
0	0%	I care about the environment
0	0%	Outdoor activities are less fun without trees/ want trees around
0	0%	Beetle kill trees are a fire hazard
0	0%	It has an effect on the economy
0	0%	It has a positive affect - I get firewood from it
0	0%	It has a negative affect - I have infested firewood
0	0%	It could make people not want to move down here
0	0%	DON'T KNOW
0	0%	REFUSE

32.How would you prefer to get future information about spruce beetle? (of 3)

0	0%	Newspaper	0	0%	Community/friend/rumor
0	0%	Public meetings	2	66.7%	Direct mail
1	33.3%	Radio	0	0%	Advertising
0	0%	Television	0	0%	Toll free line / get it myself
0	0%	Workplace	0	0%	All methods
0	0%	DON'T KNOW	0	0%	Already know what to do
0	0%	REFUSE	0	0%	Kenai Borough

TABLE 1B

Why do you think the spruce beetle problem is not serious



A. It's blown out of proportion

B. I've had no personal contact with it

C. It hasn't surpassed previous levels

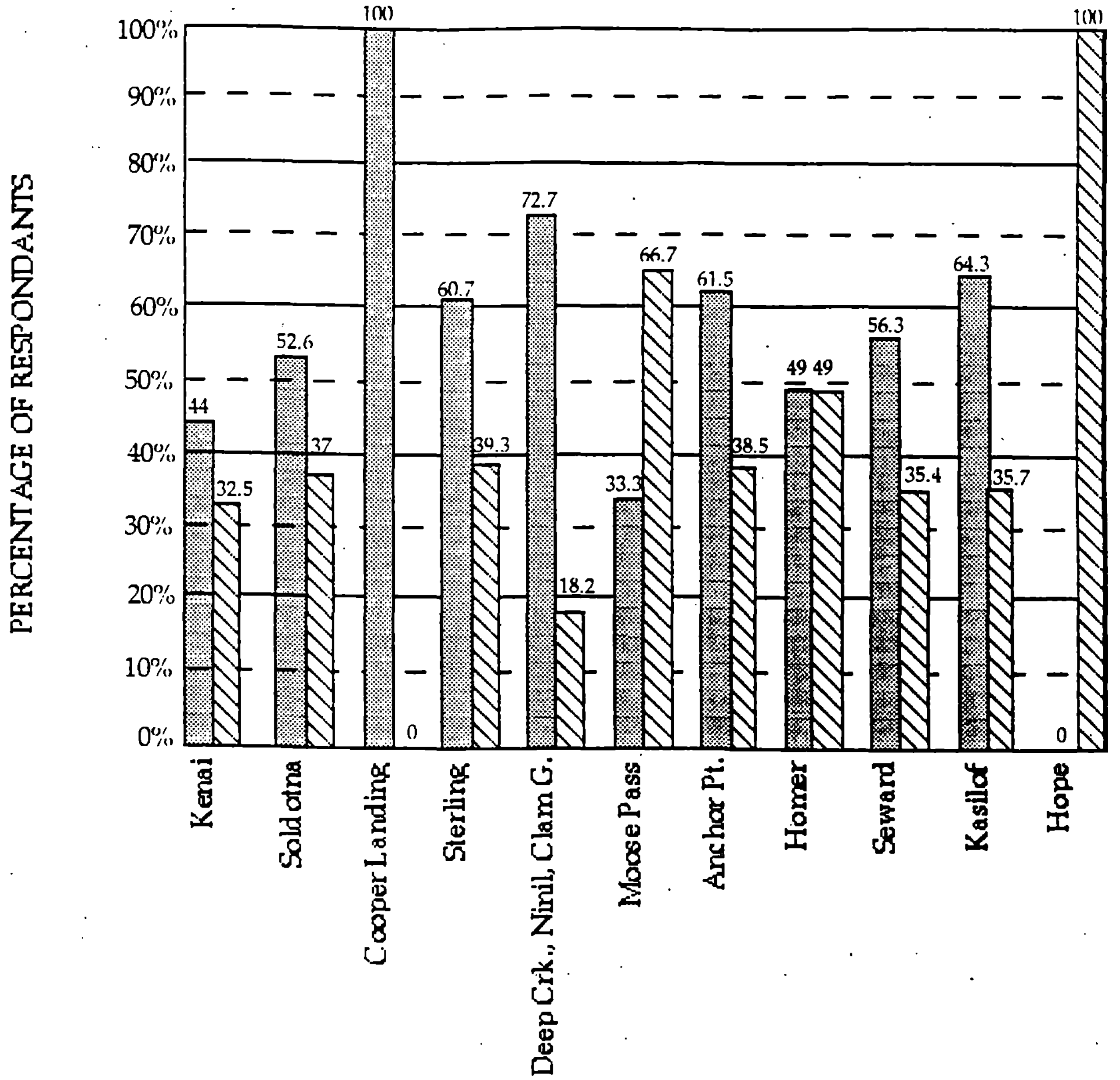
D. Let nature take it's course

E. People can control it themselves

F. Don't know

TABLE 1C

Does the problem affect you directly or indirectly



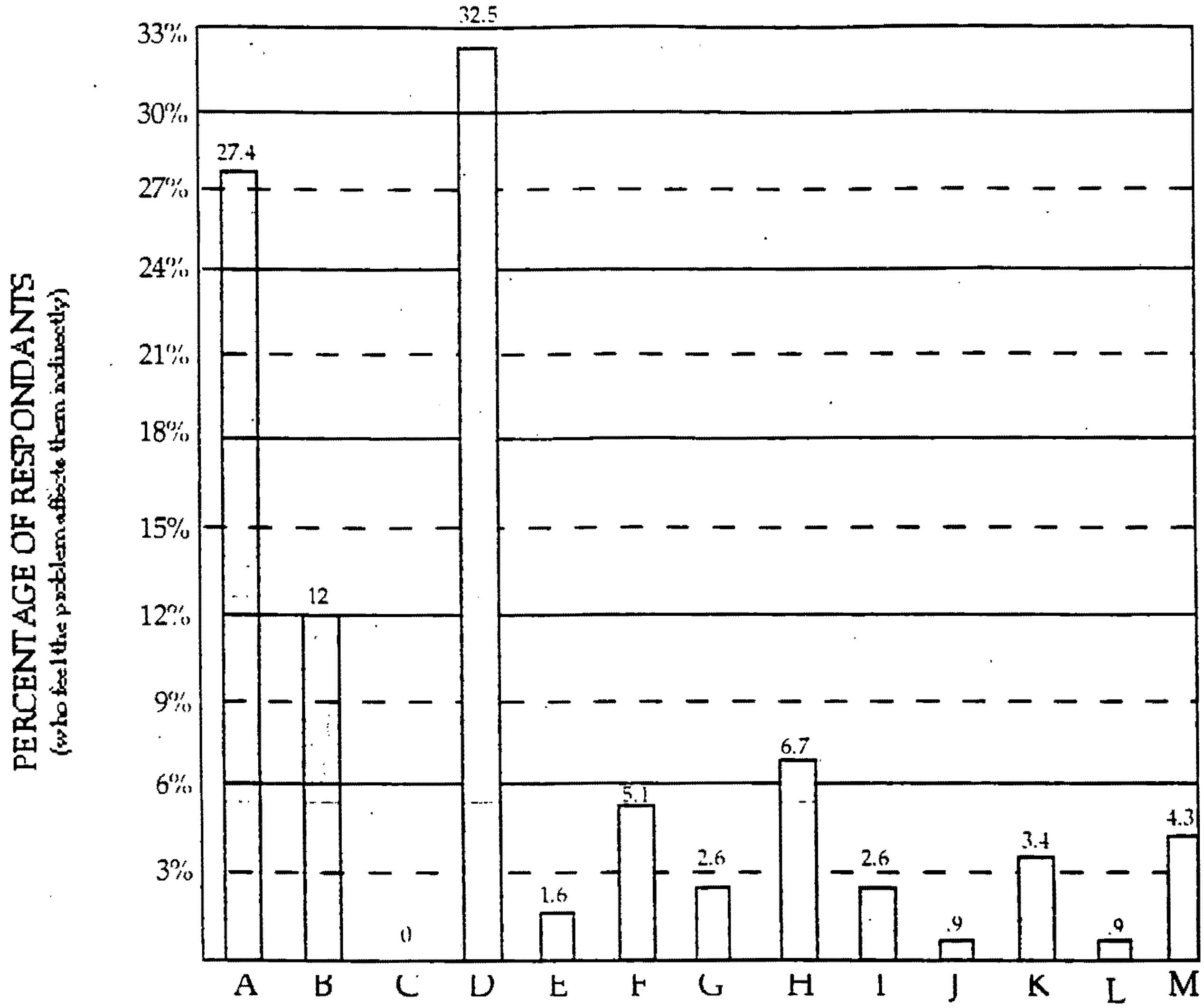
Feel problem affects them directly

Feel problem affects them indirectly

(Any missing percentage points can be attributed to "Don't know" or "Refuse" answers)

TABLE 1D

How does the problem affect you indirectly



A. It could spread to where I own property
B. It could spread to where I live
C. It could affect my place of work or the work I do
D. It makes the trees unsightly
E. It could be harmful to children
F. I care about the environment
G. Outdoor activities are less fun with no trees / want trees around
H. It's a fire hazard
I. It affects the economy
J. It has a positive effect - get firewood from beetle kill trees
K. It has a negative effect - infested firewood
L. It could make people not want to move down here
M. Don't know

Tables 1A, B, C & D indicate the level of concern and involvement respondants have with the spruce beetle problem. 91% of those surveyed, in all areas, feel the problem is very or somewhat serious. Table 1A clearly indicates that in no community do less than 85% of the residents feel the problem is serious. Very few, in no case more than 9%, feel the problem is not serious at all and that is primarily because they have not had any personal experience with it.

55% feel the problem affects them directly and of the 43.4% who feel it affects them only indirectly, most (32.5%) say it's because it makes the trees unsightly. Another 39.3% (a combination of two answers) are afraid it could spread to where they live or where they own property.

Hypothesis 2

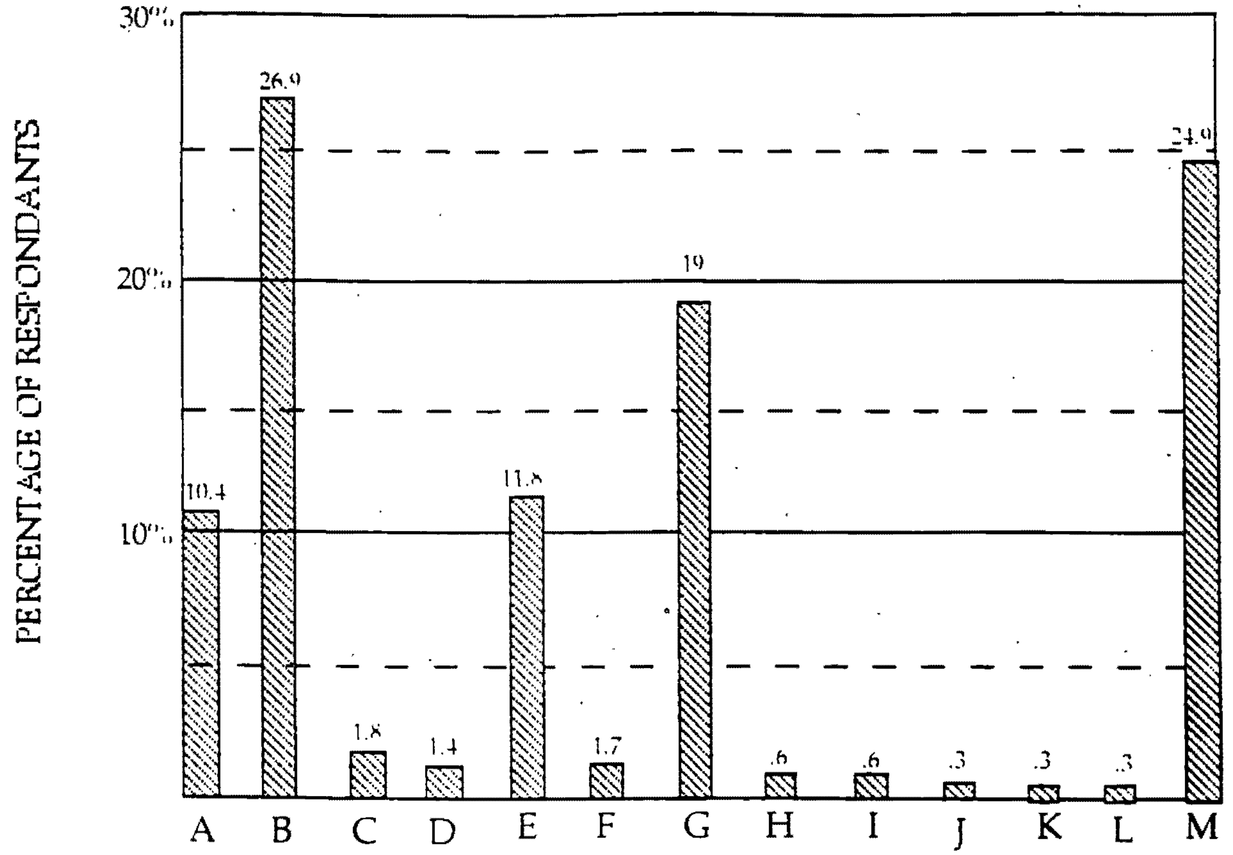
There is no statistical difference in the preference of the respondants for or against using pesticides at home as a method of beetle control, for or against using pesticides on other property, for or against people other than themselves using pesticides, for or against cutting mature trees as a method of prevention or for or against cutting and salvaging trees and creating access. There is also no significant preference about the use of preventative measures or reactive measures of control and no significant preference regarding which preventative measures are taken.

To address this hypothesis, the researcher included questions designed to determine each respondants current level of knowledge about available methods of beetle control, their preference for taking preventative measures or waiting for infestation before dealing with the beetle and their preference of control method when given a list of choices. The questions which addressed these issues are 16 and 19 through 26.

Table 2A indicates respondant answers to question 16. Table 2B indicates respondant answers to question 19. Table 2C indicates respondant answers to question 20. Table 2D indicates respondant answers to question 21. Table 2E indicates respondant answers to question 22. Table 2F indicates respondant answers to question 23. Table 2G indicates respondant answers to questions 24, 25 & 26

TABLE 2A

What is the most effective method you've heard of for controlling the beetle



A. Spray pesticides
B. Cutting and burning infested trees
C. Keeping healthy trees healthy
D. Cutting trees over 12 inches in diameter
E. Clear away fresh cut or fallen trees before they get infested
F. Use attractants on trees to draw beetles away - then dispose of tree
G. Haven't heard of any methods
H. Clear cutting
I. Leave it alone to run its own course
J. Put sterile bugs out
K. Cut fire line too wide for bugs to cross / contain them
L. Whatever kills the beetles is okay
M. Don't know

TABLE 2B

If pesticides were available that killed only spruce beetle would you use them where you live to control infestation

	YES	NO	DON'T KNOW
Actual frequency	255	39	50
Expected frequency	115.33	115.33	115.33

The null hypothesis is rejected at better than the .05 level of significance

TABLE 2C

If pesticides were available that killed only spruce beetle would you use them other than where you live to control infestation

	YES	NO	DON'T KNOW
Actual frequency	249	43	50
Expected frequency	115.33	115.33	115.33

The null hypothesis is rejected at better than the .05 level of significance

TABLE 2D

Would you support others using pesticides even if you did not need them.

	YES	NO	DON'T KNOW
Actual frequency	251	45	49
Expected frequency	115.33	115.33	115.33

The null hypothesis is rejected at better than the .05 level of significance

TABLE 2E

Would you cut your mature trees (over 12 inches) before you had the beetle if it would prevent infestation

	YES	NO	DON'T KNOW
Actual frequency	173	103.	67
Expected frequency	115.33	115.33	115.33

The null hypothesis is rejected at better than the .05 level of significance

TABLE 2F

Would you cut and salvage trees even if it meant creating access on your property

	YES	NO	DON'T KNOW
Actual frequency	194	73	76
Expected frequency	115.33	115.33	115.33

<u>The null hypothesis is rejected at better than the .05 level of significance</u>

TABLE 2G

On your property would you rather take preventative measures or wait and see?

70.5%	Take preventative measures
18.5%	Wait and see, then cut and salvage
4%	Don't do anything
.3%	Do periodic testing
.3%	Already have the problem / need help now
5.8%	Don't know

On state or borough property, would you rather they take preventative measures or wait and see?

78.3%	Take preventative measures
10.1%	Wait and see, then cut and salvage
2%	Don't do anything
.3%	Periodic testing
.3%	Depends on the cost
.3%	Depends on the degree of risk
8.4%	Don't know

You want the government to take preventative measures. Which do you prefer?

22.9%	Spray pesticides
13.9%	Cut and salvage already infested trees
2.9%	Keep healthy trees healthy
2.5%	Cut mature trees
11.9%	Clear away and burn fresh cut and fallen trees
3.6%	Use attractants on a specific tree and then dispose of that tree
11.4%	All of the methods
1.4%	All methods except pesticides
.4%	Clear cutting
.4%	Cut wide enough fire line to contain spread
1.1%	Which ever is proven effective
.7%	Which ever is safest
.4%	Do sample testing
.4%	Keep trees well watered
25.8%	Don't know

Tables 2A through 2G make it clear that most respondants do have a preference of control methods. 70.5% would rather take preventative measures on their own property rather than wait to see if they get infested before taking action, while on state or borough lands, 78.3% would prefer the government take preventative measures rather than wait and see. This result should indicate to the Division of Forestry that the public would rather keep public lands from ever becoming infested. It could be taken as a sanction to take appropriate action to curb the problem.

When asked questions about types of control methods like using pesticides, cutting mature trees or cutting and salvaging trees which would require creating access, the majority picked the use of pesticides. When combining the answers from questions 19, 20 and 21, 73% of the respondents supported the use of pesticides. 50.6% preferred cutting mature trees and 56% preferred to cut and salvage, even if it meant creating access. Of the 78.3% that preferred the government use preventative measures on state or borough lands, again the majority (22.9%) supported the use of pesticides, 13.9% said cut and salvage already infested trees, 11.9% said clear away fallen trees, and 11.4 said use a combination of all methods available.

These results make it clear that the Division of Forestry's anticipation of a negative reaction to pesticides was not born out; the majority support their use. However, a large and significant percentage of those asked also answered "don't know." This would indicate that a further breakdown of these results by area would be necessary to conclude if there really was a significant amount of resistance to pesticide use. It also indicates that while many people are aware of the problem, they don't know what to do about it.

Hypothesis 3

There is no significant difference in the preference among respondants about how they receive future educational information about spruce beetle control methods.

To discover any preferences, it was necessary for the researcher to determine how respondants *currently* received local news and information, as well as how they would prefer to get spruce beetle information in the future and from whom. Without detailing the specific questions or breaking down the answers by area , the results to questions 32 through 35, 38 & 39 were as indicated in Tables 3A to 3E.

TABLE 3A

How would you prefer to get information about dealing with the beetle?

28.3% Newspaper
6.1% Public meetings
4.6% Radio
12.1% Television
.3% Workplace
0% Community grapevine / friend / rumor
40.5% Direct mail
1.2% Advertising
2.6% A toll free information line to call / I'll find the information myself
1.4% All methods should be used
.3% Don't need info. I already know what to do
.3% Borough
2% Don't know

TABLE 3B

What government agency would you trust most to have accurate information about the problem?

- 15% U.S. Forest Service
- 55% State Division of Forestry / Dept. of Natural Resources
- 1.2% Dept. of Fish an Game
- 1.7% Division of Agriculture
- 1.2% U.S. Fish and Wildlife
- 1.2% Cooperative Extension Service
- 2% Bureau of Land Management
- .3% Soil Conservation Service
- 5.2% Any of the above would be okay
- .3% State Division of Parks and Recreation
- 3.2% None of the above / don't trust any government agency
- .6% A combination of resources
- .6% Hire an expert
- .9% Dept. of Environmental Conservation
- .9% Kenai Borough
- 10.7% Don't know

TABLE 3C

What paper do you read?

- 47.4% Anchorage Daily News
- 14.4% Anchorage Times
- 26.3% Peninsula Clarion
- 7% Homer News
- 1.4% Seward Pheonix Log
- 1.2% Don't read a paper
- 1.4% Don't know

TABLE 3D

What television station do you watch for local news?

- 17% KIMO Channel 13
- 41% KTUU channel 2
- 8.7% KTVA Channel 11
- 2% KAKM Public television
- 17% Don't watch T.V. for local news or only watch cable
- 7% RATNET
- 6.6% Don't know

TABLE 3E

What radio station do you listen to most often? (Only those with 5 responses or more were listed)

23.1%	KSRM	2.9%	KCSY
12.4%	KBBI	2.3%	KYAK
6.4%	KGTL	2.3%	KSKA
5.5%	KRXA	1.7%	KCZP
4.6%	KWVV	1.7%	KENI
4%	KPEN	22.8%	DON'T KNOW
3.2%	KWHQ		

What radio station do you listen to 2nd most often? (Only those with 5 responses or more were listed)

10.1%	KSRM	2.6%	KRXA
5%	KFQD	2.6%	KZXX
5%	KGTL	1.7%	KBBI
4%	KCSY	1.7%	KSKA
3.5%	KWVV	1.4%	KYAK
3.2%	KWHQ	1.4%	KENI
3%	KPEN	49%	DON'T KNOW

The results listed in Tables 3A through 3B indicate that 97.7% of the respondants do have a preference about getting future information. Most (40.5%), would like to get their information from a direct mail piece and 55% would prefer to get it from the Alaska Division of Forestry. Should other methods be used to distribute educational information, Tables 3C through 3E indicate it would be most effective if disseminated through a combination of the Anchorage Daily News (47.4%) and the Peninsula Clarion (26.3%), KTUU television news (41%) and KSRM radio news (23.1%).

CHAPTER VIII
CONCLUSIONS AND RECOMMENDATIONS

The purpose of this project was to determine the level of public knowledge and concern about spruce beetle, as well as knowledge about related control problems, and to create a plan to increase that knowledge.

The main objective was to survey a selected portion of the public about what they knew, or believed to be true, about the problem and then use the information to better educate the people of the Peninsula about current, effective control methods. Secondly, the project was designed to determine the most effective method of educating the public. Thirdly, it was an objective of this project to use this information to create a public education campaign for the Alaska Division of Forestry.

At the start of the project, the researcher developed three null hypotheses: 1) that there was no difference in the attitudes of people in different areas toward the spruce beetle problem, 2) that there was no preference among these same people for or against any particular method of beetle control and, 3) that there was no preference among these people about how they received future educational information about spruce beetle and control methods.

This chapter presents an interpretation and discussion of the findings of the survey as well as the detailed public relations and education plan called for in the objectives.

Conclusions

There has been a considerable amount of information already given to the public concerning the spruce beetle and it was expected that most would be aware of the problem. Newspapers, and television stations have given extensive coverage to the problem as it reached epidemic proportions in Cooper Landing, and various government agencies have distributed information. As a result, the researcher did not expect that such a large percentage, about 13% of the people surveyed, would have never even heard about the problem.

Of the three hypotheses developed, the first predicted there would be no difference in attitude between people in different areas toward the spruce beetle problem. This hypothesis was proven wrong. 82% of those people in areas already affected by the beetle (Moose Pass, Cooper Landing & Sterling) felt the problem was very or somewhat serious. 64.4% in those in areas only slightly affected or about to be affected (Kenai, Soldotna, Ninilchik, Deep Creek, Clam Gulch and Kasilof) felt the problem was very or somewhat serious. 64% of those in unaffected areas (Anchorage Point, Homer, Seward) felt the problem was very or somewhat serious.

These findings indicate that those people already affected know how serious the problem is and are likely to be open to suggestions about control methods (where it's still possible) because they are concerned. Those in unaffected areas are less concerned and are likely to be more difficult to educate and motivate to take action. Considering the difficulty interviewers had in finding willing respondants in the Seward and Homer areas, the researcher was surprised to find the level of concern there virtually the same as in the Kenai/Soldotna area. One would think that if they were concerned, they would be as willing, if not eager, to participate.

The second hypothesis predicted no statistical difference in the preference of these people for or against any method of spruce beetle control. The results showed that was also not true. There was significant support for the use of preventative measures of control, as opposed to waiting until infestation had already occurred. When asked what they would prefer to do on their own property, 70% said take preventative measures, while 23% said wait and see or don't do anything.

When asked what they would prefer the government to do on state or borough land, 79% said take preventative measures while 12.6% said wait and see or don't do anything. 23.3% of those asked to be specific about which preventative measures they would prefer the government take said pesticides, while 23.3% didn't know, 14.1% supported cut and salvage methods, 11.6% preferred clearing away deadfall or slash and 10.7% wanted the government to use every method at their disposal.

While the Division of Forestry felt there might be public concern about the use of pesticides, the survey did not find that indicated. 73.3% said they would use pesticides where they live, 72.6% said they would use pesticides on property other than where they live and 72.9% said they support others using pesticides even if they did not need them. This would indicate that, as a whole, there is general support for the use of pesticides although, a breakdown by specific community would help pinpoint areas where there is a vocal minority that is opposed.

52% of those surveyed said they would cut down the larger, more mature trees on their property before the beetle got there, in order to prevent the spread of the beetle. However, 46.5 % said they would not cut these trees before infestation or that they didn't know what they'd do. This indicates that there is a significant enough amount of resistance to cutting down large, healthy trees as a method of prevention, that this should only be a suggestion, not a "must do."

There was also a statistically significant difference between the number of people who <u>would</u> cut and salvage wood on their property including the creation of access and those who weren't sure or said no. 55.4% said yes, and 43% said no or I don't know. This indicates that while most people don't mind cutting and salvaging wood, a significant portion of them <u>would</u> mind creating roads or other access on their property to do so.

The third hypothesis predicted that there would be no significant difference in the respondants preference for how they received future information about spruce beetle control methods. This also proved to be wrong. A majority, 40.4% indicated they would prefer direct mail, 27.4% prefer getting information through the newspaper, 11.3% prefer television, 6.2% prefer public meetings and 4.5% prefer radio. This indicates that most people prefer that they receive information through the mail or via the news media, methods which require little effort on their part.

Formal recommendations

This survey has made it very clear that the people of the Kenai Peninsula and surrounding area, are concerned about the spruce beetle problem and do have opinion about its control. It is necessary for not only the state Division of Forestry to take action on this problem, but for the people themselves to get involved in protecting thousands of acres of privately owned property.

In order to get people involved in an appropriate and constructive way, they must be educated. The survey has proven that there are a significant percentage of people who should know about the beetle problem who don't and of those who do know, many have no idea what control methods are available or which are most effective.

Therefore, this researcher feels it is necessary to conduct a thorough public relations and education plan designed to reach every corner of the Kenai Peninsula. What follows is a recommended public relations and advertising plan for the education of the peninsula, based on the results of this survey. It is assumed that, should the Division of Forestry decide to follow the plan, it will be implemented during the summer of 1991. No costs are included as this researcher has no information on the amount of money available for such work.

Media relations.

The Division of Forestry and the selected public relations firm should determine the potential hard news, feature and business stories related to the spruce beetle problem. The survey makes it very clear which media are preferred in each area and should make designing a story placement strategy very simple.

A plan should be devised to spread those stories out throughout the late spring, summer and early fall depending on when the story is most naturally expected to occur. For instance, if spruce beetle were known to breed most heavily in the late spring, that would be the most appropriate time to place a feature story concerning that subject. Both parties should plan for time to gather information pertinent to each story and for at least two proofs of each release prior to dissemination.

One of the first stories could potentially be the announcement of this public education campaign during a press conference at the Division of Forestry. It would be a good time to let the press know whom they can contact for scientific information and to provide them with a list of story ideas which they would be free to pursue at any time. Those stories which would be better released at a later date should be withheld.

A request could be made to all media outlets to make room for a regular newpaper column, nightly T.V. blurb or radio broadcast about spruce beetle control. Many newspapers run regular columns on other subjects, like "Earth First," which concerns environmental issues. They, as well as the other media, should be asked to include such a focus piece everyday or once a week, providing a news outlet for spruce beetle control information. The articles could be prepared by the Division of Forestry or the public relations firm.

Talk shows are always an easy way to get information across the airwaves to many people. There are a number of talk shows in Anchorage and on the peninsula where requests should be made for time.

Direct Mail.

A direct mail piece should be designed to convey information to the public in each area. Depending on budget contraints, this could be a series of direct mail pieces distributed to blanket the peninsula or a few specially designed pieces aimed at the unique interests of the population in each area as determined by the survey. For instance, Homer is not sufficiently in favor of using pesticides as a method of control (57%) to make it worth the potential opposition and a greater percentage favor cutting and burning infested trees or using attractants. A direct mail piece on available pesticides would not be appropriate nor appreciated, but one concerning other methods is likely to be more effective.

Toll free information line.

Only .03% of the people surveyed said they would gather information on their own if they wanted it, however, a few suggested that an information line would be helpful. From a public relations standpoint, this could be a very effective tool for conveying information, would not necessarily require a living person to answer questions and would be convenient for the public. The phone number would be included in every news story, on every direct mail piece and in every advertisement.

The information could be as simple as phone numbers of people or departments capable of answering specific questions. However, this would be the last choice since many people get upset about calling a machine only to get a message telling them to make yet another call. Another possibility, would be providing a different helpful hint on dealing with spruce beetle every day. This too has drawbacks because the hint may not give the caller anything close to what he or she wants.

The best alternative is to have several forestry people capable of answering most spruce beetle questions and rotate the responsibility between them on a daily or weekly basis. During the busiest season for Forestry, the line could be handled by the public relations firm while allowing for in depth scientific questions to be referred back to Forestry.

Instructional classes.

During many phases of this project, the Division of Forestry will be asking people to do things they may not know how to do; apply pesticides, use an attractant tree, store already infested wood for future burning, or keep healthy trees healthy enough to repel the beetle. If there were a person available, it would be advisable to plan a schedule of town meetings in concerned areas and teach interested persons appropriate control methods.

Advertising.

Advertising, although second to news stories, is an effective way to catch the eye of the public. Especially when it's advertising made to look like a news story. It is critical that the public relations firm involved also be an advertising firm, because the coordination and timing of each cog is important to the effectiveness of the whole. If a news story is going to stress the use of pesticides and their effectiveness, it might be worthwhile to conduct instructional classes in how to apply it safely, and they should be held and advertised at the same time the news story is published.

Speakers bureau.

One of the simplest ways to convey information to people is when they are already gathered in large groups. Rotary Clubs, Chambers of Commerce, Petroleum Clubs, fraternal organizations and other groups provide easy ways to convey information to a larger number of people on a personal basis. The timing of these is not as crucial as other parts of the plan, primarily because getting on the agenda must be done several months in advance when it's impossible to know what will be in the works regarding the spruce beetle project. However, the speech given can be adjusted at the very last moment, alleviating that concern.

Recommendations for further research

It is the recommendation of this researcher that a public relations education campaign based on the enclosed survey results be implemented. However, it is further recommended that an evaluation similar to that conducted for this study, be conducted again after the educational plan has been concluded. This is necessary to determine the effectiveness of the plan, as well as to determine if public opinion has changed at all concerning the beetle problem and proposed solutions.

It would also be useful to compile some sort of information about the impact further education has had on controlling the beetle population. Has there been any difference in the spread of the beetle, now that the help and participation of the general public has been enlisted? This researcher feels that acquiring this information, however, would require a great deal of technical knowledge. and, therefore would be better conducted by forestry professionals, than by the public relations professionals who conducted the education campaign.

Forest Health Management Plan

for the

Western Kenai Peninsula and Kalgin Island

State of Alaska
Department of Natural Resources
Division of Forestry

Alaska Department of
NATURAL
RESOURCES

Forest Health Management Plan for the Western Kenai Peninsula and Kalgin Island

October 1992

This plan was prepared by the
Department of Natural Resources, Division of Forestry

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Executive Summary

Spruce bark beetles have killed trees on more than 700,000 acres of the Kenai Peninsula since 1970. This is about 35 percent of all forested land on the peninsula. What to do about this infestation has become a prominent management issue for state government. It is also an important issue to the public, which is concerned about the threat of fire, less attractive views, loss of privacy screening, loss of timber resources, and impacts of prevention and suppression treatments.

In response to these concerns, the Alaska State Legislature appropriated $450,000 to the Division of Forestry in July, 1991 to develop a "forest pest infestation management plan." DOF is the lead agency on this project, charged with the responsibility of addressing forest health statewide. In August, 1991, Pete Buist was named Project Manager for DOF. The division is beginning on the western Kenai Peninsula, but intends to expand the effort to other forests in the state where insects pose a threat to management objectives.

Recognizing that pest problems are often a symptom of poor forest health, the division embarked upon a program to encourage the care and management of forests as a means of preventing and suppressing infestations. The term "healthy forest" means different things to different people. Whether or not a forest is considered "healthy" depends upon the management objectives for that forest. In the context of this plan, the Division of Forestry considers good forest health to be "a condition in which influences on the forest do not threaten management objectives for a given forest unit now or in the future."

This plan provides practical information that allows the public and land managers to cooperate effectively in making forest health management decisions. It presents management strategies that deal with issues important to the public while allowing forest owners and managers to better achieve their objectives.

The plan is part science, part art and part politics. The science gives us the ability to develop technical alternatives. The public and land managers will direct us in where, when and how those alternatives may be best used. Our goal is to implement a technically sound plan that citizens can accept.

Readers should bear in mind that spruce bark beetles cannot be eradicated over extensive areas by any known method, but management and control may be practical in limited high value forested areas.

It is clear that recommended actions must be cost-effective if they are to be implemented. Accessible, high value forests on the Kenai Peninsula can be treated. However, there are large areas that are not accessible or where treatment is not cost-effective. Sale of timber and other by-products, where markets exist or can be developed will help make treatments and reforestation feasible in more areas. It is also important that actions be taken with an eye to the future and to providing for the long-term health and productivity of the forest.

In crafting this plan, economic feasibility and the technology available to us have been considered. Survey and inventory information has been assembled. The public has been involved in this process and representatives of the public, interest groups, agencies and landowners have identified 20 important issues that need to be addressed.

Specific recommendations for enhancing forest health within the planning area fall under the following general categories:

- Continued support and funding of programs that promote forest health.
- Specific spruce beetle treatments, in the context of land status and statutory responsibilities and constraints.
- Timber harvest and the economic feasibility of various choices. Considerations include finding new markets, forging cooperative agreements between landowners, and drafting regulations for emergency salvage timber sales.
- Cost-effective reforestation.
- Research and information needs, such as continued survey and mapping, timber studies, and research on fire intensities in beetle-killed spruce.
- Finally, recommendations are included that reflect the division's commitment to implementing the plan in ways acceptable to the public.

With the development of markets, good planning, an effective public participation program and progressive forest management techniques, we can begin to restore Kenai Peninsula forests to a healthy condition. Healthy forests will be better able to fend off infestations and provide for a wide range of activities and objectives. This plan and its recommendations are a beginning.

Public Participation

The Division of Forestry began work on the Forest Health Initiative with a dedication to involve the public in the project. The public involvement process was modeled after one recently used by the Forest Service in the Cooper Landing area. Some of the principles of public participation important to the division are:

1. The planning process is a cooperative effort between agencies and the public.
2. The planning process must be fair to all, and all points of view must be considered and evaluated. Foresters, entomologists and economists don't have a monopoly on solutions. Anyone might hold key parts to the puzzle.
3. If the public feels that decisions are made without their involvement, they may not support the plan, even if it is scientifically defensible.
4. Agency officials should convey consistent messages when communicating with the public. Communication techniques must contribute to and support the messages.
5. Issues raised early in the process have a better chance of being resolved than those raised later.
6. Personal contacts need to be made with key opinion leaders so they will be informed about the process and not surprised by projects or proposals.
7. The public participation process is part of the product. Building credibility for the Division of Forestry and other cooperators is critical for success.

As the lead agency, DOF took a number of steps to involve the public and other agencies in a cooperative planning effort, including the establishment of the following three groups to provide input and guidance.

Planning Team

The Planning Team includes Division of Forestry and U.S. Forest Service staff with expertise in forestry, entomology, geographic information systems, resource management and public information. The State Forester, his deputies and the Chief of Fire Management have made their expertise available when needed. The group discussed project procedures, the public process, geographic boundaries and technical aspects of forest and pest management.

Policy Group

The Policy group consists of the major landowners and managers within the planning area. Members are generally those with the authority to choose which options and recommendations (if any) to implement on land they own or manage. Members are:

Bob Dick, Department of Natural Resources, State Forester

Daniel Doshier, Kenai National Wildlife Refuge Manager

Marty Epstein, University of Alaska Land Management Director

Don Gilman, Kenai Peninsula Borough Mayor

Carl Marrs, Cook Inlet Region, Inc., Senior Vice-President

Bruce Oskolkoff, Ninilchik Native Association President

The Policy Group met in January, 1992 and endorsed the approach and public participation process proposed by the Planning Team. Members regularly receive information on the progress of the Working Group and the public process.

Working Group

The Working Group was given the tasks of defining the boundaries of the planning area and identifying the issues that need to be addressed. The group received information on spruce beetles, history of the infestation, land ownership, fire behavior, and measures that can and have been taken to prevent and suppress the infestation. The Working Group met first in late February, 1992 and almost every other week through May.

Members of the Working Group and agencies and organizations on whose behalf they attended:

- Daniel Doshier, U.S. Fish and Wildlife Service, Kenai National Wildlife Refuge
- Cliff Eames, Alaska Center for the Environment, environmental groups
- Mike Franger, Cook Inlet Region, Inc., Native corporation landowners
- Dan Golden, Department of Commerce and Economic Development
- Nancy Hillstrand, private citizens, Homer area
- John Mohorcich, Kenai Peninsula Borough
- Drew Pesnell, Klukwan Forest Products, industrial foresters
- Jim Peterson, Division of Forestry, Kenai-Kodiak Area Office
- Representative Gail Phillips, Alaska State Legislature
- Carl Propes, University of Alaska, Office of Statewide Land Management
- Ted Spraker, Alaska Department of Fish and Game, Division of Wildlife Conservation
- Mike Swan, private, small parcel landowners (Steve Gibson, Homer, proxy)
- Chris Titus, Division of Parks and Outdoor Recreation, Kenai Area Office
- Michael Wiedmer, Alaska Department of Fish and Game, Habitat Division

In addition, Gene Lessard and Warren Oja, of the U.S. Forest Service, participated in Working Group meetings and provided technical assistance and information.

Working Group meetings were advertised and open to the public and a comment period for members of the public was included in the agenda of each meeting. Members of the public and other agencies who attended were inviteded to participate in discussions. The Working Group will continue to meet and discuss the details of implementation of this plan.

Open Houses

Informal open houses were held to allow those who were not able to attend the weekday Working Group meetings to participate in the discussions. Open houses were held in Anchorage, Homer, Soldotna and Ninilchik. Members of the Planning Team and Working Group were present to discuss planning efforts. Displays, written information and videos on spruce bark beetles and forest health were shared.

Survey of Public Opinion

In 1991 the Division of Forestry asked the University of Alaska Anchorage, Institute of Social and Economic Research to survey public opinion on managing spruce bark beetles. ISER's study, entitled, *Developing a Public Consensus on the Management of Spruce Bark Beetles on the Kenai Peninsula* includes a survey of 400 peninsula households and 100 Anchorage households.

Nearly 90 percent of those surveyed said that dead or dying spruce trees are the most serious problem with forests on the Kenai Peninsula. Respondents said that the chief problems caused by beetle-killed trees were (1) less attractive views, (2) fire threat, and (3) loss of privacy. Other problems cited were large areas affected, loss of timber and declining property values.

The survey asked how the state should manage infested spruce near homes, along highways, in campgrounds and in the backcountry.

Please note that a shortcoming of this, and similar surveys, is that respondents were asked to choose from a given set of options. Some options that **might** be viable in Alaska have no data to support their effectiveness, so were not given as options.

Following is a summary of the responses:

- About three out of four respondents want the state to cut and remove dead trees near homes.
- More than half want the state to plant new trees near homes and either scrape the ground or use fabric mats to discourage grass from choking seedlings.
- Fewer than one-quarter support the use of chemicals near homes to kill grasses that could choke newly planted trees.
- Two-thirds of peninsula residents and more than half of Anchorage residents want the state to cut and burn beetle-killed trees along the highways and plant new trees.
- A substantial minority—40 percent in Anchorage and nearly 30 percent on the peninsula—think the state should do nothing about beetle-killed trees along highways.
- More than half want the state to thin infested trees in campgrounds.
- Nearly 40 percent favor protecting selected trees in campgrounds by spraying them with insecticides.
- Two-thirds of Kenai Peninsula homeowners with dead or dying trees on their own property think that the state should encourage them to save selected trees by spraying an insecticide.
- Southcentral residents are almost evenly split in their opinions about what the state should do about beetle-killed trees in the backcountry; roughly half say the state should do nothing, and almost half want the state to cut and burn dead trees and plant new ones.

A summary of survey results is available from the Division of Forestry and the complete report is available from ISER.

Planning Area

Boundary

The Working Group identified the planning area as the Kenai Peninsula west of the Chugach National Forest and Kenai Fjords National Park, and Kalgin Island. The area is more than 125 miles long from north to south and more than 60 miles wide at its widest point. It covers some 3.2 million acres. A map showing the planning area is on page 27.

Topography and Vegetation

The Kenai Mountains and glaciers, running north and south, roughly define the eastern boundary of the planning area. It ranges from sea level to more than 6,000 feet. Timberline averages about 1,800 feet. The division estimates that about half of the Kenai Peninsula is forested land.

General vegetation classes are 1) coastal forests dominated by dense stands of Sitka spruce; 2) lowlands and hills with stands of white spruce, black spruce, hemlock, birch, alder, aspen and willow; 3) alpine tundra consisting of lichens and dwarf shrubs, with some taller shrubs, primarily willow and alder. The Kenai Peninsula is one of the few areas where the Lutz spruce, a white/Sitka spruce hybrid, is found. Some foresters believe the infestation could seriously impact the gene pool of Lutz spruce.

Land Ownership

The planning area includes land owned by thousands of small private landowners, four Native corporations, the federal government, state land managed by the departments of Natural Resources and Fish and Game, the Kenai Peninsula Borough and the University of Alaska. A significant amount of land is also involved in the Mental Health Trust Land litigation. Because of the patchwork of land ownerships and management objectives, cooperation among agencies and landowners is crucial.

Kenai National Wildlife Refuge

The largest landowner in the planning area is the federal government. The Kenai National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service, covers 1.8 million acres, or fifty-four percent of the planning area. More than one million acres of the refuge is designated as wilderness. Management objectives for this large block of public land are clear and options for suppressing current infestations and preventing future ones are limited.

The refuge manager reports that the most extensive areas of spruce bark beetle infestation have generally occurred within remote, non-commercial forest lands, primarily on steep inaccessible terrain. The vast majority of affected spruce trees are located within designated wilderness areas, the most protected administrative land use zone within the refuge, where natural processes such as spruce bark beetle infestations are generally acceptable.

Although certain fuel reduction, pest control and other control measures may occur on a case by case basis within national wildlife refuges, such measures, on a large scale, must comply with refuge objectives and the National Environmental Policy Act, according to the U.S.F.W.S. No authority or management zone strategy allows timber salvage for economic purposes, although limited salvage may occur within campgrounds or near highways for fuel reduction and/or public health and safety purposes.

Private Land

Private land accounts for about 23 percent of the planning area. Two ANCSA Regional Corporations, Cook Inlet and Chugach, own 386,000 acres, while about 98,000 acres are held by village corporations. Much of this land is forested and timber production is a major concern. Another 240,000 acres are patented Native allotments and other small private parcels. Management objectives for these acres varies.

State Land

The State of Alaska owns or manages about 19 percent of the planning area. Managers are the Department of Natural Resources' Division of Parks and Outdoor Recreation and Division of Land, and the Department of Fish and Game. State park lands and critical habitat areas have clear management objectives and classifications. Management objectives for the remainder of state land are being developed by the Division of Land in the Kenai Area Plan.

Approximately 19,000 acres within the planning area are designated as Mental Health Trust Lands. Management of, and objectives for, this land depends on the outcome of litigation. The University of Alaska owns 9,797 acres that it manages to produce revenue for the university.

Kenai Peninsula Borough

The Kenai Peninsula Borough has title to 90,000 acres and has selected another 26,000 acres through its municipal entitlement. While this is only four percent of the land in the planning area, it is very important because most of it is accessible, high value land and much of it is forested. Borough land use plans and ordinances define the management objectives for these lands.

Land Status and Spruce Beetle Infested Acres on the Kenai Peninsula

The following chart shows land status for the Planning Area (the Western Kenai Peninsula and Kalgin Island, not the entire peninsula).

Gross acres do not include significant bodies of water such as Tustumena, Skilak and Hidden lakes. Infested acres are acres that are now infested with spruce beetles, or that have been infested at some time in the past ten years. The percentage of land infested includes all forested land, some of which is not of commercial value.

The numbers of infested acres shown in the following chart were determined during aerial surveys conducted by DOF in conjunction with USFS. Aerial surveys are a cost-effective way to survey large acreages, but are of limited value in obtaining infestation intensities, for example, percent of mortality and number of impacted trees per acre. In addition, aerial maps of spruce beetle damage do not indicate the level of infestation, which may be from five or 10 trees per acre to as much as 80 or 90 percent of the mechantable trees. Nor do they show volumes or stocking levels of merchantable trees at risk to beetle attack. To gather additional information about infested acres, foresters conduct surveys on the ground in specific areas.

Land Status	Gross Acres	Infested Acres	Percent
Kenai National Wildlife Refuge	1,782,510	252,785	14.2
Native corporation - village & region	482,798	62,684	13.0
State patented or tentatively approved	311,388	43,751	14.1
State parks & critical habitat areas	298,696	8,408	2.8
Private, including Native allotments	240,401	16,297	6.8
Kenai Peninsula Borough	90,395	19,375	21.4
Mental Health Trust lands	19,342	27	0.1
State selected lands	14,494	1,540	10.6
University of Alaska	9,936	4,177	42.0
TOTAL	**3,249,959**	**409,045**	**12.6**

Spruce Bark Beetle: Biology and Life Cycle

Spruce beetle, Dendroctonus rufipennis (Kirby) [Coleoptera: Family Scolytidae]

Description: Adult spruce beetles are brownish black, cylindrical and approximately 1/4 inch long and 1/8 inch wide. Larvae are white, legless grubs that pass through four stages (instars). The pupae are soft-bodied and white with some adult features.

Distribution: Spruce beetles are present in all spruce forests, infesting white, Lutz (a white/Sitka hybrid) and Sitka spruce. They rarely attack black spruce. Spruce beetles have become a serious pest in southcentral Alaska, throughout Cook Inlet and the Kenai Peninsula.

Damage: Bark beetles bore through the bark and feed and breed in the phloem—the thin layer of soft living tissue just beneath the bark. The phloem transports food manufactured in the needles down to the roots. If it is girdled, the tree dies.

Biology: The life cycle of the spruce beetle in southcentral Alaska is commonly two years. Warmer weather may shorten the developmental period to a one year cycle. Adult beetles emerge from overwintering sites and fly in search of a new spruce host in late May to early June, when air temperatures reach a threshold of 61° F. These flights last until mid-July and may be short-range, although beetles are capable of flying for several miles without stopping.

When the female beetle finds a suitable host, she bores into the tree and constructs egg galleries in the cambium (inner bark) parallel to the grain of the wood. Females are joined by males and, after mating, lay eggs in small niches along the sides of the egg galleries. Most eggs hatch by August and the larvae construct their own galleries perpendicular to the egg gallery. Larvae do not enter the wood but may score it.

Normally, spruce beetles pass the first winter in the larval stage, resume feeding the next spring, and pupate by summer of the second year. About two weeks later, pupae transform into adults, which pass the second winter, either in the old pupation site, or more commonly, in the lower part of a tree below snow level. The following spring, two years after initial attack, the new adults emerge from the now dead or dying trees by boring holes, and attack fresh or down trees. When temperatures are abnormally high, or on warmer micro-sites, spruce beetles may complete their development within one growing season and emerge one year after the tree was attacked.

Spruce beetles produce chemicals (called pheromones) to communicate with other members of the same species for purposes of mating, locating susceptible hosts, and to attract or repel other spruce beetles. Foresters are testing the effectiveness of using artificial pheromones to repel beetles from healthy trees, or to attract them to "trap trees" where they can be destroyed. Pheromones are often used as part of a logging operation to limit the spread of developing infestations.

Causes of Infestations

Small populations of beetles are always present in spruce forests. Most of the time the number is kept low (at endemic levels) by climatic conditions and parasites and predators, but when conditions are right, spruce beetles may increase to epidemic numbers. The right conditions include an abundance of breeding material accompanied by drought conditions. Beetles prefer to attack and breed in fresh windthrown, felled or injured trees; or large diameter slash from logging or right-of-way clearing. When the beetle population outgrows the supply of dead and injured trees, they may move into nearby living trees, particularly mature, slow-growing stands of spruce. Beetles generally attack slower growing trees, however, epidemic levels of beetles can result in attacks on vigorous, young trees as well.

Forested areas that are most susceptible to beetle attacks are large areas of dense, over-mature, large-diameter spruce. Fire suppression on the Kenai Peninsula has helped create these conditions by allowing forests to mature, and downed and injured trees to remain on the ground.

Other factors that stress spruce and increase susceptibility are too little moisture early in the season, secondary plant disease or insects, for example, fungi and defoliation by spruce budworm, and significant events such as fire, drought or flooding. Improper slash management has also contributed to spruce beetle population increases in many areas of the Kenai Peninsula prone to infestation. Simply put, the spruce beetle is an indicator that some significant change has occurred, either in the host tree or the physical environment, which has increased spruce susceptibility to attack.

Climatic changes and seasonal climatic trends also play a part in providing optimal conditions for spruce beetle population build-up from endemic levels in downed spruce to aggressive mass-attacks on standing live trees. The warmer springs and summers since 1989 appear to have increased the beetle numbers by reducing beetle larval development times from two years to one year. Generally warmer winter temperatures may also have increased spruce beetle winter survival rates.

History and Trends of the Infestation

U.S. Forest Service pest management surveys indicate that spruce forests in Southcentral Alaska have been repeatedly infested by the spruce beetle for decades.

In 1987, the Forest Service conducted an inventory of forest resources on the Kenai Peninsula, historically the area in Southcentral Alaska most heavily impacted by the spruce bark beetle. The objective was to assess the impact of the spruce beetle on the timberland component of forested areas (van Hees and Larson 1991). Total timberland of the Kenai Peninsula was estimated at 482,000 acres (timberland is forest land producing or capable of producing crops of industrial wood). Estimates of mortality were averaged over the five years before the inventory. The spruce beetle appeared to have had a significant impact on overall mortality. On all timberlands, insect damage was responsible for 52 percent of the total estimated spruce mortality, which equaled or exceeded annual growth on many sites.

The infestation over the whole Kenai Peninsula has increased substantially in recent years and will likely maintain its magnitude with continued favorable conditions. It appears likely that the current spruce beetle infestation between Kasilof and Ninilchik (south and west of Tustumena Lake) will maintain, and possibly increase in magnitude over the next five years if climatic conditions favorable to the spruce beetle continue.

The Alaska Division of Forestry and the University of Alaska, Institute of Social and Economic Research are analyzing the 1990-1991 spruce beetle survey results (Clam Gulch/Kasilof Spruce Beetle Survey Project). The results will provide information on rate of spread, areas affected, infestation levels, estimates of volume affected and percentages of stands affected.

Preliminary results from the 1990-1991 southern peninsula spruce beetle survey have been compiled for selected areas and are available for review. A written report and summary of the findings will be available in late 1992.

For a detailed description of the history and trends of the spruce bark beetle, see Forest Service Technical Report: R10-90-18, Forest Pest Management Report; Spruce Beetle Activity in Alaska: 1920-1989, printed in February, 1990.

Issues

A major task of the Working Group and the participating public was the identification of issues and problems regarding forest health on the Kenai Peninsula. Following is the list of issues the group agreed were important to address:

1. There is increased pressure to "use it or lose it," including areas otherwise unavailable for harvest.
2. Developing access may positively impact tourism, timber harvest, and recreation.
3. The cumulative impacts of harvest operations may negatively impact scenic values, wilderness, tourism, recreation, wildlife populations, wildlife habitats, water quality and soils.
4. Developing access may negatively impact scenic values, wilderness, tourism, recreation, wildlife populations, wildlife habitats, water quality and soils.
5. Actions and treatments, including regeneration and reforestation, should be cost-effective.
6. Different landowners may have different management concerns, constraints and objectives.
7. Dead trees in varying stages of decay may increase or decrease the potential for, or intensity of, fire.
8. Management options for responding to spruce beetle infestations include opportunities for altering habitat to increase specific wildlife species such as moose.
9. Management activities such as harvest and roads can negatively impact fish habitat.
10. Market opportunities need to be developed for both green and dead trees.
11. Death of mature riparian spruce can negatively impact fish habitat due to changes in bank structure, increased sedimentation, and changes in large woody debris input, thereby decreasing recreational and commercial activities.
12. Spruce beetles may negatively impact scenic values, wilderness, tourism, recreation, wildlife populations, wildlife habitats, water quality, and soils.
13. Dead spruce are less attractive than green trees. This may impact property values, tourism, privacy screening, and desirability of residential lots.
14. The misunderstanding and/or mismanagement of the forest cycle can create negative assumptions and/or actions which may be costly both economically and naturally.
15. Insecticide and herbicide use can negatively impact fish, wildlife, and human health.
16. Dead trees near highways, campgrounds, residences and other high use areas can be dangerous to people and property.
17. Spruce beetle activity is diminishing the spruce timber resource on Kenai Peninsula lands available for harvest.
18. Action or lack of action by one landowner may impact adjacent landowners.
19. Treatment costs can be reduced by increased timber market value.
20. Insecticide and herbicide use can reduce regeneration costs and prevent attacks on individual trees.

Considerations

1. The Division of Forestry is responsible for maintaining healthy forests to meet a variety of objectives.
2. The best strategy for managing spruce beetles, in many areas, is to actively manage the forest in a manner that reduces the chance of outbreaks occurring.
3. Actions or inaction taken by a land manager may impact the forest and/or management objectives of adjacent land managers.
4. The likelihood of harvesting recommendations being followed depends, in part, on the ability of the Kenai Peninsula Borough Timber Resource Utilization Task Force and others to find markets. Harvesting is feasible only if there is a market for the wood. Other considerations such as wildlife, scenic and aesthetic values also play a role in determining appropriate treatments.
5. The Division of Forestry is the agency responsible for implementing and facilitating recommendations. Additional staff and funding may be needed to carry out new projects.
6. Although not currently as valuable commercially as timber in Southeast or Interior Alaska, Kenai Peninsula forests do have many values in addition to timber, including recreational, fish and wildlife habitat and scenic values.
7. Management and control of spruce beetles is viable in forests with relatively high value (timber or other values). It may be cost prohibitive in other areas.
8. The public is very concerned about how forest health management activities will effect anadromous fish streams. There are good reasons for this concern. First, much of the spruce, and most of the oldest and largest spruce, grow in riparian zones. These trees are the most susceptible to beetle attack. Second, a large number of people depend on healthy fish populations and habitat for their recreation and livelihood. This includes commercial and sport fisheries and the tourism industry. Protection of the Kenai River drainage is of the utmost importance and any treatments of bark beetles must consider all possible impacts on this resource.
9. The public is concerned that beetle-killed spruce significantly increase the likelihood of wildfires spreading to communities on the Kenai. How fire danger is affected by beetle-killed spruce is subject to some debate; fire behavior is not an exact science. There is little disagreement that during the first two years after the tree is killed (when dead needles are still attached) the chance of a rapid rate of spread is increased. Fires in these types of fuels are very difficult to control. As the needles drop from the tree, it does not appear able to carry fire as readily, but it is not clear how the needles and small branches that have fallen to the ground affect rate of spread and resistance to control on the ground. Fire managers are concerned about the danger posed by the combination of calamagrostis grass and heavy concentrations of brush and snags in areas of beetle-killed spruc,e as they relate to resistance to control.

   Other unanswered questions are, how are ground fire intensities affected by large numbers of fallen spruce, and is erosion more likely following a fire in beetle-killed spruce? No conclusive research was found on the effects that sustained fire in these fuels has on soil stability. The Forest Service is researching information from the Pothole Lake fire and may answer some of these questions by identifying what the fire intensity was in different fuels and areas.

10. There are many landowners and managers on the Kenai peninsula, both public and private, and many different management objectives. This plan offers alternatives and recommendations, but landowners and managers will decide if and how they will implement them.

11. In some areas, especially those with non-timber values such as wildlife or recreation, the impact of treatment may be more damaging to those values than the damage caused by the spruce bark beetle.

12. Although there are minimal studies regarding the efficacy of some potential treatments in Alaska, the data is available from Canada and northern states to scientifically substantiate the recommendations. It would be irresponsible to remove tools such as pesticides, just as it would be irresponsible to downplay potential risks.

Division of Forestry Recommendations

Forest Health

1. Forest health should be an important consideration in land management planning and activities.
2. Private landowners are encouraged to take measures to prevent and/or suppress beetle infestations on their property. Management practices that promote forest health are good business and lend themselves to sustained yield and the possibility of income from forest resources in the future.
3. The division recommends interagency cooperation in dealing with harvest, pesticide use, air and water quality, and habitat considerations to achieve our mutual goal of good forest health.
4. The Division of Land, as manager of public domain state land, must be actively involved in the decision-making process regarding forest health on state lands.
5. The Division of Forestry should continue to promote forest health on private land through the Forest Stewardship Program.
6. The legislature should continue to fund forest health planning and activities. Forests in the Fairbanks, Copper River, Mat-Su, Kuskokwim, and Yukon areas also have conditions that threaten forest health. Sound programs promoting forest health can help reduce infestations, preserve a valuable resource, expand market opportunities and provide private sector jobs.

Treatments

7. Managers of public and private land should consider treatments such as prescribed fire and underplanting that are compatible with their management mandates. Agencies may also wish to examine fire management plans and ensure that there are buffer zones of Full or Modified Protection Levels along boundaries with other landowners.
8. Landowners and managers of public recreation areas, such as campgrounds, trailheads, pull-outs and boat launch sites should remove hazardous trees in intensively used public areas.
9. In areas where harvesting dead or susceptible spruce is not possible, young trees should be underplanted to begin a new, healthy forest

Timber Harvest and Markets

10. The protection of streams and riparian zones is of the utmost importance. The Forest Practices Act will be the standard applied to all harvest operations. Variation requests from Forest Practices requirements shall be fully documented and normal procedures followed.
11. The Department of Commerce and Economic Development should continue to work closely with landowners and managers, both public and private, to develop market opportunities for Kenai Peninsula wood and wood products.

12. The Division of Forestry should continue to work with the Department of Commerce and Economic Development to assess market conditions and, where appropriate, provide timber sales of appropriate sizes. In addition to large sales, smaller sales shall be held to accommodate local operators and commercial firewood cutters.

13. The Department of Natural Resources should continue to engage in cooperative agreements to secure access and develop salvage timber sales with adjacent landowners. The preferred authority is AS 38.05.027 (Cooperative Resource Management or Development Agreements) rather than AS 41.17.082 (Control of Infestations and Disease). See Attorney General memo in Appendix on page 35.

14. The Division of Forestry should have regulations that allow emergency timber sales under AS 38.05.113(c) adopted by February, 1993. Copies of the public notice and proposed regulation are in the Appendix, on pages 37 - 39.

15. The Division of Forestry, in concert with the Division of Land, should continue to examine the feasibility of cost-effective salvage timber sales on state land that has recently infested trees and reasonable access.

16. Harvesting operations must consider the long-term health of the forest and be designed to achieve or enhance future productivity and other management goals.

17. Treatments that include harvesting operations should be designed with public input and with regard for public concerns. Harvest operations on public lands should keep clear-cut areas small, with irregular edges to maintain a more natural appearance.

18. Transport of beetle-killed timber should be done in ways that do not hasten the spread of spruce bark beetles. Hauling should not be done during beetle flight. Firewood can be debarked and split before transport.

Reforestation

19. Reforestation is a primary concern in all treatment areas and should be designed to develop healthy and vigorous forests. Toward this end, the division will collect and store Kenai Peninsula seeds for the Forest Regeneration Center (nursery) to use in seedling production.

20. Reforestation costs may exceed product value in some areas. Reforestation regulations may consider salvage logging in beetle-kill areas similar to the way they treat areas burned by wildfire. Cost effectiveness is a crucial component of reforestation and alternate methods and funding sources should be researched and pursued.

21. Reforestation efforts should be planned to create natural conditions of mixed-age, mixed-species stands; not large areas covered by straight rows of a single species.

Research and Information Needs

22. The division should continue to cooperate with the U.S. Forest Service in aerial survey and mapping of infestations and vegetation cover. This information is crucial in targeting priority areas for treatment, and identifying forests with potential for timber harvest or salvage.

23. The division recommends an inter-agency effort to research fire intensities and rate of spread in areas infested by spruce bark beetles. More information is needed on whether beetle-killed spruce significantly increase either the chance of a fire starting or a more rapid rate of spread. Both the public and agencies need this information to provide effective fire prevention and management programs. Another question to answer is whether or not fire is as important to natural forest succession in the marine environment as it is in the Interior.

24. Survey and inventory work is needed on timber volume and quality, with specific data on defect percentages, tonnage per acre figures (particularly for low value timber and fuelwood), and information on how long the beetle-killed trees have been dead. Funding is needed to do volume plots in conjunction with beetle surveys and to continue periodic surveys to measure changes in conditions.

25. The division should continue to cooperate with the U.S. Forest Service in researching and testing methods of preventing and suppressing spruce beetle infestations.

26. DOF should promote, fund and cooperate in investigations that document impacts of spruce beetles on non-timber forest resources and values such as wildlife and habitat, water, soils, tourism, recreation and scenic values. New information should then be made available to resource managers.

27. Work must continue on developing ways to deal with calamagrostis grass. This grass, which dominates areas where trees have died or been harvested, inhibits the growth of young trees and poses a fire hazard between spring break-up and summer green-up.

28. The Division of Forestry should continue to participate in the National Forest Health Monitoring Program. The EPA, Forest Service and others designing this program should be flexible in modifying the plot requirements to accurately reflect Alaska's size and conditions.

29. An economic analysis should be done of the potential for development of Kenai Peninsula timber. An attempt should be made to determine how to get the raw product to potential buyers, the costs of manufacturing, how Kenai Peninsula timber will compete in existing markets, and what remuneration landowners can expect for their timber.

Public Information

30. The Division of Forestry should increase efforts to provide information to small landowners about how to prevent and suppress spruce beetle infestations. A video on this subject is being prepared and will be available, free of charge, by early spring, 1993.

31. The Division of Forestry should expand programs that inform landowners of sound methods of timber harvest and right-of-way clearing to help prevent spruce bark beetles from spreading.

32. The Division of Forestry and other agencies should promote an understanding of natural forest dynamics and the importance of such an understanding in meeting the landowners' objectives.

33. Prescribed and natural fire should be encouraged as practical beetle prevention and suppression tools. While wildfire danger is an important public issue and life and improvements must be protected, land managers must create a public awareness of the importance of fire in natural cycles so that fire becomes a more acceptable tool.

34. The Division of Forestry should encourage landowners to be sensitive to concerns of the public and adjacent property owners. Likewise, the public should be made aware of the need for landowners with different objectives to manage their land differently. For example, the manager of a wildlife refuge has a legal responsibility to manage land differently from the owner of a large private corporation. Mutual understanding reduces conflicts and allows landowners to more easily meet the objectives they have for their land.

35. Public land managers will continue to involve the public in the decision-making process as these recommendations are implemented.

Salvage Harvest Priority Units

Some landowners may choose harvesting or salvage logging (logging trees that are dead) as a means to restore their forest to a healthy condition—a condition where their objectives for the land are being met.

The Division of Forestry has identified and prioritized seven units for possible harvest and salvage logging. The units were selected by using maps showing vegetation type and spruce beetle activity, and by considering access, economic factors and land status and ownership. All logging will, of course, be the responsibility of individual landowners.

Vegetative cover maps were prepared by DOF to show forested areas where commercial timber may be present. For purposes of this plan, those areas are defined as areas where at least 25 percent of the land cover has closed, open or woodland forest with a crown cover greater than 10 percent.

The units were prioritized according to the infestation levels and the amount of timber potentially available for harvest. Harvesting activity and schedules depend on many factors and will not necessarily begin in Priority 1 and proceed through Priority 7. Initial activity on state lands will occur in the Falls Creek Unit.

Below is a summary of each of the seven prioirty units, estimated acreage of state commercial forest land, and a volume estimate for state lands. These figures are estimates made from ocular observations of type maps, aerial photos, past timber cruises and field experience. Although they may not be 100 percent accurate, they are good working estimates of the acreage and volume potentially available from state land identified in the seven priority units.

A chart showing land ownership, status and acreage in each area is on page 23.

1. South Soldotna

This unit is located south of Soldotna down to the Kasilof River area. The large parcels of state land are primarily swamp/muskeg. Small parcels adjacent to Crooked Creek, Kasilof River and Kasilof Airport may have high public interest. Most of the land within this unit is private and native, with smaller amounts of borough and state land.

Much of the ground within the unit is level to gently rolling. Spruce beetle activity is heaviest in the vicinity of Kasilof and near Skyview High School. Parcels of state land are scattered and small in size. Harvesting costs would be high. One idea to consider is having small operator set-asides with the state doing most of the pre-sale work to reduce operator costs.

Estimated state acreage and volume potentially available:

AREA	ACRES	CCF*
Kasilof Airport	50	286
South of Kasilof River	100	571
Reflection Lake	20	143
State selected land	50	171
Total	**220**	**1,171**

Most stands are a mixture of spruce and hardwoods and the terrain is level to gently rolling. A large swamp that bisects the island is a Critical Habitat Area. This would require that two different log transfer facilities be developed. Cook Inlet has strong tides and currents and the waters around the island are relatively shallow.

Estimated state acreage and volume potentially available:

AREA	ACRES	CCF*
Kalgin Island	12,000	71,429

7. Fox River

The Fox River valley is located at the head of Kachemak Bay and on adjoining uplands to the west to Caribou Lake. Spruce beetles have been active in the Fox River valley for several years. There had been some scattered and isolated spruce beetle activity on the uplands in the past, however, the 1992 aerial surveys indicated that activity is increasing. This unit is primarily state land, with wildlife refuge in the north and private land located mostly in the southern portion.

The stands in the valley are mostly spruce with some hardwoods (cottonwood) near streams. The upland is almost entirely spruce, but at fairly low stocking levels. Access is off the East End Road from Homer or up Kachemak Bay. There is no developed access into the area and it would be difficult to develop. There are a number of braided channels in the Fox River valley and a Forest Practices Act variation would be necessary. The state also leases the valley for grazing purposes.

Estimated state acreage and volume potentially available:

AREA	ACRES	CCF*
Uplands	3,050	17,429
Valley	1,000	5,714
Total	**4,050**	**23,143**

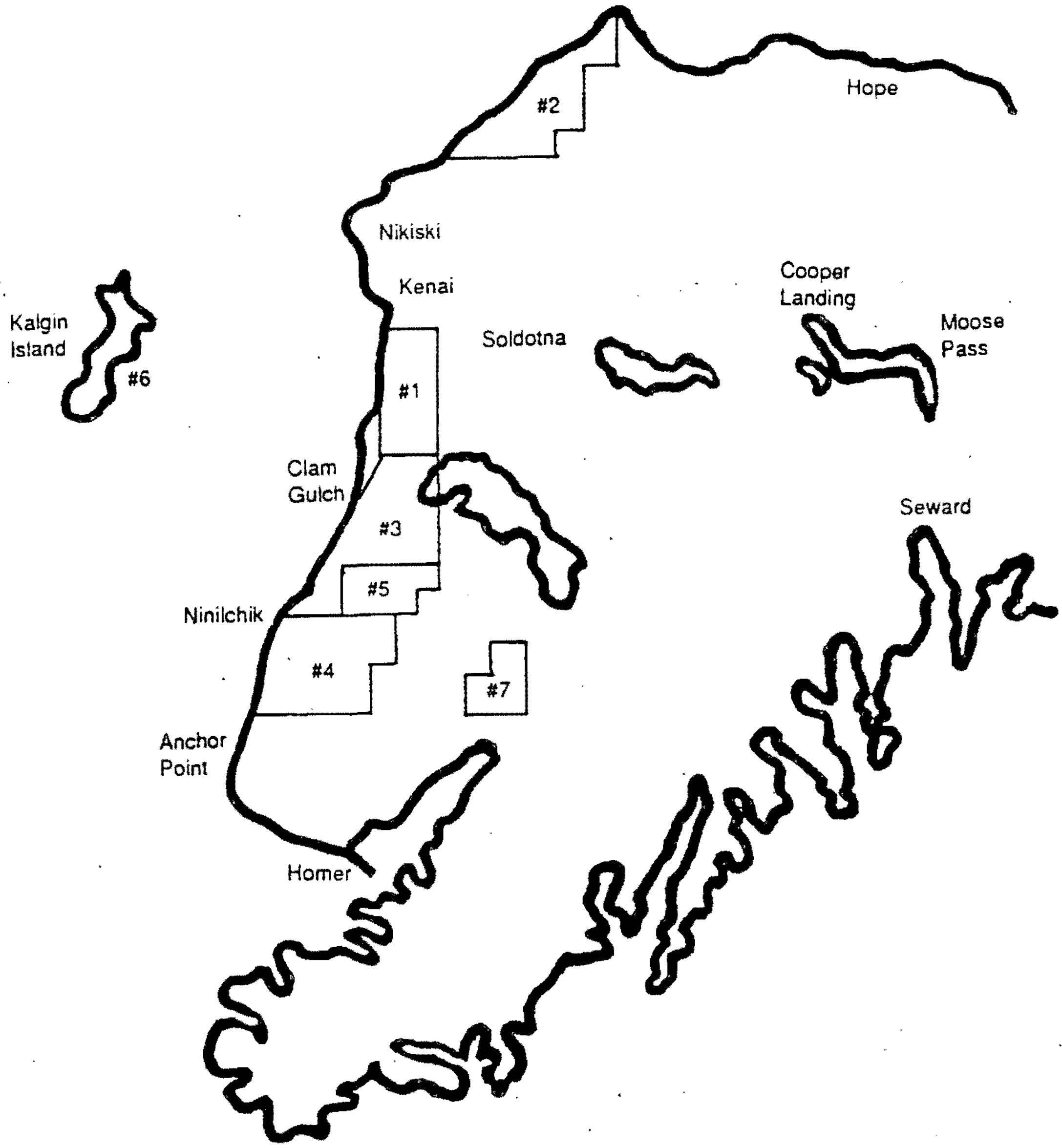
Total of all priority units:

36,251 acres and 253,641 CCF

*Please note: CCF = 100 cubic feet

The board foot to cubic foot ration used is 3.5 bf/cf.

Salvage Harvest Priority Areas



Salvage Harvest Priority Areas								
Land Status	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Fish & Wildlife	9,514	30,901	19,278	0	2,582	0	8,809	71,084
Native	9,248	32,896	23,120	70,381	31,219	0	0	166,864
Private	12,877	494	6,619	15,259	108	493	1,905	37,754
University	0	0	6,953	0	823	0	0	7,776
Kenai Pen. Bor.	7,611	21,031	3,063	6,097	0	0	0	37,802
State, non-park	5,882	1,887	17,422	26,701	18,752	11,450	33,190	115,283
State Parks	0	1,755	0	183	0	2,414	27	4,379
Other	84	2	0	0	0	156	0	243
Total Acres	45,216	88,967	76,455	118,621	53,484	14,513	43,930	441,186

NOTE **:** Lakes larger than 20 acres are not included in area estimations.

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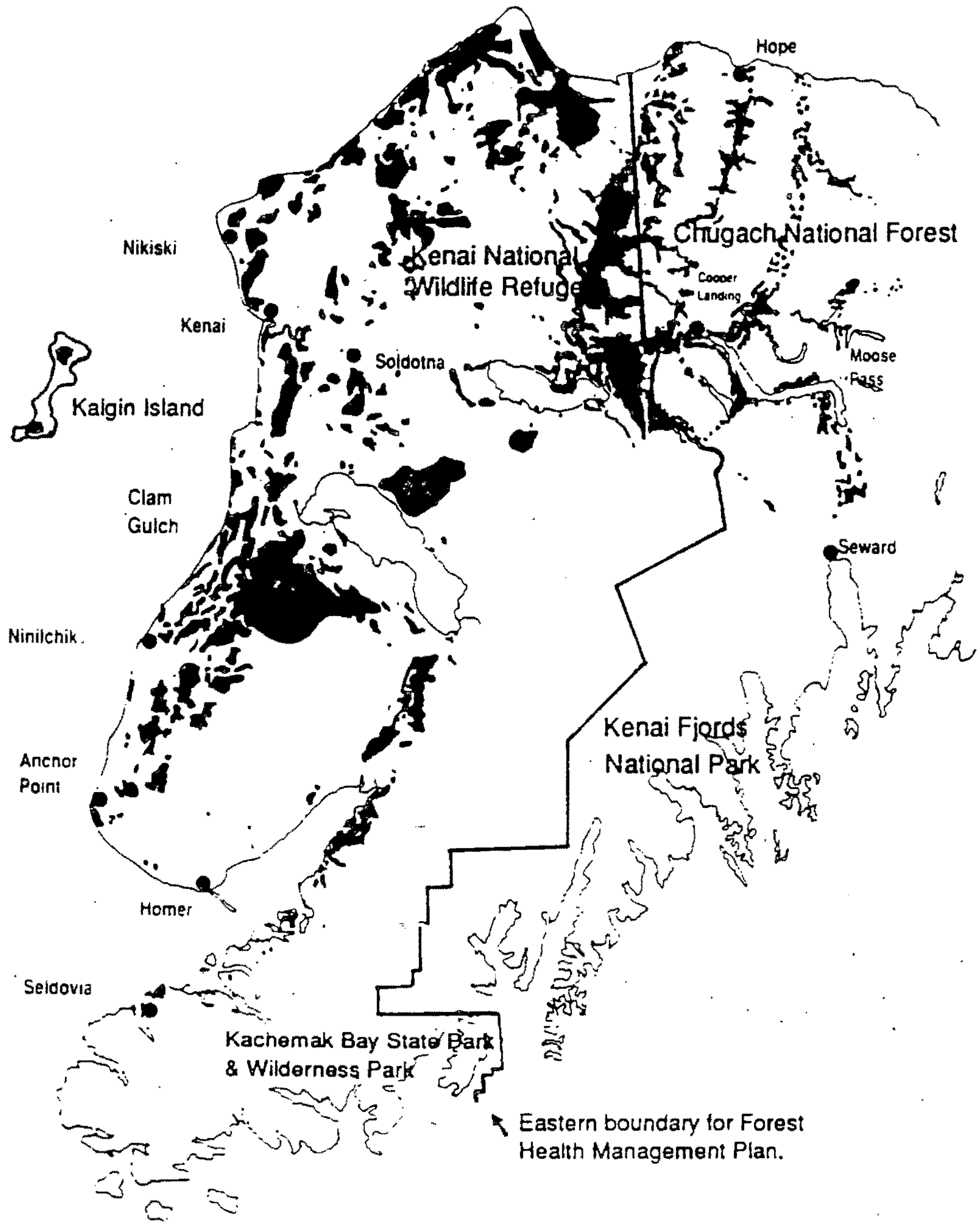
Appendix

Spruce Bark Beetle Infestation on the Kenai Peninsula

Since 1970, spruce bark beetles have killed trees on 700,000 acres—about 35 percent of forested land on the Kenai Peninsula. This map shows areas infested at some time between 1970 and 1990, as detected in aerial surveys. Aerial surveys show only red tops, trees attacked one year earlier and now dead, not the level of infestation or the volume of timber affected.



Guidelines for Reducing Beetle Infestations

The Division of Forestry encourages landowners to take measures to prevent spruce bark beetle damage rather than waiting and responding to an infestation. Activities that disturb the environment contribute to spruce beetle attack and epidemic outbreaks. These include severe winds that cause windthrown trees; land clearing for road, seismic line, pipeline or power line construction; and timber harvest. The Division of Forestry, Cooperative Extension Service and U.S. Forest Service recommend the following guidelines for reducing beetle attacks:

1. Maintain stands in a healthy and vigorous condition by removing over-mature, diseased, damaged, windthrown or dying trees.
2. Establish a stand rotation age (harvest age) of less than 150 years.
3. Timber sale size and orientation of cutting areas are important in creating stands that can withstand high winds. Leave-strips between clear-cut or shelterwood cutting areas should be more than 100 feet wide. Timber sales should not be located along ridge tops where shallow-rooted spruce are highly susceptible to high wind.
4. All logs cut after September should be removed and used prior to beetle flight the following May.
5. All slash and cull logs four inches in diameter and larger should be disposed of by burning, burying, chipping or peeling.
6. Stumps should be cut as low as possible.
7. Whole tree logging will eliminate most of the breeding material usually left in the forest and concentrate it at the logging landing where it can be destroyed.
8. Timber along rights-of-way for roads, seismic lines, pipelines, and power lines should be cut in the fall and the logs used before the next spring. Trees next to the right-of-way should be examined for beetle attacks in late summer following cutting. If trees are infested, they should be removed or treated.
9. During construction, care should be taken to avoid scarring trunks, severing roots, altering drainage patterns, severely compacting the soil or any other action that will damage and stress the tree.

Specific guidelines are also included in the state's Forest Practice Act regulations.

Matching Spruce Beetle Management Strategies to a Land Classification System

This information was provided to the Division of Forestry and the Working Group by Gene Lessard of the U.S. Forest Service, State and Private Forestry, Forest Pest Management Office.

The spruce bark beetle is endemic to white, Sitka, and Lutz spruce and tree mortality will continue where these hosts are found. The key to managing the beetle is to reduce tree mortality to an acceptable level, which will vary with the goals and objectives of land managers for specific areas. Therefore, forest health management strategies must be developed that consider a wide range of management objectives and land use values.

Five major premises are applicable to spruce beetles in Alaska (Freeling and Seaver, 1980). Failure to recognize these premises will lead to failure for any long range management of spruce beetles:

1. All host types, regardless of ownership can be stratified into land classification units.
2. Spruce beetles cannot be eradicated by any known method over extensive areas.
3. Management and control of spruce beetles is viable in restricted areas with trees that have relatively high value.
4. The ideal strategy for managing spruce beetles is to intensively manage the host type, thereby preventing outbreaks from occurring.
5. Prevention is a viable strategy only in moderate to high susceptible stands, or in low susceptible stands which will be in a moderate to high susceptible condition in the near future.

Criteria

A procedure has been developed to match management strategies to a land classification system (Freeling and Seaver, 1980). The land classification system is based on the following criteria:

1. Risk to spruce beetle infestation
    - low
    - moderate to high
2. Land accessibility and/or operability
    - accessible and/or operable
    - inaccessible and/or inoperable)
3. Tree value
    - low value
    - high value

The criteria are qualitative, however, each can be quantified. The classification system is dynamic; it will need to be updated to keep pace with tree growth (and thus risk), changes and improvements in harvest technology and changing land use values. The Forest Service is developing a computerized "expert system" that will be helpful in using this land classification system for spruce bark beetles in Alaska.

Spruce Beetle Risk: The Forest Service has developed a risk scheme for spruce beetles in south-central Alaska. The information is currently being reviewed for publication.

Accessibility and/or Operability: These criteria vary with the management strategy selected and the equipment available to implement the strategy. For example, slopes in excess of 40 percent may be inoperable and inaccessible for conventional logging equipment but operable for a high lead system; or appropriate for chemical pesticide application.

Tree value: Value systems are highly variable and often difficult to quantify. The management goals and objectives for an area determine the value system to be used (e.g., recreation and aesthetics, wildlife habitat, timber products, etc.) Thus, the values of a given piece of land and its tree resource is affected by tree density, quality, and ultimate land use. Effects of the spruce beetle may detract from or enhance that value. The objective is to minimize the loss of value from beetle damage through the application of one or more strategies.

Land classification categories

A. Moderate to high SB risk
Accessible and/or operable
High individual tree value

B. Moderate to high SB risk
Accessible and/or operable
Low individual tree value

C. Moderate to high SB risk
Inaccessible and/or inoperable
High individual tree value

D. Moderate to high SB risk
Inaccessible and/or inoperable
Low individual tree value

E. Low SB risk
Accessible and/or operable
High individual tree value

F. Low SB risk
Accessible and/or operable
Low individual tree value

G. Low SB risk
Inaccessible and/or inoperable
High individual tree value

H. Low SB risk
Inaccessible and/or inoperable
Low individual tree value

Management strategies

Preventive strategies:

1. Thinning stands
   A. Intermediate treatments
   B. Regeneration methods
2. Preventive spraying
3. Favoring tree species other than host species (spruce)

Suppression strategies:
(Direct control actions to reduce the population immediately)

1. Chemical treatment

2. Mechanical treatment

3. Trap tree
    a) Lethal (chemically treated)
    b) Non-lethal (mechanically treated)

4. Pheromones
    a) Attractants
    b) Repellents

Some management strategies are more applicable for some land classifications that for others. For example, direct chemical treatment of low risk, low value trees over large inaccessible areas would be inefficient economically and therefore inappropriate.

Management opportunities identified by this system are as follows:

1. Incorporate into any forest management plans prescriptions for the major insects and diseases causing tree damage.

2. Involve state and local governments to a greater degree in future planning efforts.

3. Initiate and maintain a continuous program of unified management on all lands.

4. In cooperation with as many landowners/managers as possible, implement a management program to prevent and suppress the spruce beetle using the following recommended strategies for specific land classifications:

Land Classification A: In developed recreation areas (campgrounds, trailheads, parking areas) where the beetle is present, suppress the insect by harvesting infested trees before the beetle flight. In developed recreation areas where an epidemic has run its course, the preferred strategy is to do nothing. If an epidemic has not yet occurred, thinning is recommended. This reduces the susceptibility of the area to the beetle.

In Type A areas other than developed recreation sites, the preferred strategy is thinning for prevention, or harvesting infested trees. In areas where the beetle is already epidemic, the preferred strategy depends upon tree value and recreation values. If the recreational value is greater than about six times the stumpage value (on a per acre basis), then suppression is best. With lower recreation values, however, thinning is the preferred strategy. In areas where the beetle is either not present, or inactive, thinning is preferred, as it may prevent beetle epidemics. Immediate thinning is much preferred to waiting for an epidemic to start and then thin. Thorough analysis of the benefits and costs of the various tactics in relation to the value of the management objectives will help in developing the best approach in a given situation.

Land Classification B: In these areas a thinning program is the preferred strategy, due to the beneficial silvicultural effects and reduced detrimental effects on recreation.

Land Classification C: In areas where thinning is impractical due to accessibility and/or operability, such as a cabin site, suppression by chemical means is considered the best strategy under epidemic conditions. However, this strategy may be only marginally superior to doing nothing and accepting the losses.

Land Classification E: On low susceptibility areas, harvesting infested trees is the preferred strategy. Because these are high value lands, this strategy is effective in reducing the impacts on scenic, recreational and real-estate values.

Land classification areas D, F, G, H: Allow the beetle to run its course.

In summary, the greatest benefit appears to be from thinning programs in highly susceptible areas where beetles are not present. There is also some benefit from taking suppression actions in those higher value areas where beetles are present.

Harvesting Strategies

Strategies recommended (Hard and Holsten, 1985) for areas where harvesting is determined to be the best course of action include:

1. Mark all spruce trees 14 inches DBH and larger for removal regardless of growth rate.
2. Mark "leave" spruce trees that are 10 to 12 inches DBH and have straight stems free of defect, live crown rations of 40 percent or more, radial growth rates of 1 mm or more in the last complete annual ring growth, and appear to be firmly rooted.
3. Mark "leave" spruce trees that are 8 to 10 inches DBH with radial growth rates of 0.5 mm or more in the last complete annual growth ring that can be released on at least three sides.
4. Fell all remaining trees in April, May, June and early July. Allow the felled trees and logs to absorb beetles in the area.
5. Postpone skidding until after beetle flight.
6. Stands in areas subject to severe wind and ice storms should not be thinned heavily. High winds and heavy snows are common causes of tree fall and top breakage.

Kenai Peninsula Borough Fuel Reduction Project at Cooper Landing
(Phase II)

	Cost per acre	Total cost
Mechanical scarification of units - 250 acres	$103.20	$25,800.00
Planting Contract: 78,000 seedlings on 250 acres and installation of 30,000 brush blankets	$70 to $150	$35,276.50
Seedlings: winter storage and summer greenhouse operation.		$6,792.03
Transportation of seedlings from Alaska Reforestaion Center in Eagle River to Soldotna		$900.00
Cost of 30,000 brush blankets		$14,988.00
Total cost of reforestation		**$83,756.53**

For more information on these figures or the Kenai Peninsula Borough's fuel reduction project, please contact John Mohorcich at 262-4441.

CUMULATIVE ACTION AND COST SUMMARY
Prepared on 4/04/92 by Warren Oja

USFS FUEL BREAK CONSTRUCTION	VOLUME REMOVED CORDS	VOLUME REMOVED MBF	TOTAL ACRES	PER UNIT COST CORD	PER UNIT COST MBF	PER UNIT COST ACRE	PER UNIT COST MILE	TOTAL NET COST **
Bean Creek FB Contract	330	165	50	- 227.27	- 454.55	- 1,500.00	n/a	$ - 75,000
West Juneau Road FB Timber Sale	96	48	12	1.50	3.00	12.00	n/a	$ 144
West Juneau Road FB Timber Sale	120	60	15	1.25	2.50	1.00	n/a	$ 150
Russian River FB Timber Sale	618	309	32	1.50	3.00	28.97	n/a	$ 927
Russian River FB Feller/Buncher	342	171	19	- 41.67	- 83.33	- 750.00	n/a	$ - 14,250
Subtotal as of 4/04/92	1,506	753	128	avg -58.45	avg-116.90	avg -687.73	n/a	$ - 88,029

FUEL REDUCTION CONTRACTS	VOLUME REMOVED CORDS	VOLUME REMOVED MBF	TOTAL ACRES	PER UNIT COST CORD	PER UNIT COST MBF	PER UNIT COST ACRE	PER UNIT COST MILE	TOTAL NET COST
Bean Creek FR Contract	1,332	666	74	48.00	96.00	864.00	n/a	$ - 63,936
Roadside FR Contract	1,092	546	84	53.49	106.99	695.42	n/a	$ - 58,415
Moosewood FR Contract	848	424	53	50.06	100.12	800.92	n/a	$ - 42,449
Subtotal as of 4/04/92	3,272	1,636	211	avg -50.37	avg-100.73	avg -781.04	n/a	$ - 164,800

FUEL REDUCTION FORCE ACCOUNT	VOLUME REMOVED CORDS	VOLUME REMOVED MBF	TOTAL ACRES	PER UNIT COST CORD	PER UNIT COST MBF	PER UNIT COST ACRE	PER UNIT COST MILE	TOTAL NET COST
Keani River - Unit 9	100	50	55	- 500.00	-1,000.00	- 909.09	n/a	$ - 50,000
Kenai Lake-Unit 56 Firewood Permits	252	126	14	1.00	2.00	18.00	n/a	$ 252
West Juneau Rd Slash Pile Chipping	25	13	5	- 200.00	- 384.61	-1,000.00	n/a	$ - 5,000
Russian Lake Trail - Unit 59	12	6	3	- 166.67	- 333.33	- 666.67	n/a	$ - 2,000
Subtotal as of 4/04/92	389	195	77	avg-145.88	avg-291.02	avg - 736.99	n/a	$ - 56,748

SPECIFIED ROAD CONSTRUCTION	VOLUME REMOVED CORDS	VOLUME REMOVED MBF	TOTAL ACRES	PER UNIT COST CORD	PER UNIT COST MBF	PER UNIT COST ACRE	PER UNIT COST MILE	TOTAL NET COST
Chunkwood Road (2.2 miles)	1,325	663	53	-177.36	-354.45	- 4,433.96	106,818.18	$ - 235,000
Subtotal as of 4/04/92	1,325	663	53	avg-177.36	avg-354.45	avg-4,433.96	106,818.18	$ - 235,000

TOTAL CUMULATIVE COOPER LANDING FUEL REDUCTION ACTIVITY/COST SUMMARY
AS OF 4/04/1992

ALL USFS FUEL REDUCTION ACTION	VOLUME REMOVED CORDS	VOLUME REMOVED MBF	TOTAL ACRES	PER UNIT COST CORD	PER UNIT COST MBF	PER UNIT COST ACRE	PER UNIT COST MILE	TOTAL NET COST
USFS Fuelbreaks	1,506	753	128	avg -58.45	avg-116.90	avg -687.73	n/a	$ - 88,029
Fuel Reduction Contracts	3,272	1,636	211	avg -50.37	avg-100.73	avg -781.04	n/a	$ - 164,800
Fuel Reduction by USFS	389	195	77	avg-145.88	avg-291.02	avg - 736.99	n/a	$ - 56,748
Fuel Reduction via Road Const.	1,325	663	53	avg-177.36	avg-354.45	avg-4,433.96	106,818.18	$ - 235,000
GRAND TOTAL as of 4/04/92	6,492	3,247	469	avg- 83.88	avg-167.72	avg -1,161.15	n/a	$ - 544,577

** NOTE: Net cost figures were calculated by: REVEUES - COSTS = NET COST. A positive net cost means revenues exceeded costs. Negative net cost means costs exceeded revenues. Also, not all salvaged volume from fuel reduction actions has been sold yet.

Attorney General's Opinion on Zones of Infestation

MEMORANDUM

State of Alaska
Department of Law

TO: Pete Buist
Forest Health

DATE: June 16, 1992

FILE NO.:

TEL. NO.: 269-5100

SUBJECT: Zones of Infestation (Kenai Peninsula)

RECEIVED
JUN 17 1992

FROM: Jim Wanamaker JW
Assistant Attorney General
Natural Resources - Anchorage

By memorandum of May 20, 1992 (copy attached) you have asked me certain questions about declaring a "zone of infestation" on the Kenai Peninsula.

I know that it will be helpful to you to have advice which is as prompt as possible. If you want to consider any of the questions in greater detail we will do that. The answers to your questions are:

<u>Question</u>: 1. Would the Commissioner take action in this regard (declaring zone of infestation) per 11 AAC 95.180 or per the current statute, AS 41.17.082? Note that draft regulations make no reference to either a zone of infestation or control.

<u>Answer</u>: The commissioner would have to act under the statute AS 41.17.082. The draft regulations are not yet promulgated and would not serve as any basis for authority. With reference to the draft regulations it is my recollection that we did not draft any regulations dealing with this <u>on purpose</u>, because the statute itself is so prescriptive that there is little a person could add by regulation.

<u>Question</u>: 2. Does such a declaration give the Commissioner the authority to require landowners (particularly large private landowners and other agencies, e.g. Department of Interior) to take steps to suppress insect infestations?

<u>Answer</u>: Actually the statute does not use the word "declaration." However pursuant to findings under part (b) the Commissioner may impose such requirements, as to large private landowners and State agencies. As to Federal agencies such as BLM, probably not.

<u>Question</u>: 3. Can the commissioner declare a Zone of Infestation only on state or municipal lands, thus leaving "inholdings" of private land or that in other agencies' jurisdictions "undeclared?"

<u>Answer</u>: This would probably be self defeating. The basis for requiring landowners to incur the expense of removing bug infested timber must be predicated on scientific testimony of

entomologists. I am certain you could not get any entomologist to state that the bug infestation on private land is a less serious problem than bug infestation on the adjoining public land. Thus, any such action would undercut the very basis for the emergency type actions contemplated by AS 41.17.082(b).

Question: 4. Does AS 41.17.082(b) limit the commissioner's authority to require action on infested lands only if it can be proven that the infestation is due to improper "timber clearing techniques?"

Answer: Yes. There must be a finding of "timber clearing activities that create conditions fostering outbreaks of infestation or infection that threaten forest resources on forest lands belonging to another person." AS 41.17.082(b).

Question: 5. Can the commissioner act under the authority of AS 41.17.082(b) without declaring a Zone of Infestation as noted in AS 41.17.082(d)?

Answer: Yes. He must, however, make findings that a forest landowner is violating AS 41.17.082(b) by engaging in conduct that will cause infestation etc. Parts (b) and (d) are really independent of each other. Part (b) works as a "stick" to compel solutions; Part (d) works as a "carrot" to seek or contract for solutions.

Question: 6. Does the declaration of the Zone of Infestation relieve DOF from any procedural or public notice requirements for timber harvest operations on state land?

Answer: I do not find the word "declaration" in AS 41.17.082. However, part (d) does use the word "determination." A "determination" under (d) sets the scene for "agreements" to control the infestation. It may be that agreements with landowners or governmental organizations under (d) would be outside of normal sale or procurement regulations for certain purposes. For example, in 1991 the State entered into agreement with the Kenai Peninsula Borough whereby the KPB received State dollars and contracted under its procedures for reduction of fuel loading at Cooper Landing. Incidentally, this was all done without a determination of an infestation zone under AS 41.17.082.

However, if it is contemplated that the trees would be removed by parties other than governments or landowners, then public process would be required. If the trees were to be removed by means of a timber sale, it would be required to utilize the timber and materials sales laws and regulations. AS 38.05.110 et seq. The only exception to this is the so called "Schnabel Law," AS 38.05.118 which allows negotiated timber sales in those instances where there is the requisite finding of "(1) a high level of unemployment; (2) an underutilized timber manufacturing capacity; and (3) an underutilized allowable cut of state timber." If these findings are made, then public notice is given under AS 38.05.945 and the Commissioner may negotiate a sale "to a local manufacturer at appraised value." The sale would still require all the same preparation work for a normal timber sale. The one difference is that it would eliminate competitive bidding.

If the State were to hire a contractor to remove the dead trees and reduce fuel loading for the forest, then the State would have to go through normal contracting and procurement procedures.

I hope that this answers your inquiry. If you need more specific advice on any specific proposals please feel free to contact me.

Proposed Regulations for Emergency Timber Sales

October 22, 1992

Dear Alaskan:

Enclosed is a Proposed amendment to the Alaska Department of Natural Resources Timber and Material Sales Regulations. The Department is seeking written comments on the proposed regulation through nOVEMBER 30, 1992. The enclosed public notice provides information as to where you can send your written comments on the proposed regulation.

Origin of this proposal - The 1990 Alaska Legislature passed legislation requiring the Department to annually prepare a five-year schedule of timber sales (AS 38.05.113). The legislation also authorizes the Department to adopt regulations to exempt small and emergency timber sales from this requirement. Because of the spruce bark beetle infestation on the Kenai Peninsula and other parts of the State, the Department must be able to act in a timely manner to salvage the timber before it looses its value. The 1990 legislation requires that a timber sale must appear in the five-year harvest schedule at least two times before it can be sold. This proposed amendment would exempt from the requirements of the five-year harvest schedule timber that has been damaged by acts of nature, such as fire, storms, insect infestations, etc. It will also permit the Department to sell small volumes (under 500,000 board feet) on a negotiated basis, without listing the sale in the five year schedule.

However, the Department will still be required to comply with all other laws and regulations relating to the disposal of forest products.

This proposed regulation will not require any additional funding.

The Department of Natural Resources welcomes your comments on the draft regulation. The <u>underlined</u> wording indicates new material that the Department proposes to add to the existing regulation.

Agency Contacts the Division of Forestry employees who can answer your questions about the proposed regulation are:

Bob Dick	762-2501
George Hollett	762-2503
Dave Wallingford	762-2511

The Department of Natural Resources wishes to thank you for your time and interest in this matter.

Sincerely,

Bob Dick

Enclosure

NOTICE OF PROPOSED CHANGES IN THE REGULATIONS OF THE DEPARTMENT OF NATURAL RESOURCES

Notice is hereby given that the Department of Natural Resources, under the Authority of AS 38.05.020, proposes to amend regulations in Title 11 of the Alaska Administrative code to exempt small and emergency timber sales from the requirements of AS 38.05.113.

11 AAC 71.010 is proposed to be amended to exempt timber sales negotiated under AS 38.05.115 and timber sales that have been designated to be emergency sales because of extensive damage to the timber caused by fire, storms, floods, insect infestations or other acts of nature, from the five-year sales schedule and two year listing requirements of AS 38.05.113. This amendment will permit the department to speed up the salvage of damaged timber and speed up the negotiation of small timber sales.

Notice is also given that any person interested may present written statements or arguments relevant to the proposed action to Commissioner Glenn Olds, Department of Natural Resources, P.O. Box 107005, Anchorage, Alaska 99510, to be received no later than November 30, 1992.

This action will not require an increased appropriation.

Copies of the proposed regulations may be obtained by writing to the Department of Natural Resources at the above address or in person form the department's Public Information Center in Anchorage, 3601 "C" Street, Suite 200, or the Division of Forestry's office in Fairbanks (3700 Airport Way) or Juneau (400 Willoughby Avenue, fifth floor).

If you are a person with a disability who may need a special modification in order to comment on the proposed regulation, please contact Bob Dick, phone number 762-2501 no later than November 27, 1992, to make any necessary arrangements.

The Department of Natural Resources, after the close of the comment period, will either adopt the amended regulation or other proposals dealing with the same subject, without further notice, or decide to take no action.

DATE: October 23, 1992

Bob Dick

SIGNATURE:

11 AAC 71.010. TIMBER AND MATERIAL SALE OFFERINGS. (a) The director will determine the location and approximate volumes of timber and of material to be made available for sale under this chapter,

(b) The director will prepare on an annual basis a timber sales plan meeting the requirements of AS 38.05.113, for all timber sales proposed for sale during the five year period, except for those exempted by this section.

(c) Timber sales negotiated under AS 38.05.115 are exempt from AS 38.05.113 and (b) of this section.

(d) Emergency sales are exempt from AS 38.05.113 and (b) of this section. Emergency sales are sales of timber which must be made on a expedited basis:

(1) to avoid loss of market value of timber which has been damaged by fire, storm, blowdown, insect infestation or acts of nature, or

(2) to avoid loss of market value of timber which is threatened by insect infestation, or

(3) to create fire breaks or reduce fuel-loading of the forest or to halt the spread of insect infestation.

The director shall make findings as to the need for an emergency sale.

(e) The division will offer timber or material sales on land selected by a municipality under AS 29.18.201 -- 29.18.213 with the concurrence of the municipality. (Eff. __/__/__, Reg. __)

Authority: AS 38.05.020
AS 38.05.110
AS 38.05.113
AS 38.05.115
AS 38.05.120

Chronology

July, 1991	Legislature funds Forest Health Initiative
July, 1991	Aerial surveys of spruce beetles on Kenai Peninsula
August 1, 1991	Project Manager hired
August 10, 1991	Planning Team formed
Sept., 1991	Review of Falls Creek Cooperative Timber Sale
Sept., 1991	Review of Zone of Infestation determination
October, 1991	Public Participation Strategic Plan completed
Oct.– Nov., 1991	Planning Team meetings continue
Jan. 9, 1992	Presentation to Alaska Board of Forestry
Jan. 14–16, 1992	State and federal forest health meeting, Moose Pass
Jan. 29, 1992	Policy Group meeting, Anchorage
February, 1992	Falls Creek Cooperative Timber Sale executed
Feb. 14-22, 1992	Fur Rendezvous demonstration cabin project (4,100 visitors)
Feb. 20. 1992	Planning Team Meeting, Anchorage
Feb. 26. 1992	Initial Working Group meeting, Soldotna
March, 1992	Lessard and Oja of Forest Service assigned to FHI part-time
March 11, 1992	Working Group meeting, Kenai
March 27, 1992	Working Group meeting, Soldotna
April 3, 1992	Presentation to Society of American Foresters
April 7, 1992	Working Group meeting, Kenai
April 29, 1992	Working Group meeting, Kenai
May 6, 1992	Open House, Anchorage
May 5, 1992	Meeting with Lt. Governor Coghill
May 11, 1992	Open House, Homer
May 12, 1992	Working Group field trip, Cooper Landing
May 13, 1992	Working Group meeting, Soldotna
May 13, 1992	Open House, Soldotna
May 14, 1992	Open House, Ninilchik
May 27, 1992	Working Group meeting, Kenai
June 15, 1992	Work on draft plan began
July 1, 1992	First draft of plan completed
July 13-14, 1992	Beetle Summit with Lt. Governor Coghill on Kenai Peninsula
July, 1992	Aerial surveys of spruce beetles on Kenai Peninsula
August 7, 1992	Public review draft of plan available
August 11, 1992	Working Group meeting, Soldotna
August 18, 1992	Public meeting for comments on plan, Homer
August 20, 1992	Public meeting for comments on plan, Soldotna
August 24, 1992	Public meeting for comments on plan, Anchorage
August 28, 1992	Deadline for public comments
November 2, 1992	Final plan available

STATE OF ALASKA

WALTER J. HICKEL, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

RECEIVED
JUN 1 1994
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL
ADMINISTRATIVE RECORD

OFFICE OF THE COMMISSIONER
410 WILLOUGHBY AVENUE, SUITE 105
JUNEAU, AK 99801-1795

Phone: (907) 465-5050
Fax: (907) 465-5070

May 18, 1994

MEMORANDUM

TO: Harry Noah
Commissioner

Robert Williams
Acting Regional Forester
USDA - Forest Service
PO Box 21628
Juneau, AK 99802-1628

FROM:

SUBJECT: 1993 Forest Health
lication

1993 Forest Insect and Disease Conditions in Alaska - This is an update to reports which appear in Forest Health, Comb bound volume 11.4.8

I want to c ger Burnside of your staffs for sect and disease conditions ur agencies. The discussion cle in forest ecosystems is of speci those agencies and people interested of forest ecosystems. The fact th oing and new infestations were survey destruction of critical habitat for species dependent on large diameter spruce stands.

This information will be particularly valuable for the Exxon Valdez Oil Spill (EVOS) Trustee Council, the Public Advisory Group and other working groups dealing with the protection and restoration of critical habitat for species injured by the spill. The Federal/State "partnership" to establish a Cooperative Watershed Restoration Program for restoring coastal watersheds should also benefit by this information.

I would urge sufficient copies of the complete report be transmitted to Jim Ayers, Executive Director for the Trustee Council, for distribution to the EVOS Trustees, the Public Advisory Group and the Habitat and Restoration working groups.

Thank you for the excellent report.

cc: EVOS Trustees; Jim Ayers and Staff; Public Advisory Group
Cooperative Watershed Restoration Program Staff
(Enclosure with cc's - Title page and pages 1-7)
FILE:BEETLE93

05/20/94 10:10 907 465 5070 ADEC RESTORATION → EV Restoration 11.4.8 I 002

STATE OF ALASKA

WALTER J. HICKEL, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

RECEIVED
JUN 1 1994
EXXON VALDEZ OIL SPILL
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Phone: (907) 465-5050
Fax: (907) 465-5070

May 18, 1994

MEMORANDUM

TO: Harry Noah
Commissioner
Dept. of Natural Resources
400 Willougby Avenue
Juneau, AK 99801-1724

Robert Williams
Acting Regional Forester
USDA - Forest Service
PO Box 21628
Juneau, AK 99802-1628

FROM: John A. Sandor, Commissioner

SUBJECT: 1994 Aerial Survey Requests; 1993 Forest Health Management Report and map publication

I want to compliment Robert Wolfe and Roger Burnside of your staffs for the detailed Alaska forest insect and disease conditions report jointly produced by your agencies. The discussion of the role of the spruce beetle in forest ecosystems is of special interest, particularly to those agencies and people interested in protection and restoration of forest ecosystems. The fact that over 700,000 acres of on-going and new infestations were surveyed, confirms the increasing destruction of critical habitat for species dependent on large diameter spruce stands.

This information will be particularly valuable for the Exxon Valdez Oil Spill (EVOS) Trustee Council, the Public Advisory Group and other working groups dealing with the protection and restoration of critical habitat for species injured by the spill. The Federal/State "partnership" to establish a Cooperative Watershed Restoration Program for restoring coastal watersheds should also benefit by this information.

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Thank you for the excellent report.

cc: EVOS Trustees; Jim Ayers and Staff; Public Advisory Group
Cooperative Watershed Restoration Program Staff
(Enclosure with cc's - Title page and pages 1-7)
FILE:BEETLE93

FOREST INSECT AND DISEASE CONDITIONS IN ALASKA – 1993

General Technical Report R10-TP-40

February 1994

Prepared by:

Paul Hennon, Pathologist
Roy Mask, Entomologist
Ed Holsten, Entomologist

Forest Health Management
State and Private Forestry
Alaska Region
USDA Forest Service
3301 "C" Street, Suite 522
Anchorage, AK 99503

FOREST INSECT AND DISEASE CONDITIONS IN ALASKA - 1993

CONDITIONS IN BRIEF

Forest insect and disease populations and related damage increased throughout Alaskan forests in 1993. All of Alaska experienced an early and record warm spring and summer; the driest summer in almost 75 years. As a consequence, insect populations responded with population increases and shortened life cycles. Spruce bark beetle activity increased for the fifth consecutive year. New and ongoing bark beetle infestations, as determined by 1993 aerial surveys, now affect approximately 700,000 acres. While spruce beetle populations have increased dramatically in the Kenai Peninsula and Copper River Basin areas, they have been offset by a decrease in beetle activity along the Yukon River and on the west side of Cook Inlet. Spruce beetle populations in Sitka spruce along Turnagain Arm have remained static, although an increase along the Sixmile River and Hope Road, primarily near Walker Creek, was noted. Spruce beetle populations have also increased in the Kachemak Bay area where more than 14,000 acres of Sitka spruce are infested on the south side of the bay.

Hardwood defoliator activity has decreased from 150,000 acres in 1992 to 41,000 acres in 1993. A significant decline in the amount of defoliated willow accounts for much of this reduction. Spruce budworm defoliation in interior Alaska also declined in 1993 by more than 133,000 acres. However, almost 4,000 acres of new budworm defoliation was detected near Lake Clark this year. Black-headed budworm populations have continued to decline in the Prince William Sound and in the Turnagain Pass/Portage areas.

In southeast Alaska, coastal spruce-hemlock forests are experiencing the largest black-headed budworm epidemic in the past 40 years. For the third consecutive year, vast areas were impacted by budworm defoliation. Over 258,000 acres of black-headed budworm defoliation was noted in 1993. Budworm activity was concentrated primarily north of Frederick Sound. Increases in defoliated acreage are expected again in 1994, as the outbreak continues. Hemlock sawfly populations in southeast Alaska also increased, impacting approximately 19,000 acres, a threefold increase over 1992. The most spectacular defoliation observed in the spruce-hemlock forests of southeast Alaska in 1993 was apparent on approximately 12,000 acres, where black-headed budworm and hemlock sawfly caused simultaneous impact. Spruce beetle activity in 1993 continued at two locations in southeast Alaska. The outbreak near Haines continued to expand and activity was noted on approximately 20,000 acres. Salvage operations are ongoing on portions of the Haines State Forest. Spruce beetle activity in Glacier Bay National Park declined and now totals approximately 2800 acres. Spruce beetles remain a concern in the Park, however, as the area of current activity includes the visitor's center and related developments. After causing substantial damage to southeast Alaska Sitka spruce in 1992, spruce needle aphid populations collapsed during extended periods of sub-freezing temperatures in January and February, 1993. Defoliation of Sitka alder (by several insect species) was prevalent throughout most of southeast Alaska in 1993.

Yellow-cedar decline, wood decay of live trees, and hemlock dwarf mistletoe were the most significant diseases of Alaskan forests. All three have both economic impact and alter ecological conditions including forest structure, composition, and succession. Wildlife habitat is provided directly by heart rot and dwarf mistletoe through the formation of tree cavities and witches brooms, respectively. More than 526,000 acres of cedar decline occur in Southeast Alaska in a broad band from western Chichagof Island through the Ketchikan area. Heartrot and buttrot fungi caused significant cull in all tree species in Alaska. Hemlock dwarf mistletoe continued to cause growth loss and mortality in old-growth forests of Southeast Alaska; its impact in young-growth stands appears to depend on the presence of large infected residuals left after harvesting of the previous stands. An outbreak of hemlock canker, apparently caused by a fungus and possibly aggravated by dust, killed small hemlocks and the lower branches of large hemlock trees along unpaved roads on Prince of Wales Island, near Rowan Bay on Kuiu Island, Corner Bay on Chichagof Island, and Caroll Inlet on Revillagigedo Island. The disease was found for the first time away from roads in natural openings in forests and along streams. Spruce needle rust was present at high levels throughout Alaska, particularly around Petersburg, but most other foliar pathogens occurred at low to moderate levels in 1993. *Rhizosphaera pini* needle cast was found causing considerable damage to the lower crowns of Sitka spruce for the first time in southeast Alaska. Porcupines continued to damage spruce and hemlock in valuable young-growth stands in southeast Alaska. Decay, canker, and foliar fungi caused a large, but unmeasured damage to hardwood species in interior Alaska.

Table 1 summarizes insect and disease activity by land ownership.

Table 1. 1993 Forest insect and disease infestation in Alaska by land ownership and agent.[a]

Pest	National Forest	Other Federal	Native	State & Private
	Acres			
Spruce beetle	26,240	191,300	150,810	356,400
Engravers	----	1,990	1,970	330
Spruce budworm	----	6,860	----	26,700
Black-headed budworm	199,300	----	21,800	37,950
Hemlock sawfly	12,100	----	780	6,090
Spruce needle aphid	620	----	----	----
Large aspen tortrix	----	14,000	24,050	25,380
Alder defoliation	430	120	310	100
Birch defoliation	----	----	----	150
Cottonwood defoliation	1,550	930	10	410
Willow defoliation	----	36,380	1,900	2,360
Larch Sawfly	----	1,780	500	9,940
Black Moth	----	5	----	5,450
Yellow-cedar decline[b]	541,350	----	17,670	10,430
Totals	781,590	253,365	219,800	481,690

Grand Total = 1,736,445 acres

[a] Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) because these losses are not detectable in aerial surveys.

[b] Value of yellow-cedar decline is not restricted to the acreage with a high concentration of dying trees for this year; it represents stands that generally have long-dead trees, recently-dead trees, dying trees, and some healthy trees. See discussion of yellow-cedar decline for a detailed listing of acreage affected by island and Ranger District.

STATUS OF INSECTS

ROLE OF SPRUCE BEETLE IN FOREST ECOSYSTEMS

There are a variety of impacts associated with spruce beetle infestations to forest resources, both timber and non-timber. These impacts can be viewed positively or negatively depending on the forest resources in question. Some of the impacts associated with spruce beetle infestations include, but are not limited to: **(1) Loss of merchantable value of killed trees:** The value of a spruce as sawtimber is reduced within three years of attack in south-central Alaska as weather checking and increased sap-rots occur. The value of a beetle killed tree as houselogs, chips, or firewood continues for some time; **(2) Long term stand conversion:** To optimally regenerate both spruce and birch, a site disturbance (i.e. fire, windthrow, flooding, etc.) is required which results in a seed bed comprised of bare mineral soil with some organic material. If there is adequate seed source, such site disturbances provide excellent sites for regeneration. However, what is occurring on many sites in south-central Alaska after spruce beetles have "opened up" the canopy is that there is a paucity of regeneration coming in as there has been minimal site disturbance. Under such conditions, grass and other competing vegetation quickly invade the site and prevent future colonization by tree species; **(3) Impacts to wildlife habitat:** Those wildlife species that are dependent on large diameter spruce stands are negatively impacted. Those species that benefit from early successional stage vegetation will benefit from spruce beetle infestations as stand composition changes; **(4) Impact to scenic quality:** Recent studies have demonstrated that there is a significant decline in scenic quality of spruce beetle impacted stands and that scenic beauty is an important forest resource. Along scenic corridors, maintaining or enhancing scenic quality necessitates minimizing impacts from spruce beetle infestations; **(5) Fire hazard:** There is concern that fire hazard of spruce beetle impacted stands will increase over time as dead trees fall, dry grass accumulates, thus increasing fuel loading; and **(6) Impact to fisheries:** If salmon spawning streams are bordered by large diameter spruce and if these trees are subsequently killed by spruce beetles, there is a concern as to the long term availability of large woody debris in the streams. A continual supply of large woody debris in spawning streams is a necessary component for spawning habitat integrity.

There are a variety of techniques that can be used to prevent, mitigate, or reduce impacts associated with spruce beetle infestations. However, before pest management prescriptions can be developed, the resource objective(s) for a particular stand, watershed, landscape, etc. must be determined. The forest manager must evaluate the resource values and economics of management actions for each stand in light of management objectives. The beetle population level must also be considered because population levels will determine the priority of management actions and the type of strategy to be invoked.

SPRUCE BEETLE
Dendroctonus rufipennis Kirby

Spruce beetle continue to impact vast areas in Alaska (Fig. 1). Areas of active infestation have increased by almost 100,000 acres in 1993. This large increase was offset somewhat by the continued decline of outbreaks along the Yukon River and on the west side of Cook Inlet. An exceptionally warm spring and summer for the fifth consecutive year may have lent impetus to the expanding spruce beetle populations in the Copper River Basin and throughout the Kenai Peninsula.

Spruce mortality on the Chugach National Forest remained nearly static (28,658 acres in 1992 vs. 26,224 acres in 1993). The areas of major activity on the Forest are: Russian, Kenai, and Cooper Lakes--18,449 acres; Summit Lake to Broadview Guard Station--3,503 acres; Ingram Creek to Hope and Palmer Creek--905 acres; and the Moose Pass area including Trail and Grant Lakes and the Placer River--4,593 acres.

From Pt. Possession at the northern tip of the Kenai Peninsula to Kachemak Bay in the south, spruce beetle caused mortality has increased by almost 100,000 acres. The 1993 total is 397,771 acres (300,000 acres in 1992). From Skilak Lake south to Ninilchik and Homer and east to Caribou Hills, almost 57,000 acres of mortality was noted. East of the Caribou Hills, in the Fox River drainage, approximately 30,000 acres of spruce beetle activity was aerially detected in 1993.

In the Kachemak Bay area, acres impacted by spruce beetles have more than tripled this year, from 12,454 acres in 1992 to 40,401 acres in 1993. The most intense areas of activity are along the north side of the bay and in the Fox River Valley. Much of the affected acreage is located on lands in private ownership along East End Road. On the south shore of the bay, spruce beetle activity is as follows: Humpy Creek to Bradley Lake--9,808 acres; Halibut Cove--2,180 acres; China Poot lake--934 acres; Sadie Cove--234 acres; Tutka Bay--311 acres; and Seldovia--545 acres.

On the west side of Cook Inlet, from Beluga Lake to Skwentna River, spruce beetle activity decreased by half from 2,958 acres in 1992 to 1,570 acres in 1993. The most significant area of spruce beetle activity occurs north of the Skwentna River, about 6 miles northwest of Porcupine Butte and covers 6,000 acres between Finger Lake and Shirley Lake. The infestation detected in 1992 along the McArthur River remains unchanged (1,168 acres in 1992 vs. 1,036 acres in 1993).

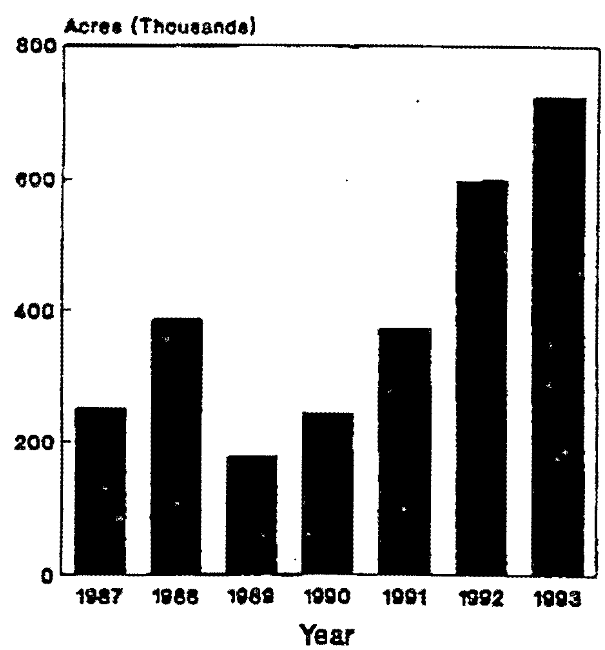

Figure 1. Acres of ongoing and new spruce beetle infestations in Alaska, 1987-1993.

Spruce beetle activity decreased in 1993 in stands of Sitka spruce along Turnagain Arm; 585 acres in 1992 vs. 155 acres in 1993. Activity did increase, however, along the Hope Road and Sixmile Creek to 475 acres with about 300 of those acres located at the mouth of Walker Creek. Along Resurrection Creek Road and Palmer Creek Road, mortality attributed to spruce beetles amounted to 420 acres.

Spruce beetle activity increased by more than 1,000 acres over 1992 levels in the Anchorage Bowl area. The outbreak in south Anchorage remained static with 1,125 acres of infested spruce reported again this year. Fire Island spruce beetle activity rose sharply from 415 acres to 925 acres in 1993 with heavy activity noted in several areas of spruce. The Pt. Campbell Military Reservation sustained 190 acres of spruce mortality with another 45 acres on lands immediately adjacent.

Just north of Anchorage, the spruce beetle continues to be quite active; 1,435 acres of infested spruce in the lower Eagle River Valley were reported while an additional 120 acres were detected at the head of the valley. This compares to 1,070 acres reported in 1992. In the Eklutna River Valley, 1,314 acres of spruce beetle activity were detected. Activity in the Knik River/Palmer/Bodenburg Butte area accounted for 4,599 acres. The most intense area of activity in the Matanuska Valley occurs along the Glenn Highway from Chickaloon to Gunsight Mountain where 15,880 acres of infested spruce were detected in 1993. This represents an increase of 9,886 acres over levels noted in 1992.

Southwest of Anchorage, in the Iliamna-Lake Clark area, spruce beetle activity is on the increase. Throughout the east end of Lake Iliamna, from Kakhonak Lake to Pile Bay, spruce beetle caused mortality was detected over 24,063 acres; an increase of 13,362 acres over 1992 levels. In the Lake Clark area, from the northeast end of the lake to the pass, an increase of 1,265 acres over levels infested in 1992 was noted.

The Copper River Basin represents the most rapidly expanding area of spruce beetle activity in the state. All infested areas noted in 1992 have increased in size and new areas have been detected. From Gulkana in the north to Chitina in the south, and east to McCarthy, acres infested by spruce beetles have increased from 77,426 to 170,045 acres; an increase of 92,619 acres. New areas of activity include: Klutina Lake--33,706 acres; from Chitina south along the Copper River to Spirit Mountain--20,473 acres; and along the Chitina River from the mouth of Tebay River east to McCarthy--19,694 acres. Areas of continuing and expanding activity include: 83,214 acres from Copper River to the Tiekel River, west of the Copper River--+ 23,508 acres over 1992 levels; 20,084 acres along the east side of the Copper River from Copper Center to Chitina within the Wrangell-St. Elias National Park, and 7,400 acres in the Glennallen/Gulkana area which represents an increase of 2,057 acres over 1992 levels.

Spruce beetle activity decreased by 41,267 acres along the Yukon River since 1992; 11,047 acres remain infested in 1993. The largest area of activity (8,096 acres across the Yukon River from Kaltag) was found to have less than one infested tree per acre in 1993. The Nulato River area, where 11,365 acres of spruce beetle activity was detected in 1992, was not flown in 1993; but will be re-surveyed in 1994.

The Kuskokwim River Drainage experienced a slight decline in spruce beetle activity. Although spruce beetle activity between Sleetmute and Deacon's Landing remained high (10,406 acres), a 7,000 acre block of spruce beetle activity detected in 1992, 15 miles east of Aniak declined to 20 acres in 1993. Likewise, the infested areas along the Kuskokwim River from McGrath downriver to Deacon's Landing decreased from 4,500 acres in 1992 to 3,000 acres in 1993.

In Southeast Alaska, the spruce beetle outbreak near Haines continued to expand, while the outbreak in Glacier Bay National Park declined. The two outbreaks combined impact approximately 24,000 acres.

During the last 15 years in Glacier Bay National Park, approximately 29,000 acres of mature Sitka spruce have been impacted by spruce beetle. Areas of heavy mortality, located among the Beardsley Islands, are now being regenerated primarily by western hemlock.

In 1993, spruce beetle activity was noted on approximately 2800 acres, located primarily within the Beardsley Islands and on the mainland between the park's visitor center and Point Gustavus. Although spruce beetle activity in the Park has declined in three of the last four years, concern is high since the area of current infestation includes the visitor's center and associated developments. The Park has recently implemented a hazard tree management program to address beetle-killed trees in developed areas. In the absence of catastrophic windthrow events, spruce beetle activity within Glacier Bay National Park should continue to decline during the next few years.

The spruce beetle outbreak on state and adjoining lands near Haines continued to expand in 1993. Current activity totals almost 21,000 acres on state, private and federal (BLM, USDI) lands. Beetle activity occurs in the Klehini, Chilkat, Kelsall and Tsirku River drainages. Scattered windthrow events at various times during 1992 and 1993 will contribute to the outbreak's duration.

Salvage and sanitation harvests within spruce beetle-impacted and wind damaged areas are ongoing (or planned) on state lands in the Klehini and Kelsall River drainages.

In 1993, spruce beetle infestations throughout Alaska by ownership are as follows; National Forest land --26,240 acres; State and Private--356,400 acres, Native land--150,810 acres and other Federal lands (e.g. Kenai National Wildlife Refuge, National Parks, etc.)--191,300 acres.

ENGRAVERS
Ips perturbatus Eichh.

1993 aerial detection surveys noted an increase of 2,352 acres of engraver infested white spruce over levels detected in 1992. All but about 400 acres were located throughout the Yukon Flats area along the Yukon, Porcupine, Chandalar, and Christian Rivers. The remainder is divided more or less evenly in small pockets along the Kuskokwim, Koyukuk, and Tanana Rivers.

11.4.8 H

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

August 17, 1993

TO: Trustee Council

FROM: Dave R. Gibbons drg
Interim Administrative Director

SUBJECT: Review material for August 23 Trustee Council Meeting

Later today, I will be delivering a copy of the review material for the August 23rd Trustee Council meeting. It will contain an options letter concerning the publication of the oil spill symposium proceedings and interim funding for the period of October 1, 1993 through January 31, 1994. Later this week, I will fax to each of you a brief memorandum with examples of restoration objectives. I've enclosed a copy of the agenda for your information.

EXXON VALDEZ TRUSTEE COUNCIL
1994 Federal Fiscal Year Project Budget
October 1, 1993 - September 30, 1994

Agency	Cooperating Agency(s)	Project Number	Project Title	NEPA Cost*	Reprt/Intrm 1-Oct-93 - 31-Jan-94	Report** 1-Oct-93 - **	Interim 1-Oct-93 - 31-Jan-94
ADEC	NOAA/DOI-NPS	94090	Mussel Bed Restoration & Monitoring	$0.0	$0.0	$0.0	$0.0
	ADNR/ADF&G/ USFS/DOI-FWS/ DOI-NPS	94110	Habitat Protection - Data Acquisition & Support	$0.0	$6.4	$0.0	$6.4
	ADF&G/ADNR/ USFS/DOI/NOAA	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0
	ADF&G/ADNR/ USFS/DOI/NOAA	94266	Shoreline Assessment & Oil Removal	$0.0	$25.6	$25.6	$0.0
	ADF&G/NOAA	94285	Subtidal Sediment Recovery Monitoring	$0.0	$21.4	$21.4	$0.0
		94417	Waste Oil Disposal Facilities	$0.0	$0.0	$0.0	$0.0
	ADNR/USFS/DOI	940ED	Executive Director's Office	$0.0	$420.3	$0.0	$420.3
	ADF&G/ADNR/ USFS/DOI/NOAA	940FC	Finance Committee	$0.0	$8.5	$0.0	$8.5
	USFS/DOI	94PAG	Public Advisory Group	$0.0	$10.7	$0.0	$10.7
	ADF&G/ADNR/ USFS/DOI/NOAA	940RT	Restoration Team Support	$0.0	$264.6	$0.0	$264.6
			ADEC Total	$0.0	$757.5	$47.0	$710.5
ADF&G	USFS	94043	Cutthroat & Dolly Habitat Restoration in PWS	$0.0	$0.0	$0.0	$0.0
		94064	Harbor Seal Habitat Use and Monitoring	$0.0	$116.9	$116.9	$0.0
	NOAA	94066	Harlequin Duck Recovery Monitoring	$0.0	$162.4	$162.4	$0.0
		94068	Deposit Sand to Promote Clam Recruitment	$2.0	$0.0	$0.0	$0.0
		94070	Restoration of High Intertidal Fucus	$5.0	$0.0	$0.0	$0.0
	NOAA	94081	Recruitment Monitoring of Littleneck Clams	$0.0	$0.0	$0.0	$0.0
		94086	Herring Bay Experimental & Monitoring Studies	$0.0	$198.0	$198.0	$0.0
	ADEC/ADNR/ USFS/DOI-FWS/	94110	Habitat Protection - Data Acquisition & Support	$0.0	$67.5	$0.0	$67.5
		94137	Stock ID of Chum, Sockeye, & Kings in PWS	$0.0	$46.7	$46.7	$0.0
	USFS	94139	Salmon Instream Habitat & Stock Restoration	$6.0	$0.0	$0.0	$0.0
	ADEC/ADNR/ USFS/DOI/NOAA	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0

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ADF&G (cont)	NOAA	94163	Forage Fish Influence on Injured Species	$0.0	$0.0	$0.0	$0.0
		94165	Herring Genetic Stock Identification in PWS	$0.0	$0.0	$0.0	$0.0
	NOAA	94166	Herring Spawn Deposition & Reproductive Impairment	$0.0	$40.2	$0.0	$40.2
		94184	Coded Wire Tag Recoveries from Pinks in PWS	$0.0	$47.8	$47.8	$0.0
		94185	Coded Wire Tagging of Wild Pinks for Stock ID	$0.0	$40.8	$0.0	$40.8
		94187	Otolith Marking - Inseason Stock Separation	$0.0	$0.0	$0.0	$0.0
		94189	Pink Salmon Stock Genetics in PWS	$0.0	$0.0	$0.0	$0.0
	NOAA	94191	Oil Related Egg & Alevin Mortalities	$0.0	$206.3	$149.6	$56.7
		94192	Evaluation of Hatchery Straying on Wild Pinks in PWS	$0.0	$0.0	$0.0	$0.0
	NOAA	94237	River Otter Recovery Monitoring	$0.0	$0.0	$0.0	$0.0
		94241	Rockfish Management Plan Development	$0.0	$0.0	$0.0	$0.0
		94244	Seal & Otter Coop Subsistence Harvest Assistance	$0.0	$0.0	$0.0	$0.0
		94255	Kenai River Sockeye Salmon Restoration	$0.0	$120.0	$120.0	$0.0
		94258	Sockeye Salmon Overescapement	$0.0	$379.2	$238.0	$141.2
	USFS	94259	Coghill Lake Sockeye Salmon Restoration	$0.0	$76.6	$76.6	$0.0
	ADEC/ADNR/ USFS/DOI/NOAA	94266	Shoreline Assessment & Oil Removal	$0.0	$0.0	$0.0	$0.0
		94272	Chenega Chinook & Coho Release Program	$0.0	$0.0	$0.0	$0.0
		94273	Port Graham Salmon Hatchery	$10.0	$0.0	$0.0	$0.0
		94277	Village Mariculture - Oyster Farming	$0.0	$0.0	$0.0	$0.0
	NOAA	94279	Subsistence Food Safety Testing	$0.0	$56.9	$56.9	$0.0
		94280	Spot Shrimp Survey & Juvenile Shrimp Habitat ID	$0.0	$0.0	$0.0	$0.0
	ADEC/NOAA	94285	Subtidal Sediment Recovery Monitoring	$0.0	$220.4	$220.4	$0.0
		94345	Evaluation of Streams on the Lower Kenai Pen.	$0.0	$0.0	$0.0	$0.0
		94504	Genetic Stock ID of Kenai River Sockeye	$0.0	$262.2	$262.2	$0.0
	USFS/DOI-FWS	94505	Information Needs for Habitat Protection	$0.0	$137.5	$137.5	$0.0
	ADEC/ADNR/ USFS/DOI/NOAA	940FC	Finance Committee	$0.0	$6.5	$0.0	$6.5
	ADEC/ADNR/ USFS/DOI/NOAA	940RT	Restoration Team Support	$0.0	$182.3	$0.0	$182.3
			ADF&G Total	$23.0	$2,368.2	$1,833.0	$535.2

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ADNR	USFS/DOI-FWS/ DOI-NPS	94007	Site Specific Archeological Restoration	$0.0	$50.8	$50.8	$0.0
	USFS/DOI-FWS/ DOI-NPS	94015	Archeological Site Stewardship	$0.0	$0.0	$0.0	$0.0
		94025	Kodiak Fishery Technology Center	$5.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ USFS/DOI-FWS/ DOI-NPS	94110	Habitat Protection - Data Acquisition & Support	$0.0	$134.6	$0.0	$134.6
	USFS/DOI-FWS/ DOI-NPS	94126	Habitat Protection & Acquisition Fund	$0.0	$98.2	$0.0	$98.2
	ADEC/ADF&G/ USFS/DOI/NOAA	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0
		94199	Seward Sea Life Center	$5.0	$0.0	$0.0	$0.0
	USFS	94200	Public Land Access 17(b) Easement ID	$0.0	$0.0	$0.0	$0.0
	DOI-NPS	94216	Gulf of Alaska Recreation Plan Development	$0.0	$0.0	$0.0	$0.0
	USFS	94217	PWS Area Recreation Plan Implementation	$0.0	$54.5	$54.5	$0.0
	ADEC/ADF&G/ USFS/DOI/NOAA	94266	Shoreline Assessment & Oil Removal	$0.0	$0.0	$0.0	$0.0
		94316	Shoreline Trash Cleanup for Oil Spill Area	$0.0	$0.0	$0.0	$0.0
	USFS/DOI-FWS/ DOI-NPS	94386	Artifact Repositories - Planning & Design	$0.0	$0.0	$0.0	$0.0
	ADEC/USFS/DOI	940ED	Executive Director's Office	$0.0	$629.1	$0.0	$629.1
	ADEC/ADF&G/ USFS/DOI/NOAA	940FC	Finance Committee	$0.0	$10.2	$0.0	$10.2
	ADEC/ADF&G/ USFS/DOI/NOAA	940RT	Restoration Team Support	$0.0	$209.8	$0.0	$209.8
			ADNR Total	$10.0	$1,187.2	$105.3	$1,081.9

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USFS	ADNR/DOI-FWS/ DOI-NPS	94007	Site Specific Archeological Restoration	$13.9	$26.5	$0.0	$26.5
	ADNR/DOI-FWS/ DOI-NPS	94015	Archeological Site Stewardship	$0.0	$0.0	$0.0	$0.0
	ADF&G	94043	Cutthroat & Dolly Habitat Restoration in PWS	$3.5	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/DOI-FWS/ DOI-NPS	94110	Habitat Protection - Data Acquisition & Support	$0.0	$5.0	$0.0	$5.0
	ADNR/DOI-FWS/ DOI-NPS	94126	Habitat Protection & Acquisition Fund	$0.0	$103.7	$0.0	$103.7
	ADF&G	94139	Salmon Instream Habitat & Stock Restoration	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/DOI/NOAA	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0
	ADNR	94200	Public Land Access 17(b) Easement ID	$0.0	$0.0	$0.0	$0.0
	ADNR	94217	PWS Area Recreation Plan Implementation	$0.0	$85.4	$85.4	$0.0
	ADF&G	94259	Coghill Lake Sockeye Salmon Restoration	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/DOI/NOAA	94266	Shoreline Assessment & Oil Removal	$0.0	$0.0	$0.0	$0.0
	ADNR/DOI-FWS/ DOI-NPS	94386	Artifact Repositories - Planning & Design	$0.0	$0.0	$0.0	$0.0
	ADF&G/DOI-FWS	94505	Information Needs for Habitat Protection	$0.0	$193.0	$193.0	$0.0
	ADEC/ADNR/DOI	940ED	Executive Director's Office	$0.0	$932.7	$0.0	$932.7
	ADEC/ADF&G/ ADNR/DOI/NOAA	940FC	Finance Committee	$0.0	$10.9	$0.0	$10.9
	ADEC/DOI	94PAG	Public Advisory Group	$0.0	$21.4	$0.0	$21.4
	ADEC/ADF&G/ ADNR/DOI/NOAA	940RT	Restoration Team Support	$0.0	$632.7	$0.0	$632.7
			USFS Total	$17.4	$2,011.2	$278.3	$1,732.9

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DOI-FWS	ADNR/USFS/ DOI-NPS	94007	Site Specific Archeological Restoration	$0.0	$12.1	$12.1	$0.0
	ADNR/USFS/ DOI-NPS	94015	Archeological Site Stewardship	$0.0	$0.0	$0.0	$0.0
		94020	Black Oystercatcher Interaction with Intertidal	$0.0	$17.3	$17.3	$0.0
		94039	Common Murre Population Monitoring	$0.0	$26.9	$26.9	$0.0
		94040	Reduce Disturbance Near Injured Murre Colonies	$0.0	$0.0	$0.0	$0.0
		94041	Introduced Predator Removal from Islands	$0.0	$0.0	$0.0	$0.0
		94102	Marbled Murrelet Recovery Monitoring	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/USFS/ DOI-NPS	94110	Habitat Protection - Data Acquisition & Support	$0.0	$0.0	$0.0	$0.0
	ADNR/USFS/ DOI-NPS	94126	Habitat Protection & Acquisition Fund	$0.0	$74.3	$0.0	$74.3
		94159	Marine Bird & Sea Otter Boat Surveys	$0.0	$146.2	$41.6	$104.6
		94173	Pigeon Guillemot Recovery Monitoring	$0.0	$0.0	$0.0	$0.0
		94246	Sea Otter Recovery Monitoring	$0.0	$163.9	$163.9	$0.0
	ADNR/USFS/ DOI-NPS	94386	Artifact Repositories - Planning & Design	$0.0	$0.0	$0.0	$0.0
	ADF&G/USFS	94505	Information Needs for Habitat Protection	$0.0	$74.5	$74.5	$0.0
		94506	Pigeon Guillemot Recovery	$0.0	$11.2	$11.2	$0.0
			DOI-FWS Subtotal	$0.0	$526.3	$347.4	$178.9
DOI-NPS	ADNR/USFS/ DOI-FWS	94007	Site Specific Archeological Restoration	$0.0	$91.5	$91.5	$0.0
	ADNR/USFS/ DOI-FWS	94015	Archeological Site Stewardship	$0.0	$0.0	$0.0	$0.0
	ADEC/NOAA	94090	Mussel Bed Restoration & Monitoring	$0.0	$12.4	$12.4	$0.0

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DOI-NPS (cont)	ADEC/ADF&G/ ADNR/USFS/ DOI-FWS	94110	Habitat Protection - Data Acquisition & Support	$0.0	$0.0	$0.0	$0.0
	ADNR/USFS/ DOI-FWS	94126	Habitat Protection & Acquisition Fund	$0.0	$0.0	$0.0	$0.0
	ADNR	94216	Gulf of Alaska Recreation Plan Development	$0.0	$0.0	$0.0	$0.0
	ADNR/USFS/ DOI-FWS	94386	Artifact Repositories - Planning & Design	$0.0	$0.0	$0.0	$0.0
			DOI-NPS Subtotal	$0.0	$103.9	$103.9	$0.0
DOI	ADEC/ADF&G/ ADNR/USFS/ NOAA	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/USFS/ NOAA	94266	Shoreline Assessment & Oil Removal	$0.0	$0.0	$0.0	$0.0
	ADEC/ADNR/ USFS	940ED	Executive Director's Office	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/USFS/ NOAA	940FC	Finance Committee	$0.0	$5.0	$0.0	$5.0
	ADEC/USFS	94PAG	Public Advisory Group	$0.0	$42.2	$0.0	$42.2
	ADEC/ADF&G/ ADNR/USFS/ NOAA	940RT	Restoration Team Support	$0.0	$101.3	$0.0	$101.3
			DOI Subtotal	$0.0	$148.5	$0.0	$148.5
			DOI Total	$0.0	$778.7	$451.3	$327.4

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NOAA	ADF&G	94066	Harlequin Duck Recovery Monitoring	$0.0	$22.6	$22.6	$0.0
	ADF&G	94081	Recruitment Monitoring of Littleneck Clams	$0.0	$0.0	$0.0	$0.0
		94083	Monitoring of Oiled & Treated Shorelines	$0.0	$0.0	$0.0	$0.0
	ADEC/DOI-NPS	94090	Mussel Bed Restoration & Monitoring	$0.0	$138.6	$138.6	$0.0
		94092	Killer Whale Recovery Monitoring	$0.0	$33.7	$33.7	$0.0
	ADEC/ADF&G/ ADNR/DOI/USFS	94147	Comprehensive Monitoring Program	$0.0	$0.0	$0.0	$0.0
	ADF&G	94163	Forage Fish Influence on Injured Species	$0.0	$0.0	$0.0	$0.0
	ADF&G	94166	Herring Spawn Deposition & Reproductive Impairment	$0.0	$25.9	$0.0	$25.9
	ADF&G	94191	Oil Related Egg & Alevin Mortalities	$0.0	$160.7	$143.8	$16.9
	ADF&G	94237	River Otter Recovery Monitoring	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/USFS/DOI	94266	Shoreline Assessment & Oil Removal	$0.0	$0.0	$0.0	$0.0
	ADF&G	94279	Subsistence Food Safety Testing	$0.0	$54.0	$54.0	$0.0
	ADEC/ADF&G	94285	Subtidal Sediment Recovery Monitoring	$0.0	$209.4	$209.4	$0.0
		94290	Hydrocarbon Data Analysis & Interpretation	$0.0	$74.7	$74.7	$0.0
		94320	Ecosystem Study Plan	$0.0	$0.0	$0.0	$0.0
	ADEC/ADF&G/ ADNR/USFS/DOI	940FC	Finance Committee	$0.0	$10.2	$0.0	$10.2
	ADEC/ADF&G/ ADNR/USFS/DOI	940RT	Restoration Team Support	$0.0	$134.8	$0.0	$134.8
			NOAA Total	$0.0	$864.4	$676.6	$187.8
			Total	$50.4	$7,967.2	$3,391.5	$4,575.7

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FORM 1B
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SUMMARY

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

TO: Trustee Council DATE: August 16, 1993

FROM: Dave Gibbons
Interim Administrative Director

Restoration Team

SUBJECT: *Exxon Valdez* Oil Spill Symposium Proceedings

The Restoration Team recommends that the Trustee Council provide funds to publish the Exxon Valdez Oil Spill Symposium Proceedings. Below we describe the status of the Proceedings as they have been arranged to date. Following, we present three funding options for the Trustee Council to consider for approval. The three options provide for different levels of return of funds to the Trustee Council from the sale of the Proceedings.

Status of the Proceedings

The estimated cost to the Trustee Council for publishing the Proceedings is $97.0K. This would offset the publisher's costs for format editing, composition, indexing, printing, promotion and marketing, development and distribution of a promotional brochure, storage and order handling fulfillment, and accounting.

Currently $33.0K is deposited in the EVOS Symposium account. These monies could be used to help pay for the Proceedings costs, leaving a further allocation request to the TC of $64K.

Funding of the Proceedings will result in the production of a peer reviewed book with the following parameters:
3,000 copies printed; cloth hard bound binding*
538 printed text pages (60 papers @ avg. 30 manuscript pages ea.= 1,800 manuscript pages)
16 pages front material
22 pages of subject index
150 tables
300 figures
10 photographs

(* costs for paper-cover volumes were considered to save costs. The cost difference was not felt significant, and the Restoration Team determined that hard cover is preferred. See attached memorandum).

Approximately 100 copies of the book will be distributed without charge. Each lead author will receive a copy of the book. The remaining 40 copies will be available for distribution by the TC.

The publisher of the Proceedings will be the American Fisheries Society in cooperation with the Wildlife Society. In conjunction, these two highly credible organizations will sufficiently represent the range of topics presented in the Proceedings and they will insure a wide distribution of the book. The American Fisheries Society technical and layout editorial services are of the highest quality, and their costs are competitive based on an examination of a number of publishers' cost estimates.

Manuscripts Status:

The presenters at the Symposium Technical Sessions were requested to provide a manuscript for the Proceedings. A total of 73 manuscript titles have been committed by the respondents with good representation from all the symposium topic areas. Manuscript submissions were due July 1, 1993. However, many authors have had to concentrate on final report submissions and field activities. Some submission delays are expected. The following table lists the number of papers expected by topic:

Summary by Session:

Fate and Toxicity	7
Subtidal	5
Treatment Effects	6
Intertidal	14
Herring	3
Salmon	13
Fish (other)	5
Birds	8
Subsistence	4
Archaeology	1
Human Impacts	4
Sea Otters	1
Other Mammals	2
TOTAL	73

Editorial Team and Objectives:

The Trustee Council's editorial team are responsible for acquiring papers, peer review, quality control, and organization of the manuscripts into a book. The editorial team consists of Jeep Rice, Bob Spies, Doug Wolfe, and Bruce Wright. The editors' objectives are to provide peer reviewed manuscripts of journal quality for the Proceedings book. The editors will be very sensitive to scientific accuracy. Rejections and all controversial decisions will be joint decisions. The Proceedings will compliment the Symposium. We see the Proceedings as being an important vehicle for dissemination of the Trustee Council's research findings.

Proposed Timeline:

Funding proposal to TC......................... August 23, 1993
Revisions of manuscripts after peer review.... November 1993
Book completion............................... July 1994

Funding Options:

Option 1. An individual book charge of $33 would be used by the publisher to pay for the remaining publishing costs. This would be the lowest cost of the Proceedings for the public. The Trustee Council would receive no return of funds from the sale of the Proceedings.

Option 2. A book charge of $54 would be used. This would return $21 per each book sold to the Trustee Council. Sale of all 3,000 copies would return the $64 K request to the Trustee Council.

Option 3. A book charge of $65 would be used. This would return $32 per book sold to the Trustee Council. Sale of all 3,000 copies would reimburse the Trustee Council for the full cost of both the Symposium and the Proceedings.

Restoration Team Recommendation:

The Restoration Team recommends Option 2 above, with one dissenting vote. NOAA's member recommended Option 1.

To: Byron Morris 13 AUG 93
From: Jeep Rice
Subject: Contact with AFS on soft/hard copy costs

Contact was made this morning with Beth Staele of AFS. She explained that the soft cover may not be preferred, but it is done on volumes as large as the planned proceedings length. The impact on costs are solely in the one line item of printing.

1. Printing costs are estimated at 25,641, for 538 text pages. Hard cover costs are $7,400 of this, as oposed to $1,700 or a savings of $5,700.

2. AFS does not recommend this route. The size of the volume will be at the max end of sizes that can be soft covered, and would be vulnerable to abuse through normal use.

3. Libraries will not like it, because of the lack of durability.

4. Authors and YOUR editiors will not like it, because it will cheapen the product and make it look like another governement gray literature product. When compared to the EXXON sponsored ASTM product, it will look like a cheap and shoddy product with a lower credibility rating based on first look appearance. BY THE WAY, EXXON sponsorship on the whole or within an individual paper will be ABSENT, including addresses by the authors. There will be the appearance that it is a neutral document, done in a very professional publication. Just how credible in quality do you want the trustee proceedings to look, and to compare to? For those of you who were there- what did you think of the ASTM posters by the EXXON contractors? Do you think they will do any thing less for the papers published by ASTM?

II. 4. 8 E

Exxon Valdez Oil Spill Public Advisory Group
August 23, 1993 Report to the Trustee Council
Brad Phillips, Chairperson

1. The last PAG meeting was July 15 and 16 in Anchorage. A meeting summary (attachment #1) was mailed to the Trustee Council and Restoration Team. Our next meeting will be in mid-September to discuss the 1994 draft Annual Work Plan.

2. The PAG recommends it have a budget of $154,625 for fiscal year 1994 (attachment #2). Included in the budget is $30,000 for PAG members to attend public meetings sponsored by the Trustee Council--a resolution (attachment #3) was passed with this request. WE REQUEST THE TRUSTEE COUNCIL APPROVE THIS PAG BUDGET FOR PUBLIC REVIEW.

3. The PAG passed a resolution favoring the establishment of an endowment (attachment #4). We set up an ad hoc work group to further define what this might be, and will report back at the next Trustee Council meeting. WE REQUEST THE TRUSTEE COUNCIL INCLUDE AN ENDOWMENT OPTION FOR PUBLIC DISCUSSION IN THE RESTORATION PLAN. We also passed a resolution and REQUEST THE TRUSTEE COUNCIL PROVIDE DEFINITIVE LEGAL OPINION ON THE ESTABLISHMENT OF AN ENDOWMENT (attachment #5).

4. The PAG passed an "Approach to Restoration" (attachment #6), which outlines our collective thoughts about key considerations for a long-term restoration plan.

5. The PAG passed a resolution (attachment #7) in which WE REQUEST THE KODIAK FISHERY INDUSTRIAL TECHNOLOGY CENTER PROJECT BE INCLUDED IN THE 1994 ANNUAL WORK PLAN FOR PUBLIC REVIEW. This project was introduced for 1993 funding, but was postponed by the Trustee Council. I understand that this project was discussed by the Restoration Team and has been added as project #94025 to the draft 1994 Annual Work Plan.

6. In earlier mailings, the PAG presented nominees for PAG alternates to the Trustee Council for their action (summary at attachment #8). WE REQUEST THE TRUSTEE COUNCIL APPROVE THESE NOMINEES AND FORWARD THEM TO THE TRUSTEES FOR SELECTION.

ATTACHMENT #1

Meeting Summary

A. GROUP: Exxon Valdez Oil Spill Public Advisory Group (PAG)

B. DATE/TIME: July 15 & 16, 1993

C. LOCATION: Anchorage, Alaska

D. MEMBERS IN ATTENDANCE:

Name	Principal Interest
Rupert Andrews	Sport Hunting and Fishing
Pamela Brodie	Environmental
James Cloud	Public-at-Large
Sarah Cronk (for Diehl)	Recreation Users
Donna Fischer	Local Government
John French	Science/Academic
James King	Conservation
Rita Stevens (for Knecht)	Subsistence
Vern McCorkle	Public-at-Large
Mary McBurney (for McCune)	Commercial Fishing
John McMullen	Aquaculture
Drue Pearce (*ex officio*)	Alaska State Senate
Brad Phillips	Commercial Tourism
Kim Benton (for Sturgeon)	Forest Products
Charles Totemoff	Native Landowners
Lew Williams	Public-at-Large

E. NOT REPRESENTED:

Name	Principal Interest
Cliff Davidson (*ex officio*)	Alaska State House
Richard Eliason	Public-at-Large
Paul Gavora	Public-at-Large

F. OTHER PARTICIPANTS:

Name	Organization
Ken Adams	Prince William Sound Aquaculture Assn.
Aimee Boulanger	Sierra Club
Mark Broderson	Restoration Team AK Dept. Envir. Conservation
Ron Dearborn	Alaska Regional Marine Research Board
Sharon Gagon	Alternate to Lew Williams
Dave Gibbons	Restoration Team Interim Administrative Director
Carol Gorbics	Fish and Wildlife Service
Bill Hall	Commercial Fisherman

Brian Havelock	CRRL
Bill Hines	National Oceanic & Atmospheric Administration
Dan Hull	Prince William Sound Aquaculture Assn.
Horace Hunt	PRVC
Bob Kellar	VFDA
Jerome Komisar	University of Alaska
Bonnie Landrum	Representative Olberg
Byron Morris	Restoration Team Nat. Oceanic & Atmos. Admin.
Doug Mutter	Designated Federal Officer Dept. of the Interior
Eric Myers	Alaska Center for the Environment
Walt Parker	Alaska Hazardous Substance Spill Technology Review Council
Ken Rice	Restoration Team U.S. Forest Service
Dave Rose	Alaska Permanent Capitol Mgmt. Co.
Marty Rutherford	Restoration Team AK Dept. Natural Resources
Arliss Sturgulewski	Self
Joe Sullivan	AK Dept. of Fish & Game
Tom Von Brocklin	City of Valdez
Edmund Waszkiewicz	Dept. of the Interior

G. SUMMARY:

The meeting was opened at 9:30 a.m. by Chairperson Brad Phillips. The May 25, 1993 meeting summary was accepted. Dave Gibbons provided a summary of the June 1 & 2, 1993 Trustee Council meeting (attachment J.9). The Trustee Council asked that the PAG send them a copy of the endowment information the PAG is reviewing when it is available.

Doug Mutter distributed a copy of the proposed fiscal year 1994 budget and anticipated expenses for the PAG (attachment J.1) and the package of nominated alternate PAG members that went to the Trustee Council for their action (attachment J.8). The budget was amended (all in favor, except Pam Brodie) by adding a suggested $30,000 for PAG members to attend public meetings that the Trustee Council and Restoration Team may hold during the next year (attachment J.2).

Jerome Komisar presented an approach to establishing a Marine Research Endowment, prepared by a coalition of persons (attachment J.10). Arliss Sturgulewski and Ron Dearborn also spoke in favor of the endowment. Bill Hall and Ken Adams also spoke in favor of a marine endowment. After substantial discussion, a motion was made to remove the motion to create endowed university chairs (see May 25 meeting summary) from the table--this motion failed, leaving the original motion tabled. A motion was passed (with Pam Brodie in opposition) in support of an endowment concept (attachment J.3), and another was passed (unanimously) requesting the Trustee Council obtain legal opinions on the establishment of an endowment (attachment J.4). A subgroup will meet before the next PAG meeting to develop more detailed language for an endowment to be considered by the PAG (see H.2, below).

The draft Approach to Restoration prepared at the May 25, 1993 meeting was discussed and passed (with amendments) with a unanimous vote (attachment J.5).

Dave Gibbons distributed the 1994 Annual Work Plan project listings and decision documents (attachment J.14). A thumbnail sketch of each of the priority one projects was provided (with PAG members asking questions) as follows: Byron Morris, NOAA; Mark Broderson, ADEC; Ken Rice, USFS; Carol Gorbics, DOI, Dave Gibbons, ADNR; Joe Sullivan, ADF&G. A motion was passed (with John French abstaining) to add the project proposed in 1993 to fund the expansion of the Kodiak Fishery Science and Technology Center (attachment J.6) to the 1994 draft Annual Work Plan for public review. A motion was made (and postponed) to establish principles for evaluating work plans (attachment J.7).

The PAG members were invited to offer comments on issues and concerns.

The meeting was opened for public comment at 11:30 a.m. on July 15 and again at 4:00 p.m. on July 16. Testimony was presented by Dave Rose, Eric Myers, and Dan Hull.

The meeting adjourned at 4:00 p.m. on July 16, 1993.

H. FOLLOW-UP:

1. Brad Phillips will present a summary of PAG actions at the August 23, 1993 Trustee Council meeting.

2. An endowment subgroup was created to meet prior to September 15 and develop detailed language (purpose, level of funding, who will manage/decide on uses of the endowment) for an endowment to be considered by the PAG. Members are: John French (chair), Lew Williams, John McMullen, Jim Cloud, Vern McCorkle, Jim King, and Pam Brodie.

3. Dave Gibbons will distribute the three-page project descriptions for 1994 to the PAG as soon as possible before September 10, 1993.

4. Dave Gibbons will distribute to the PAG, when available, the comments of the Chief Scientist on the draft 1994 Annual Work Plan projects.

I. NEXT MEETING: September 15 and 16 (OR 20 and 21), 1993 in Anchorage.

J. ATTACHMENTS:

1. PAG proposed FY 1994 budget (Vol. I tab VI.C)
2. Resolution to amend the budget and add money for attending public meetings
3. Motion in support of an endowment
4. Motion to obtain legal opinions on endowments
5. PAG Approach to Restoration (Vol II tab II)
6. Motion to add the Kodiak Fishery Science and Technology Center project for 1994 public review (Vol II tab IV)
7. Statement of Principles for Evaluation of EVOS Work Plans (Vol II tab IV)

Handouts attached for those not present:

8. PAG alternates package for Trustee Council action (Vol. I tab IV)
9. June 1 & 2, 1993 Trustee Council Meeting Notes
10. Marine Research Endowment
11. Fairbanks Daily News-Miner article about an endowment
12. Fairbanks Chamber of Commerce resolution on an endowment
13. Notice of luncheon forum on shoreline impacts
14. 1994 Annual Work Plan projects/decisions (Vol II tab IV)
15. Restoration Team assignments for the 1994 draft Annual Work Plan (Vol II tab IV)

K. CERTIFICATION:

______________________________ ______________

PAG Chairperson **Date**

EXXON VALDEZ OIL SPILL PUBLIC ADVISORY GROUP
PROPOSED BUDGET ALLOCATIONS
19-Jul-93

Budget Category	Mar 1, 1992-- Sep 30,1992 FY1992	Oct 1, 1992-- Feb 28,1993 FY1993	Mar 1, 1993-- May 31, 1993 FY1993	Jun 1, 1993-- Sep 30, 1993 FY1993	Totals	Oct 1, 1993-- Sep 30, 1994 FY1994	
Personnel		$9,000.00	$2,400.00	$13,900.00	$25,300.00	$31,800.00	DOI
Travel	$30,800.00	$40,000.00	$17,600.00	$22,400.00	$110,800.00	$87,000.00	DOI
Contractual		$15,800.00	$7,400.00	$7,400.00	$30,600.00	$22,200.00	DEC
Commodities		$10,800.00	$7,400.00	$2,700.00	$20,900.00	$7,300.00	FS
Equipment							
Capital Outlay							
Subtotal	$30,800.00	$75,600.00	$34,800.00	$46,400.00	$187,600.00	$148,300.00	
General Administration		$1,300.00	$900.00	$1,100.00	$3,300.00	$6,324.00	DOI
Total	$30,800.00	$76,900.00	$35,700.00	$47,500.00	$190,900.00	$154,624.00	

NOTES:

Mar 1, 1992-Sep 30, 1992--allocation has been completed.
Oct 1, 1992-Feb 28, 1993--need to I/A $10,800 to FS, will have unused contractual not required by DEC.
Mar 1, 1993-May 31, 1993--need to I/A $7,400 to FS, the $7,400 for DEC will be "unused" since DEC will increase next court request to include this.
Jun 1, 1993-Sep 30, 1993--court request allocates $7,400 to DEC and $2, 700 to FS, plus added $7,400 to DEC for previous period to avoid an I/A.

Oct 1, 1993-Sep 30, 1994--assumes six meetings

ATTACHMENT #2

EXXON VALDEZ OIL SPILL PUBLIC ADVISORY GROUP
ESTIMATED EXPENDITURES FROM 10-1-93 THROUGH 9-30-94
19-Jul-93

Activity	Personnel	ravel/Perdie	Supplies	Printing	Mail	eleconferenc	Public Record	Advertising	Total
FWS staff, .5 FTE	$19,800.00								$19,800.00
DOI staff, .2 FTE	$12,000.00								$12,000.00
November meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
January meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
March meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
May meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
July meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
September meeting		$9,500.00		$800.00	$250.00		$2,000.00	$1,700.00	$14,250.00
PAG Notebooks III?			$1,000.00						$1,000.00
Public meetings*		$30,000.00							$30,000.00
TOTALS	$31,800.00	$87,000.00	$1,000.00	$4,800.00	$1,500.00		$12,000.00	$10,200.00	$148,300.00
	DOI	DOI	FS	FS	FS	FS	DEC	DEC	

*PAG attendance at public meetings held by the Trustee Council

ATTACHMENT #3
7-16-93

RESOLUTION

EVOS - PAG July 15-16 Meeting

Whereas both the Restoration Team and the Public Advisory Group have roles in expressing public opinion to the Trustee Council;

Whereas the Public Advisory Group represents the public-at-large and specific interests spread across the spill-affected area;

Whereas the Restoration Team has responsibility for assessing public opinion on the Restoration Plan and the various Work Plans; and

Whereas closer communication between Public Advisory Group members and Restoration Team members on the public attitudes in spill-affected communities could increase the quality and efficiency of the deliberations of both groups.

Therefore, be it resolved that the opportunity should be available for Restoration Team public hearing teams to include one to two Public Advisory Group members and that these members work closely with the hearing team to help minimize the additional cost of the public hearings.

Further, be it resolved that the Public Advisory Group requests the addition of $30,000 to its FY94 budget for this process.

Brad Phillips

ATTACHMENT #4

EXXON VALDEZ OIL SPILL PUBLIC ADVISORY GROUP

Recommendation to the Trustee Council

The EVOS Public Advisory Group is in support of the concept of the establishment of an endowment or trust that will provide funding for the purposes established by the settlement agreement.

The use or administration of the endowment or trust should be established by a charter developed and approved by the Trustee Council.

ADOPTED the 15th day of July, 1993, by majority vote.

ATTACHMENT #5

A RESOLUTION OF THE EXXON VALDEZ OIL SPILL PUBLIC ADVISORY GROUP REQUESTING CERTAIN INFORMATION FROM THE EXXON VALDEZ TRUSTEES CONCERNING ESTABLISHMENT OF AN ENDOWMENT

WHEREAS: A super majority of the EVOS PAG has voted to support the establishment of an endowment or trust that will provide funding for the purposes established by the Settlement Agreement; and,

WHEREAS: There have been comments alleging that Federal Attorneys of the EVOS TRUSTEES may feel such an endowment or trust to fall outside laws or regulations; now,

THEREFORE BE IT RESOLVED that the EVOS PAG and the Trustee Council be furnished with briefs setting forth any such differing views for the purpose of understanding such differences; and,

BE IT STILL FURTHER RESOLVED that where differing opinions do exist that appropriate action be taken to test at court the validity of such differing views and that this be done in a timely manner.

RESOLVED this 16th day of July, 1993 by the EVOS PAG in public session, a quorum having been duly established and qualified.

Brad Phillips

BRAD PHILLIPS, Chair
EVOS PAG
July 16, 1993

ATTACHMENT #6

Exxon Valdez Oil Spill Public Advisory Group

--Approach to Restoration (7/15/93)--

The *Exxon Valdez* Oil Spill Trustees should give priority to the projects which are most effective in restoring and protecting injured resources and services. Preference should be given by the Trustees to projects (1) within the spill area as defined in the Restoration plan brochure of April 1993, or (2) outside the spill area within the state of Alaska.

A. Pick-up oil which is fouling the environment and where it makes environmental and economic sense to clean up and with the approval of local residents, landowners and resource users. This includes:

- Monitoring and feasibility studies
- Physical clean-up

B. Restore injured resources and services by taking direct action in pertinent environments. This includes:

- Subsistence
- Cultural
- Recreational
- Commercial
- Fish
- Wildlife
- Habitat

C. Protect habitat critical to resources injured by the oil spill or threatened by potentially injurious actions. This includes:

- Acquisition
- Conservation easements
- Leases
- Trade
- Application of management techniques with landowners

D. The Public Advisory Group is in support of the concept of the establishment of an endowment or trust that will provide funding for the purposes established by the settlement agreement. The use or administration of the endowment or trust should be established by a charter developed and approved by the Trustee Council.

E. Replace and/or enhance injured resources/services through indirect means. This includes:

- Enhancement of equivalent resources to reduce pressure on injured ones
- Increase populations or levels of service over pre-spill conditions

F. Provide funding for facilities which support A through E, above.

ATTACHMENT #7
7-16-93

MOTION

The EVOS-PAG recommends that the Trustee Council include the final $3.5 million required to complete the funding for the expansion of the Fishery Science and Technology Center in Kodiak in the FY 94 Work Plan as it goes out for public comment.

The restoration benefits of this project extend to several fish, bird and marine mammal species and injured services. The project includes the involvement of several state and federal agencies in addition to the University of Alaska and has strong support from the City and Borough governments. The cost sharing includes land contributed by the City of Kodiak, State of Alaska EVOS Criminal Settlement Funds and Federal lease payments.

Brad Phillips

ATTACHMENT #8

‹xon Valdez Oil Spill

Public Advis‹ , Group Proposed Designated A‹‹ernates

Status of Information as of July 19, 1993

Member	Alternate	Bio or Resume	EVOS knowledge	Relation to interest	Why select	Conflict answers
Rupert Andrews Sport Hunting & Fishing	None					
Pamela Brodie Environmental	Eric Myers	have	---	---	---	have
James Cloud Public-at-Large	will delegate to a current PAG member					
James Diehl Recreation Users	Sarah Cronk (Girdwood)	have	have	have	have	have
Richard Eliason Public-at-Large	will delegate to Jim Cloud or Vern McCorkle					
Donna Fischer Local Government	Dave Beck (Valdez)	have	have	have	have	have
John French Science/Academic	Brenda Norcross (Fairbanks)	have	have	have	have	have
Paul V. Gavora Public-at-Large	Donald McCumby (Fairbanks)	have	have	have	have	have
James King Conservation	George Matz (Anchorage)	have	have	have	have	have
Richard Knecht Subsistence	Dolly Reft (Kodiak)	have	have	have	have	have
Vern C. McCorkle Public-at-Large	will delegate to a current PAG member					
Gerald McCune Commercial Fishing	Mary McBurney (Cordova)	have	have	have	have	have
John McMullen Aquaculture	Dan Warren (Anchorage)	have	have	have	have	have
Brad Phillips Commercial Tourism	Bill Elander (Anchorage)	have	have	have	have	have
John Sturgeon Forest Products	Kimberley Benton (Anchorage)	have	have	have	have	have
Charles Totemoff Native Landowners	Gail Evanoff (Chenega)	have	have	have	have	have
Lew Williams Jr. Public-at-Large	Sharon Gagnon (Anchorage)	have	have	have	have	have

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

TO: Trustee Council

DATE: August 19, 1993

FROM: Dave Gibbons
Interim Administrative Director

SUBJECT: Examples of restoration objectives for your information

At your recent meeting, you asked for examples of objectives so you can better understand their form and content.

Purpose. Objectives help the Trustee Council make better decisions by separating "What do we want to accomplish?" from "Do we like *this* project?" Specifically, it separates the following issues:

- Should we pursue this objective?
- How effective is this project in reaching the objective? Are there more effective projects?
- Having objectives will give more direction to the public when we solicit projects.

What is an objective? An objective is a specific result that helps achieve recovery. They are measurable except where measurement is infeasible or not cost effective.

Examples. The next two pages present examples for Kenai River Sockeye Salmon, and Archaeology. The wording may change upon peer or agency review. In addition, the Trustee Council may or may not fund activities to achieve any or all of these examples.

Draft Example Objectives
Kenai River Sockeye Salmon

(Note: Kenai River sockeye salmon populations are expected to crash in 1994. The definition of recovery and the objectives pertain to Kenai River sockeye and fisheries in 1994 and beyond.)

RESTORATION OBJECTIVES

- Restore production of Kenai system fry and smolt to prespill averages. When this objective is met, sufficient numbers of juvenile salmon will be produced to allow for prespill levels of adult returns. The objective has been met when Kenai and Skilak Lakes produce sockeye fry and smolt levels comparable to prespill averages without exceeding the carrying capacity of the Kenai System.

- Reduce risk of over- or underescapement. Data suggests that too many spawning fish (overescapement) caused the initial oil spill injury. Additional overescapement might further unbalance the trophic system and delay recovery. Future run declines may cause major underescapements with subsequent reduced adult returns due to lack of spawners. Escapement is influenced by fishing seasons that are set, in part, using predictions by the Alaska Department of Fish and Game. Errors in those predictions can cause over- or underescapement. The objective has been achieved when fisheries managers can meet escapement goals with an accuracy of +/- XX fish over a period of Y years.

- Protect spawning and rearing habitat in the Kenai River system from damage by human activities. When this objective is achieved, human-caused habitat degradation will not significantly impact Kenai River sockeye rearing and spawning. It is difficult to quantify the effect on fish production except in terms of documenting both a linkage between the habitat and sockeye salmon, and an absence of habitat disturbance.

DEFINITION OF RECOVERY (The goal)

For Kenai River Sockeye Salmon:

Recovery has occurred when the Kenai River sockeye population is healthy and productive, and exists at prespill abundances. One indication that recovery has been achieved is when Kenai and Skilak Lakes support sockeye fry populations and smolt outmigration is comparable to prespill averages. (Note: Limitations such as climate, and factors at sea may prevent us from reaching full recovery.)

For Kenai River Sockeye Salmon fishery (including the commercial, sport, subsistence, and personal-use fishery):

Recovery occurs when Kenai River sockeye harvests meet prespill averages, or when total Upper Cook Inlet sockeye harvests are comparable to prespill averages. (Note: this example shows that it may be possible to declare the fishery recovered by replacing Kenai River fish with fish elsewhere.)

Draft Example Objectives
Archaeology
(for all regions)

RESTORATION OBJECTIVES

- Stop site deterioration. Stabilize injured sites and extract the relevant information.

- Protect archaeologic sites. Protect archaeologic sites from looting and vandalism. This has been achieved when looting and vandalism of sites is at or below prespill levels.

- Display information about archaeologic resources. Protect and display artifacts and information for the public and for the scientific community to learn about their cultural heritage.

DEFINITION OF RECOVERY (The goal)

Cultural resources cannot recovery in the same sense as biological species. They are a finite non-renewable resource. Thus, the resource will be considered recovered when spill-related injury ends, when looting and vandalism returns to or below prespill levels, and when archaeologic information is available for the public and for the scientific community to learn about their cultural heritage.

II.4.8 C

RECEIVED
AUG 2 4 1993

Allocations of *Exxon Valdez* Civil Settlement Funds as of June 1993

Civil Settlement Funds Received $240,000,000
Civil Settlement Funds Allocated and/or Expended $220,308,000
Unexpended balance $19,692,000
1992 funds budgeted but not expended, to be returned to trust account $6,500,000*

*Includes $1,500,000 in administrative costs

Categories of Expenditures

Negotiated in the Settlement:

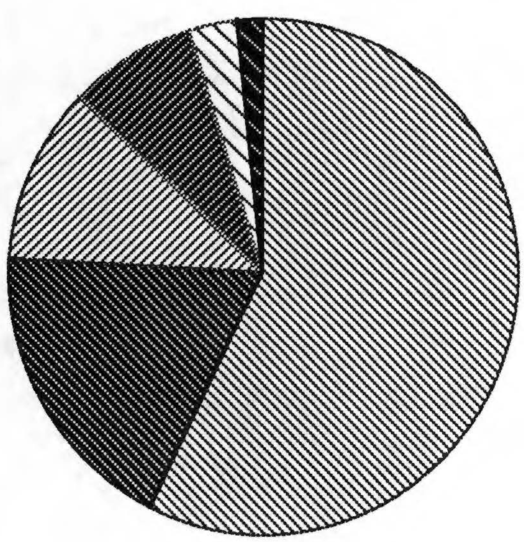
Reimbursements to State and Federal Governments $107,500,000
(for cleanup, damage assessment, and litigation costs)
Federal $49,200,000
State $58,300,000

Credits to Exxon for cleanup costs in 1991 & 1992 .... $39,900,000

1992 and 1993 Work Plan Expenditures Budgeted by Category

Category	*Budgeted*	*Percent*
Habitat Protection	$41,110,000	57.2%
Restoration Projects	$13,464,000	18.7%
Damage Assessment	$8,122,000	11.3%
Administration	$5,841,630	8.1%
Public Participation	$2,204,570	3.1%
Independent Scientific Review	$1,165,800	1.6%

Work Plan Expenditures by Category



Note that amount shown here for Public Participation does not include salary allocations for personnel involved in public participation activities except for OPSIC staff, PAG support, and PIO.

Source: 1992 and 1993 Trustee Council Budgets

08/24/93 11:27 ☎ →→→ EV Restoration 11.4.8 B 001/003

STATEMENT TO EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL 8/23/93

I'm Tom Boutin, State Forester, from the Alaska Division of Forestry. With me is Ed Holsten, entomologist with the State and Private Forestry organization within the United States Forest Service. We've been asked to describe a forest habitat health situation which has existed not far from here for quite some time.

The earliest recorded spruce bark beetle epidemic in Alaska was noted by the United States Forest Service to be in the Copper River area in 1920. More recent Kenai Peninsula activity began being discussed as a forest health issue in the late 1970's.

In the late 1980's the Forest Service made one of the first efforts to selectively log some of the beetle-infested stands. The needed environmental impact statement was challenged.

In the early 1990's a cooperative effort between the Forest Service, the Kenai Peninsula Borough and the State Forestry Division used a state appropriation to salvage some beetle-killed timber and build a fire break at the community of Cooper Landing. That 3-way cooperation has continued although further results have been meager.

Last week all three agencies participated in a review of the infestation and its implications by people from outside. The Borough would likely participate in responding to anything the Trustee Council required regarding the bark beetle on the Peninsula.

1,150,000 acres of recent spruce bark beetle infested land was mapped during 1991, 1992 & 1993, of which 585,000 acres is on the Kenai Peninsula. This year was the warmest in 70 years during the weeks most important to beetle activity so we could see an increase in 1994 infestation of another magnitude.

So here's the description of the size of the infestation. 585,000 acres of infestation were mapped on the Kenai in the three year period ending this year. The Kenai Peninsula is about 5.2 million acres in size, of which 1.9 million acres is forested.

Considering the infestations prior to 1991, it's likely that half of the forests on the Kenai Peninsula have been impacted. Also, coastal forests are showing great amounts of infestation for the first time.

The situation has been surveyed and studied regularly and quite extensively. Opinion polls of residents and visitors have been done. I am not aware of any investigation which predicts the long term effects on habitat and other resource values. The consensus among forest managers is that this is a forest health emergency.

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Mark Broderson	From Tom Boutin
Co.	Co.
Dept.	Phone # 762-2501

A normal bark beetle outbreak is 3 to 5 years in a localized area. This outbreak on the Kenai is generally in its 6th or 7th year in most areas and is still on the increase.

A recent study report of forest health in South-Central and Interior Alaska said that spruce beetles have and always will be a feature of these ecosystems, however, the notion that this infestation is or should be managed as a totally "natural" event is erroneous. While several environmental factors such as annual weather conditions, host susceptibility and changes in predator and parasite populations continue to influence beetle population changes, past and future human intervention such as fire suppression, clearing activities and related human habitation has removed this situation from a natural setting. Consideration of human needs and influences to establish an appropriate desired future condition for these impacted forest types is ecologically appropriate.

Without some sort of artificial intervention to mitigate this non-natural wholesale change in the eco-system, significant habitat loss may result. There is a paucity of regeneration. The seed source is being destroyed and the site disturbance required for regeneration isn't present, even where there is a remaining seed source.

One possible method of reducing hazard and habitat loss at the landscape level is to maintain a mosaic of cover types and age classes. Active eco-system management, using proven silvicultural techniques is certainly one alternative. Maintaining bio-diversity on the Kenai will certainly include tree planting. Tree planting is usually impractical without logging. Although forest harvest can affect the biodiversity within the forest landscape, negative impacts can be avoided and positive impacts favored.

The previously mentioned study said that lack of action and continued forest health decline will result in:

- Increasing loss of wildlife habitat for mature forest species.
- Continued riparian area degradation.
- Substantial long-term conversion from forest to grass, or hardwoods from lack of spruce regeneration.
- Increased community fire hazard & associated increased fire suppression costs.
- Degradation of aesthetic quality of forested landscapes.
- Degradation of developed recreation areas and increased maintenance costs for removal of hazard and down trees.

As mentioned a moment ago, the spruce bark beetle epidemic was studied last week by three prominent forestry officials; Jane Difley, President of the Society of American Foresters; Les Reed, retired Chief of the Canadian Forest Service and Professor Emeritus, University of British Columbia; and, David Adams, Forest Health Professor, University of Idaho.

Ms. Difley said that there are timber, wildlife and water resources at risk. She said this is an opportunity to prove silvicultural techniques can restore habitat. The Society has published more than 30 articles on forest health since 1990 and is now distributing an 83 page task force report on the subject.

Dr. Adams said that the Kenai epidemic is not a natural one. He said that parallel with forest health is long term sustainability of the ecosystem. He said the Kenai forest has no resiliency. A stressor like climatic fluctuation would not produce this sort of broad-scale habitat conversion and loss in a healthy eco-system.

Dr. Reed said that from what he saw on the Kenai we can't wait for perfect information. He thought that the lack of a forest products industry on the Kenai, notwithstanding the recent reopening of one small sawmill in Seward, and the sole emphasis on recreational values in forestry decisions may have allowed this problem to be discussed for years without any action taken.

Long term changes in forest cover types and forested wildlife habitat as a result of this forest health problem has not been studied or raised as an issue on the Kenai Peninsula. The limited and naturally fragmented landscape patterns found in Alaska, perhaps especially on the Kenai where the maritime coastal forest meets the Northern boreal forest so abruptly, make this loss of habitat a critical issue.

Thinking back to what Dr. Reed said about the lack of a forest products industry possibly being part of the problem, I think I see the industry we now have as a potential source of subsidy for the solution. Any payment for remaining value in some of the timber, and especially any site preparation and access construction which can be absorbed by logging contracts, is a subsidy to resolving this forest eco-system problem.

In closing my description of the spruce bark beetle epidemic I am suggesting you direct that one of six agencies represented by the Trustee Council determine and report the possible and likely long term habitat effects of this infestation. The 3-way partnership of the Forest Service, Kenai Peninsula Borough and Alaska Forestry Division could no doubt handle the project if asked. The dollar amount most often suggested to me by foresters is $75,000.