Chugach National Forest

Kenai Peninsula Spruce Bark Beetle Management Strategies & Five Year Action Plan

July 8, 1999

Prepared by
Warren Oja - Forest Supervisor's Office
Ron Freeman - Acting District Ranger, SRD
Mark Black - Fire Specialist, SRD
Bill Schuster - Wildlife Biologist, SRD

Table of Contents

Executive Summary 3

Introduction 4

Background 4
- Current Management Direction 5
- Management Action To-Date 5
- Spruce Bark Beetle Impacts and Management Concerns 5
- Kenai Peninsula Spruce Bark Beetle Task Force Report 7
- Other Resource Assessments 7
- Cooperative Efforts with Other Agencies 7

Management Strategies for Chugach National Forest Lands on the Kenai Peninsula 10
- Introduction 10
- Management Strategy 1 – Fire Protection 11
- Management Strategy 2 – Fuels Management 13
- Management Strategy 3 – Forest Health and Watershed Restoration 16
- Management Strategy 4 – Wildlife Habitat Management 18

Chugach National Forest Five Year Action Schedule 21

Action Schedule Implementation Tools 26

APPENDIX A – Assessment of Existing Ecosystem Conditions on the Chugach National Forest Portion of the Kenai Peninsula Landscape 27

APPENDIX B – Chugach National Forest Five Year Action Plan Detail 86

APPENDIX C – Discussion on Treatment Options 93

APPENDIX D – Fire Suppression Capabilities 101

APPENDIX E – Literature Cited 104

APPENDIX F – Maps 109

EXECUTIVE SUMMARY

South-central Alaska has been experiencing a spruce beetle epidemic of unprecedented size and intensity for over 10 years. Beetle-caused tree mortality is affecting every component of the forest ecosystem and the socioeconomic system that is dependent upon those forests. Beetle-caused tree mortality has dramatically increased the potential for large, intense wildfires unlike any that have occurred in recorded history. The related changes in forest structure and composition are affecting fish and wildlife populations and their habitats, hydrologic properties, timber values, recreation, and aesthetic values. In addition, in the urban/forest interface, property and human lives are also at risk from the increasing hazard of wildland fire. It is important to understand the changes that are occurring in these forest ecosystems to develop plans to insure the restoration of productive and sustainable forests and to prevent similar situations from occurring in the future.

Concerns over the infestation's impact to Alaska's forests, public safety, and ecosystems prompted the Senate Appropriation Committee to direct the U.S. Forest Service to establish a multiparty task force to prepare an action plan to manage spruce beetle infestations in Alaska and rehabilitate the infested areas.

The Task Force completed its "Action Plan for Rehabilitation in Response to Alaska's Spruce Bark Beetle Infestation" on June 30, 1998. The Task Force's action plan provides a vehicle by which individual landowners and public land managers can cooperate, share information and resources and coordinate their individual efforts in:

- Fire Prevention and Public Safety
- Fuel Modeling and Risk/Hazard/Behavior Assessment
- Timber Management and Reforestation
- Public Education and Communications
- Coordinating Efforts
- Public Assistance
- Long-term Planning
- Science and Research.

In concert with the Task Force's recommendations and action plan, this document presents the following four management strategies with an accelerated 5-year action schedule for the Chugach National Forest portion of the Kenai Peninsula, which represents about 9.8 % of the total Kenai Peninsula infestation:

- Strategy/Priority # 1 – Fire Protection and Management
- Strategy/Priority # 2 – Fuels Management
- Strategy/Priority # 3 – Forest Health & Watershed Restoration
- Strategy/Priority # 4 – Wildlife Habitat Management

Management strategies focus primarily on fuels reduction, hazard tree removal, insect & disease protection in green stands and restoration of beetle killed stands in areas of high human use on the Forest. These areas include riparian zones, road and trail corridors, stands adjacent to utility corridors, campgrounds, recreation cabins, administrative sites, personal use forest product areas, and commercial timber stands. The primary management tools that will be used are prescribed fire, timber stand improvement, and revegetation/reforestation.

Implementation of the action schedule on approximately 123,000 acres over the next 5 years will require approximately 10.5 million dollars in appropriated funding, increased staffing, and key upgrades to the Kenai Lake Work Center that will serve as a field support facility to fully implement the management strategies and priorities.

CHUGACH NATIONAL FOREST
KENAI PENINSULA
SPRUCE BARK BEETLE
MANAGEMENT STRATEGIES

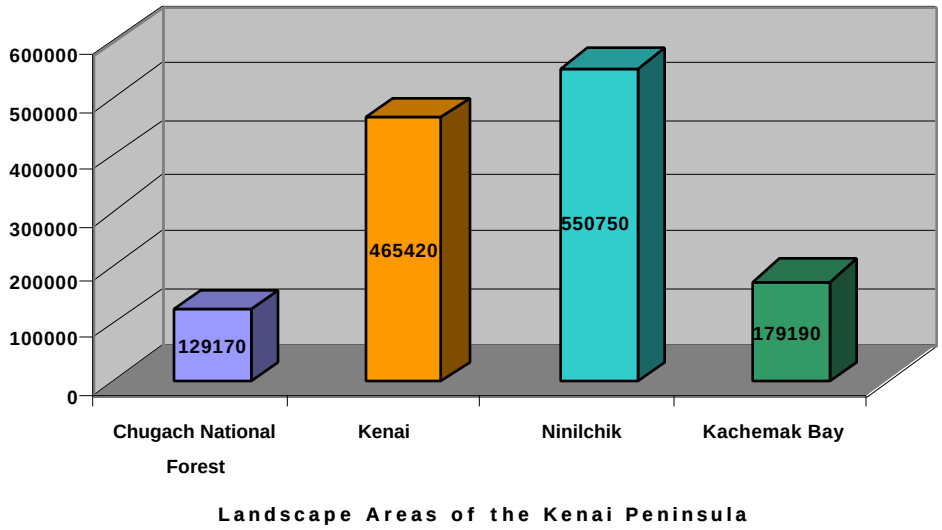
INTRODUCTION

This report presents a set of management strategies and an accelerated five-year action schedule for National Forest lands on the Kenai Peninsula to deal with the impacts of the on-going spruce bark beetle epidemic. Both are intended to be dynamic and recognize that changes in individual strategy and/or actions will be necessary to respond to changing conditions on the ground, new information, public concerns, available skills and budgets, and a revised Forest Plan when completed in June 2000.

BACKGROUND

The spread of the Spruce Bark Beetle (SBB) in Alaska, and particularly on the Kenai Peninsula, started in the 1960's and has continued over the last decade at a unprecedented level. Statewide, the infestation is considered the largest in North America with estimates that the infestation has impacted over 2.3 million acres of Alaska spruce forests over the last 7 years. On the Kenai Peninsula, the cumulative infestation between 1957-1998 has impacted over an estimated 1.3 million acres. The area west and southwest of the Chugach National Forest in Kenai, Ninilchik, and Kachemak Bay watersheds have been the most severely impacted on the Kenai Peninsula with over 1.283 million cumulative acres infested between 1972-1998. This amounts to 90.2 % of the total Kenai Peninsula infestation while the cumulative infestation on the National Forest is 129,170 acres or 9.8 % of the total infestation. Figure 1 compares the cumulative infested acreage in these four areas of the broader Kenai Peninsula landscape.

Figure 1: Cumulative SBB Infestation in Kenai Peninsula Landscapes, 1957-1998



Current Management Direction

The 1984 Chugach Land and Resource Management Plan (Forest Plan) provides management direction for the four management areas (MA 1- Road Corridor, MA 2 – East Side, MA 3 – Resurrection Pass, and MA 4 - Crescent Lake) located on the Kenai Peninsula. Management goals common to all MA's include maintaining landscape character, maintaining and enhancing wildlife and fish habitat, and increasing and/or improving recreation opportunities. Maintaining existing wilderness character in areas recommended for wilderness is an additional management goal in MA 2.

All four management areas have specific management direction to improve a combined total of 9,850 acres of moose habitat per decade using a combination of prescribed fire, timber stand improvement and/or timber harvest management tools. The use of allowable sale quantity (ASQ) timber harvest as a management tool is limited to MA 1 and 4. Non-ASQ timber harvest is allowed in all four MA's. MA 2 has specific management direction for improving Dall Sheep and Mountain Goat habitat using prescribed fire as a management tool.

Forest-wide standards and guidelines provide for vegetation manipulation near roads, trails, campgrounds, and recreation cabins. Scheduled prescribed burning, timber stand improvement, and timber harvest are specified as management tools for maintaining a visually diverse landscape.

Management Action To-Date

Since 1981, management treatments total 11,967 acres. Of the total acreage treated to-date, 59% was treated by prescribed fire, 37% was treated by timber harvest and 4% was treated by timber stand improvement. Refer to the discussion under Management Activity Disturbance on page A-14 in Appendix A for detail by watershed association.

In response to the 1995 Salvage Rider passed by Congress in 1995, the Forest initiated and/or scheduled NEPA analyses in all watershed associations containing SBB susceptible vegetation on the Kenai Peninsula. The NEPA analyses evaluated fuels, vegetation and integrated pest management treatments using prescribed fire, timber salvage harvest, timber stand improvement and integrated pest management techniques as management tools. In 1997, the North Shore Salvage Sale decision memo, which was a project decision from the Moose Pass Cooperative Project (initiated in 1993), was appealed to the Ninth Circuit Federal Court. At that time, Forest Supervisor Larry Hudson made a decision to defer all pending NEPA analyses until such time as there was more public support for management action in response to the SBB epidemic on the Chugach National Forest. Since then, SBB management action on the Forest has been limited to personal use firewood permits, small prescribed burns for wildlife habitat improvement, a few small commercial salvage sales and the normal recreation site hazard tree rellrbrd fer ae.

SprucebBarkbBeetlst (SBQ) areonse od themosat imporaent disturbancenagentsion mstue, whtre spruce stantsionesoth-scenrtal nd.

fire hazardion SBBimp acied stants wialioecreuse veor tiea. Aftfer n SBBsotbcrek, er ass r o the flina vegetationpgrountcCveorioecreuss;s and(fire speoad raepillythgrogh, thsed(vegetationtypres. Aso the SBBkilaled tres)bcreks

Hazard Trees
There is a concern for public safety with hundreds and/or thousands of SBB killed trees in areas that receive high human use such as campgrounds, recreation cabins, road corridors, trail corridors, administrative facilities, and some riparian zones along popular fishing streams. Hazard trees in stands adjacent to narrow clearings for high voltage utility lines are also a concern.

Impacts to Watersheds
Intense bark beetle outbreaks can kill large amounts of forest vegetation. The "removal" of significant portions of the forest will impact to some degree the dynamics of stream flow, time of peak flow, etc. There have been no hydrologic studies in Alaska quantifying or qualifying impacts associated with SBB outbreaks. Impact studies, however, have been done elsewhere. In a Montana watershed impacted by mountain pine beetles that killed 80% of the lodgepole pine (equal to 35% of all the timber), there was a 15% increase in annual water yield for 5 years following the infestation, a 2-3 week advance in snowmelt, and a 10-15% increase in low flows (Potts 1984).

Impacts to Fish Habitat
Riparian vegetation has important effects on physical and biological processes in forest streams (Beschta 1998). In addition to providing nutrients and substrate for biological activity, large woody debris that falls into streams affects channel patterns, forms pools of various sizes and depths, dissipates energy of flowing water, and traps sediments. The size, amount, and species of large woody debris entering streams can have significant affects on their physical and biological characteristics (Sedell et al). Changes in forest stand composition and structure following a spruce beetle outbreak could significantly alter stream ecosystems for long periods of time including their suitability as habitat for anadromous fish. The successional processes that follow a spruce beetle outbreak, whether natural or human-altered, will determine the magnitude and duration of any changes in stream ecosystems.

Impacts to Wildlife Habitat
There is little empirical data on the response of wildlife populations to spruce beetle-caused tree mortality in Alaska. Consequently, responses of most species must be inferred from knowledge of their habitat requirements (Ross 1999). For example, wildlife populations, which depend on live, mature spruce stands for habitat requirements may decline. We expect to see decreases in Red Squirrel, Spruce grouse, Townsend Warblers, and possibly Marbled Murrelet populations. On the other hand, wildlife species (moose, small mammals and their predators, etc.) that benefit from early successional vegetation such as willow and aspen may increase as stand structure and composition changes.

While there are currently several research projects underway to assess the response of songbird populations to spruce beetle infestations, much more research will be needed to generate definitive conclusions regarding the effects of spruce beetle infestations and silvicultural treatments on wildlife populations (Ross 1999).

Impacts to Scenic Quality
Scenic Beauty is an important forest resource. Several studies have demonstrated that there is a significant decline in public perception of scenic quality where SBB impacted stands adjoin corridors such as National Scenic Byways. Maintaining or enhancing scenic quality may necessitate minimizing impacts from SBB infestations. Surveys have also shown that the public is evenly divided as to whether SBB outbreaks damage scenic quality in backcountry areas (University of Alaska-Anchorage 1991) (Daniel et al.1991).

Long-term Stand Conversion
The best regeneration of spruce and paper birch occurs on a seedbed of bare mineral soil with some organic material. Site disturbances such as fire, windthrow, flooding, or ground scarification, provide excellent sites for germination and establishment of seedlings if there is an adequate seed source. However, on some sites in south-central Alaska, grass and other competing vegetation quickly invade the sites where SBB have "opened up" the canopy. This delays re-establishment of tree species. The duration of this delay is unclear, but limited research indicates the delay could last 20 years or longer (Schulz 1995).

Loss of Merchantable Value of SBB killed trees
In south-central Alaska, the economic value of spruce as saw timber is reduced within three years of SBB attack due to weather checking and sap rots. The value of SBB killed trees as house logs, chips, or firewood will continue for many years if SBB killed trees remain standing.

Impacts on Recreation
Forest Service campgrounds, recreation cabins, and trails have been and are continuing to be impacted by the SBB epidemic. Spruce trees in campgrounds, around recreation cabins, and in trail corridors are continuing to be killed every year by spruce bark beetles creating hazard trees and/or fuels as they break off and block trails. When hazard tree removal or other vegetation

management has to be performed in these areas, campground loops and sometimes, entire campgrounds may have to be closed to public use until project work is completed.

Additionally, the setting of the recreation site may radically change in just a few years. Management efforts are often needed to restore the area to a more desirable setting.

Kenai Peninsula Spruce Bark Beetle Task Force Report

Concerns over the infestation's impact to Alaska's forests, public safety, and ecosystems prompted the Senate Appropriation Committee to direct the U.S. Forest Service to establish a multiparty task force to prepare an action plan to manage spruce beetle infestations in Alaska and rehabilitate the infested areas.

The Task Force completed its "Action Plan for Rehabilitation in Response to Alaska's Spruce Bark Beetle Infestation" on June 30, 1998. The Task Force's action plan provides a vehicle by which individual landowners and public land managers can cooperate, share information and resources and coordinate their individual efforts. This framework will contribute to successful implementation of the Task Force's recommendations for:

- Fire Prevention and Public Safety
- Fuel Modeling and Risk/Hazard/Behavior Assessment
- Timber Management and Reforestation
- Public Education and Communications
- Coordinating Efforts
- Public Assistance
- Long-term Planning
- Science and Research.

Task Force recommendations in which the Chugach National Forest has a role and is taking action on are identified in Figure 2 on pages 11 and 12.

Other Resource Assessments

The Forest is currently in the process of revising the Forest Plan and has initiated a number of additional resource information assessments for the revision process. We anticipate these science-based assessments will be of benefit to the SBB Task Force, the public and land managers on the Kenai Peninsula. Information from these assessments is expected to become available over the next two to six months. These assessments include:

- Brown Bear Assessment for the Kenai Peninsula
- Vegetation Assessment for the Kenai Peninsula
- Recreation/Tourism Assessment

Cooperative Efforts with Other Agencies

The Forest is currently collaborating with the Alaska Dept. of Fish and Game on the Brown Bear Assessment and the Alaska Dept. of Forestry on the Land & Vegetation Cover Mapping of the Kenai Peninsula. Cooperative fire efforts with the Alaska Dept. of Forestry, Kenai Peninsula Borough, community fire departments and other Federal Agencies have been on-going (Appendix D).

The Forest was awarded a grant as a part of the Forest Service's Natural Resource Agenda to focus on forest health issues near and in the community of Seward. This grant is in line with recommendations of the Spruce Bark Beetle Task Force Report, and work will be completed in 1999. The grant will focus on public education forums and defensible space workshops for Seward and the surrounding communities, and an urban forestry plan for the community of Seward. Jointly sponsored Forest Service/State Forestry defensible space workshops have also taken place in the communities of Cooper Landing in 1992, and Moose Pass in 1994.

Figure 2 – STATUS OF FOREST SERVICE ACTION ON SBB TASK FORCE RECOMMENDATIONS

(A) FIRE PREVENTION AND PUBLIC SAFETY	(Item 9)	Incident Command System (ICS) Team and Seasonal Fire Fighter Availability and Training	The Forest has engines and fire qualified personnel that are available for an incident under the closest available resources concept. This is no change from Standard Operating Procedures between agencies. The Forest also has a limited number of people with higher level ICS qualifications who are available for a rapid response team on the Peninsula.
	(Item 12)	Fire Training	The Forest has agreements with the volunteer fire organizations in the communities of Bear Creek, Moose Pass and Cooper Landing. The Forest makes the Alaska Interagency Fire Training Bulletin available to these organizations, and can act as the sponsor to nominate individuals from these organizations to the available training. Completion of a wildland fire training plan is targeted for June 1, 1999.
	(Item 14)	Coordination of Hazard Tree Removal Including Right of Way Clearing	The Forest has an ongoing program to remove hazard trees from National Forest campgrounds and administrative sites. Hazard tree removal from public right-of-ways is done by the Forest Service or permitees such as in the free use firewood program.
	(Item 15)	Use of fire as a Management Tool	This plan is the strategic analysis to implement prescribed fire on National Forest lands on the Kenai Peninsula for forest health, wildlife, reforestation and hazard reduction purposes for the next 5 years. This plan outlines the long term strategy to continue to assess National Forest lands on the Kenai Peninsula by prioritizing watershed level Environmental Assessments for these purposes. The use of prescribed fire is expected to continue as a highly successful tool to be used to implement forest health, wildlife, reforestation, and hazard reduction projects. The Forest completed a change to the Alaska Interagency Wildland Fire Management Plan in January 1998. This converted the majority of lands within it's jurisdiction from Modified suppression zone to Limited suppression zone, in order to use wildland fire to meet resource objectives and further reduce the costs of fire suppression on the Forest. Reference Map # 8 in Appendix F.
		Working Group For Use of Fire As a Management Tool	The Forest has a small number of individuals with prescribed fire qualifications. This group likely contains all Forest Service personnel with current prescribed fire qualifications in Alaska. Members of this group participate with other groups, share available resources with other agencies, and coordinate logistics and implementation of a Kenai Peninsula prescribed fire program. This group shared resources and equipment with the Kenai National Wildlife Refuge to implement prescribed fires on both agencies' lands during the 1998 field season. Currently, 2 barriers exist that limit sharing of resources and equipment with other government agencies for fuels treatment, hazard reduction and prescribed fire projects: 1. Currently no Regional Sharing Agreement between the Forest Service and State Division of Forestry. **RESOLUTION: REGIONAL LEVEL.** 2. Only Dept. of Interior is allowed to hire AD firefighters (firefighters off-the-street) for hazardous fuels treatment and prescribed fire projects. The Forest Service is not allowed to hire AD firefighters for these projects. **RESOLUTION: NATIONAL LEVEL**

Figure 2 – STATUS OF FOREST SERVICE ACTION ON SBB TASK FORCE RECOMMENDATIONS (Continued)

		Working Group For Use of Fire As a Management Tool	The Forest currently has small programs in place to educate the public about the beneficial uses of fire, but recognizes that that a combined interagency effort would have greater impact at cheaper cost.
	(Item 16)	Use of Organized Emergency Fire Fighting Crews for Fuel Reduction and Reforestation Projects-----	The Forest sees the benefits of using organized emergency fire fighting crews for these purposes at the local level. The need for cost effective additional resources are crucial to the implementation of the prescribed fire program, especially during the short-term burning windows available on the Kenai Peninsula. However, current management direction at the Washington Office and Regional Office currently preclude the use of these crews but can be addressed by a policy change or signed agreement.
(B) FUEL MODELING &RISK/HAZARD/BEHAVIOR ASSESSMENT	(Item 1)	Urban interface fire hazard assessment	See item 4.
	(Item 2)	Fuel Modeling and risk/hazard assessment	See item 4.
	(Item 3)	Fuel Model Map	A current fire behavior fuel model map has been produced for National Forest lands on the Kenai Peninsula using "fire behavior" rather than the National Fire Danger rating System fuel models. This map, including two custom fire behavior fuel models, was developed by John See of the State of Alaska Division of Forestry for the Cooper Landing project in 1990. In 1995, the logic base was expanded in the Forest's GIS system to include all National Forest lands on the Kenai Peninsula. The fuel model map can be found in Appendix F, Map # 6.
	(Item 4)	Geographic Risk and Hazard Assessment	The Urban/Interface fire hazard assessment, fuel modeling and risk/hazard assessment and the Geographic Risk and Hazard Assessment (Items 1,2,4) will be completed during the summer of 1999 by a joint Forest Service, State of Alaska, Division of Forestry contract which has been awarded.
(C) TIMBER MANAGEMENT AND REFORESTATION	(Item 1)	Re-examine Feasibility of an in-state seedling nursery.	The Forest sees the need for a local nursery that can produce quality seedlings at reasonable cost for all landowners and public land managers on the Kenai. Historically, the Forest's seedling needs have ranged between 20-80,000 seedlings per year. Our current needs are for 20-40,000 seedlings per year.
	(Item 3)	Spruce Seeds	The Forest currently maintains approximately 200 pounds of spruce seed from over 20 seed-lots.
	(Item 6)	Fuel Breaks	Fuel breaks were implemented by the State, Borough and Forest Service as key elements of the Cooper Landing and the Moose Pass Cooperative Projects. Maintenance of these existing fuel breaks is incorporated into our management strategy. The addition of new fuel breaks will be evaluated in future project environmental assessments.
	(Item 14)	Reforestation of high value public lands	Reforestation of high value public lands will be evaluated in individual project environmental assessments. For suitable projects, requests for funding will be made. Reference our proposed reforestation projects in the action schedule (Appendix B) for funding needs.
(D) PUBLIC EDUCATION AND COMMUNICATIONS	(Item 6)	Public Education on role of Fire	See (A)-(Item 15) This is currently being done on a small scale by the Forest Service. Efforts would benefit with coordination of working groups.
(E) LONG TERM PLANNING	(Item 2)	Land and vegetation cover mapping.	The Forest is participating in this multi-agency project.
	(Item 3)	Wildlife Maintenance.	The Forest is participating in a multi-agency brown bear planning team for the Kenai Peninsula.

MANAGEMENT STRATEGIES FOR CHUGACH NATIONAL FOREST LANDS ON THE KENAI PENINSULA

Introduction

There are a variety of techniques that can be used to prevent, mitigate, or reduce impacts associated with SBB infestations. However, before pest management options can be developed, the resource objective(s) for a particular stand, watershed, landscape, etc. must be determined. The forest manager must evaluate the resource and public values along with the feasibility of management actions for each stand in light of management objectives. The beetle population level must also be considered because population levels may determine the priority of management actions and the type of strategy to be invoked.

The key to forest ecosystem management is to manage vegetation patterns in order to maintain species diversity, both plant and animal, while providing for a multitude of resources such as recreation, fisheries, wildlife, and the production of wood fiber for personal and commercial uses. Properly applied silvicultural practices as well as fuels and fire management on the National Forest, can maintain the forest diversity needed to provide the range of amenities, wildlife habitats and products available in the forest for now and in the future.

In concert with the Spruce Bark Beetle Task Force Report, the Forest has developed four management strategies to focus cost effective management action on National Forest lands based on assigned strategic priorities. The strategies and priorities are:

- Strategy/Priority # 1 – Fire Protection and Management
- Strategy/Priority # 2 – Fuels Management
- Strategy/Priority # 3 – Forest Health & Watershed Restoration
- Strategy/Priority # 4 – Wildlife Habitat Management

Each management strategy is independent of the others and has it's own set of objectives and uniquely numbered priorities to provide flexibility in response to treatment area suitability, treatment method, funding availability and/or restrictions, and risk.

The management strategies embrace the "Forest Health Vision" of the Chief and incorporate existing management direction and recommendations contained in the Forest Plan, the Kenai Peninsula Spruce Bark Beetle Task Force Report, and the Forest Service's Natural Resource agenda. The strategies are consistent with the Forest Service's new interim road policy and are based on the following additional information located in the Appendices to this report:

- a current analysis of existing ecosystem conditions on National Forest System lands (Appendix A)
- Chugach National Forest Five Year Action Schedule detail spreadsheets (Appendix B)
- treatment options which are discussed in Appendix C
- our fire suppression capabilities which are discussed in Appendix D
- current scientific data related to the SBB on the Kenai Peninsula (reference citations in Appendix E).
- resource maps used in the Appendix A assessment (Appendix F)

The strategic acreage of proposed treatments under each strategy is based on mapped data contained in the Forest GIS adjusted by professional judgement. In most cases, the proposed treatment acreage is less than the total acreage that is SBB susceptible. The actual feasible acreage needing treatment remains to be determined by project level NEPA analysis and decisions and could be greater or less than the strategic acreage derived from the Forest GIS and adjusted by professional judgement.

Management Strategy 1 has no on-the-ground actions to be implemented, except fire suppression at the time of a wildland fire, and consequently, does not have a specific set of proposed actions, general project locations or estimated acres and is not displayed in the 5-year action schedule.

While public education is certainly a component of this strategy, under the SBB Task Force recommendations, the State has been assigned primary responsibility for funding and educating the public on fire safety. The Forest plays a support role in this public education by assisting State Forestry in holding defensible space workshops in communities and cooperating with other agencies in education efforts (previously discussed on page 8).

Management Strategies 2, 3 and 4 provide pre-planned, strategic actions that may be implemented on the ground after completion of project-level NEPA analysis and decisions, and collectively when combined, will contribute to accomplishment of the Fire Protection and Management Strategy before wildfire suppression becomes necessary.

Management strategies 2, 3 and 4 each have independent priorities identified in Figures 4, 5, and 6. These figures provide the detail of the strategy and list specific priorities, proposed action criteria, general project location criteria, and the estimated number of acres planned for treatment for that strategic priority. The strategic priority number is also identified in the 5-year action schedule for each proposed treatment as either a primary, secondary or tertiary strategy, since one treatment can meet more than one strategic objective. This number links the treatment in the 5-year action schedule back to the strategic priority.

The Forest recognizes that treatment actions under one strategy might overlap with priorities in one or more of the other strategies depending on location, funding, etc. The overriding implementation objective is to maximize benefits by first selecting acres for treatment that fall within these assigned priorities and then selecting treatments that accomplish the highest number of objectives at the least cost.

Management Strategy 1 – Fire Protection and Management

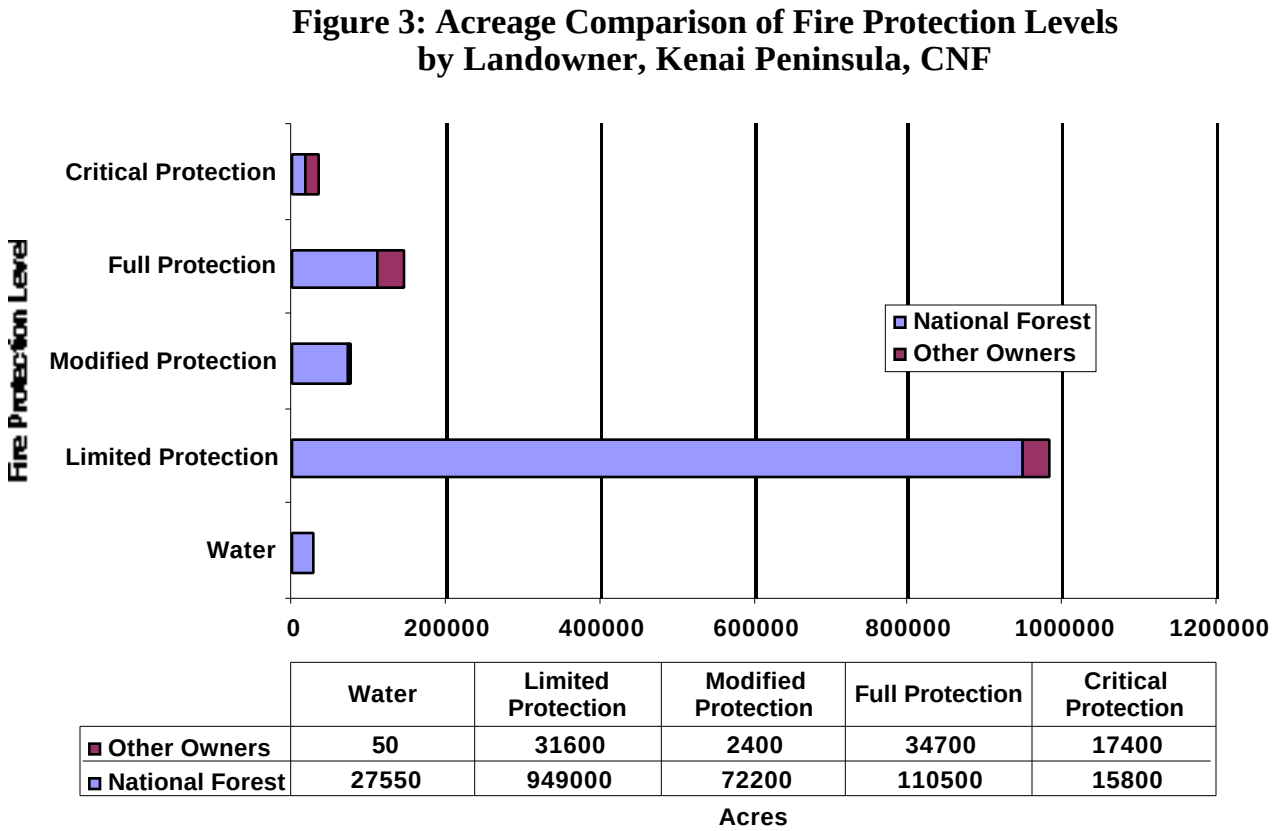
Fire protection within the forest boundary is the highest priority fire management strategy. Fire protection consists of prevention, detection, pre-suppression and suppression. No pre-planned on-the-ground outputs will occur except fire suppression, which will occur at the time of a wildfire.

To facilitate fire protection efforts, the Forest has been zoned into Fire Protection Designations or Levels with pre-determined tactical suppression responses based on protection designation, tactics, economics, and risk. Regardless of fire protection designation or the appropriate suppression response chosen, protection of life and property will always be the first priority of fire suppression efforts. **For a discussion of specific fire suppression capabilities and staffing on the Kenai Peninsula, refer to Appendix D**.

1. Fire Protection Land Designations

The Alaska Interagency Fire Management Plan (AIFMP) has classified and mapped all lands within Alaska as one of four fire protection designations or levels. The protection designations determine response, and are used to set priorities for fire fighting resources when Alaska has multiple fires. The
Plan also divides the responsibility for wildland fire suppression in Alaska between 3 agencies: the Bureau of Land Management, the State Division of Forestry, and the Forest Service. The Forest Service has **total responsibility** for **wildland** fire suppression **within the Forest boundary**, regardless of land ownership. Reference Map #8 in Appendix F for the AIFMP Fire Protection Level for the Kenai Peninsula portion of the Forest. Figure 3 provides a comparison of the relationship between designated protection areas by landowner.

Figure 3 – Acreage Comparison of Fire Protection Levels by Landowner, Kenai Peninsula, CNF



	Water	Limited Protection	Modified Protection	Full Protection	Critical Protection
Other Owners	50	31600	2400	34700	17400
National Forest	27550	949000	72200	110500	15800

The fire protection designations or levels on the Kenai Peninsula portion of the Forest with their respective definitions are:

a. **Critical Protection** (33,200 acres, all land owners): Areas where human life or habitation is present have priority over all others. Immediate and continuous efforts are made to minimize loss of life and damage to property (AIWFMP, 10/1999).

b. **Full Protection** (145,200 acres, all land owners): Valuable resources, such as commercial timber stands and historic structures exist, but no human life or habitations exist in these areas. Immediate and aggressive action is taken to limit the numbers of acres burned (AIWFMP, 10/1999).

c. **Modified Protection** (74,600 acres, all land owners): Uninhabited; with resources of lesser value. Land managers consider trade-off of acres burned versus suppression expenses. Fires during critical burning months are attacked, but a lower level of protection is provided when the risks of large damaging fires are less. Lands classified as "modified" may convert to "limited" after July 15th during a "normal" fire season (AIWFMP, 10/1999).

d. **Limited Protection** (980,600 acres, all land owners) Areas where natural fires are beneficial, or where the costs of fighting the fire are greater than the fire damage. Suppression efforts are limited to keeping a fire within a designated area, or protecting critical sites within the areas (AIWFMP, 10/1999).

2. Forest Service Appropriate Suppression Response.

The Forest Service has three Appropriate Fire Suppression Responses that can be used on wildland fires within the designated protection areas. They are based on tactics, economics, and risk

a. **Confine**: To limit fire spread within a predetermined area principally by use of natural or pre-constructed barriers or

environmental conditions. Suppression action may be minimal and limited to surveillance under appropriate conditions (State of Alaska DEC 1998).

b. **Contain**: To surround a fire with control line as needed, that can reasonably be expected to check the fire's spread under prevailing and predicted conditions (State of Alaska DEC 1998).

c. **Control**: To complete the control line around a fire and any interior islands to be saved; to burn out any unburned area adjacent to the fire side of the control line; and to cool down all hot spots that are immediate threats to the control line, until the line can reasonably be expected to hold under foreseeable conditions (State of Alaska DEC 1998).

3. Priorities for Implementing Fuels, Forest Health & Watershed Restoration, and Wildlife Habitat Management Strategies on National Forest Lands

Actions implemented in strategies 2, 3 and 4 will focus treatment on National Forest lands in the following fire protection priorities to the extent practical:

Priority	Fire Protection Level
1	**Critical**
2	**Full**
3	**Modified**
4	**Limited**

Management Strategy 2 – Fuels Management

Treatment of hazardous levels of fuels is the most pro-active method of breaking the fire behavior triangle of fuels, weather and topography. Weather and topography cannot be modified. Methods which deny a fire's access to continuous fuels, or modify existing fuel loading in such a manner that what remains is less flammable, or burns with reduced intensity, will reduce the resistance to control of a wildfire, and reduce the ultimate costs of fire suppression.

Where appropriate, fuels treatment has **always** been found to be more cost effective than fire suppression, and more desirable than living with adverse resource impacts of either a wildfire, or a wildfire suppression effort, or both.

Natural fuels are those which build up through natural processes. Activity fuels are those which accumulate as a by-product of timber harvest or some other management activity. The array of fuel treatment methods for natural fuels is identical to that of activity fuels. The level of effectiveness, cost, and the number of acres treated over time can measure differences.

Factors that determine fuel treatment cost include available road access, treatment method, and the size of the area to be treated. If the area to be treated is large and road access is not available, a prescribed burn of the area can be the most effective method of reducing hazardous fuels at the least cost. If prescribed burning is not an option, another less effective method of fuels treatment may have to be substituted to keep the project cost effective.

On National Forest lands on the Kenai Peninsula, low road densities restrict treatment of most natural fuels. Most natural fuels treatment occurs in treatment areas that are generally small in size and in areas with higher probabilities of fire starts. The methods used only target fine fuels that contribute to ignition and rates of fire spread. Larger material like dead spruce tree boles can not be dealt with without equipment and still be cost effective. Over time, as SBB killed spruce stands start to fall apart, tree boles (called 1000 hour fuels) break off and accumulate close to the ground (post SBB kill). These kinds of fuel, once ignited contribute to high fire intensity levels and resistance to control.

Activity fuels on the other hand generally have some form of road access associated with the activity, such as a timber sale road or campground access road. The area to be treated is also generally small. This combination of factors allows cost effective activity fuels treatment by hand or machine piling for later disposal by burning during low risk periods or chipping.

The use of prescribed fire to treat fuels by under-burning natural live stands, a highly viable and effective method of fuels treatment in a number of areas in the continental United States, is not effective in Alaska where all tree species have thin bark and would be killed by the passage of fire. If a stand has already experienced severe SBB mortality and lacks advanced regeneration, under burning would be a viable option provided there is enough fuel on the ground to carry the fire. Reference Appendix C for further discussion of the prescribed burning treatment option.

The objective of the fuels management strategy on National Forest lands is to focus cost effective fuel management treatments in specific areas to minimize the risk of wildland fire occurrence and/or intensity, particularly in critical and full protection level areas (Refer to Map # 8 in Appendix F).

Priorities for fuels treatment within distance zones established by the Seward District fire specialist are displayed in Figure 4 and include areas meeting the following criteria:

1. Legally required fuels management (timber sales) and fuels generating management activities.

2. Areas within an optimal distance zone of one mile of human habitation/private property where SBB related fuels (beetle infested spruce trees, blue-joint reedgrass and/or brush) are found. For the purpose of prioritizing treatment with limited funding, the 1mile zone is split into a higher priority zone of 0-1/2 mile and a lower priority _-1 mile zone.

3. Existing fuel breaks and fuel reduction areas in Cooper Landing and Moose Pass.

4. Key areas where SBB related fuels (beetle infested spruce trees, blue-joint reedgrass and/or brush) are found and historical fire ignitions have occurred and/or areas with public facilities that need to be protected. These areas are generally within _ mile of the road system and in/and adjacent to campgrounds, recreation cabins, trails and administrative sites. Areas that already have recent NEPA decisions for hazardous fuel treatment are also included in this strategy.

Note: One consideration in the determination of fuels treatment distance zones is the rapid rate of fire spread in fuel models containing blue-joint reedgrass. As SBB mortality continues, the amount of blue-joint reedgrass is expected to increase over time on many sites on the Kenai Peninsula.

Figure 4 – Fuel Management Priorities and Estimated Treatment Acres

Priority	Proposed Action(s) Criteria:	Location	Estimated ACRES
2-1	**ACTIVITY FUELS**	**Management Activities**	
2-1-A	Minimize activity fuels	a. timber sale areas	100
2-1-B	Minimize activity fuels	b. personal use areas	80
2-1-C	Minimize activity fuels	c. timber stand improvement areas	40
2-1	**Subtotal Activity Fuels**		**220**
2-2	**NATURAL FUELS IN URBAN INTERFACE ZONES**	**SBB Infested Trees and/or Stands**	
2-2-A	Minimize natural fuels	a. Within 0-1/2 mile of Human Habitation (Reference Map # 13 in Appendix F)	590
2-2-B	Minimize natural fuels	b. Within 0-1/2 mile of campgrounds and 500 ft of recreation cabins and admin facilities (Reference Map # 13 in Appendix F)	100
2-2-C	Minimize natural fuels	c. Within _-1 mile of Human Habitation (Reference Map # 13 in Appendix F)	216
2-2	**Subtotal Urban Interface Natural Fuels**		**906**
2-3	**FIREBREAK /FUEL REDUCTION AREAMAINTENANCE**	**Previously Treated Areas**	
2-3-A	Maintain fuel break mineral lines in existing fuel breaks & reduce flashy fuels fuel reduction areas.	a. Cooper Landing Cooperative Project Units	2,110
2-3-B	Reduce flashy fuels in fuel reduction areas.	b. Moose Pass Cooperative Project Units	40
2-3	**Subtotal FireBreak and Fuel Reduction Maintenance**		**2,150**
2-4	**NATURAL FUELS IN KEY AREAS**	**SBB Infested Trees and/or Stands**	
2-4-A	Minimize natural fuels	a. Within _ mile of roads (Reference Map # 14 in Appendix F)	194
2-4-B	Minimize natural fuels	b. Within 100 feet of trails (Reference Map # 10 in Appendix F)	894
2-4-C	Minimize natural fuels	c. Units with existing NEPA decisions for hazardous fuel treatment. ** 1,194 acres scheduled for FY1999	0 **
2-4	**Subtotal Natural Fuels**		**1,088**
2	**GRAND TOTAL**		**4,364**

Management Strategy 3 – Forest Health & Watershed Restoration

"No matter how we define a healthy forest, two aspects of forest health remain constant. First, forest health is more than just healthy trees. A healthy forest is one that maintains the function, diversity, and resiliency of all its components, such as wildlife and fish habitat, riparian areas, soils, and rangelands. Healthy forests also provide for human needs and desires, including appearing the way people want them to look. Second, health must be based on science. Science provides information for the decision-making process by identifying the status of forest ecosystems with options for addressing health issues. As science evolves, management practices must be modified accordingly.

A healthy forest is more than healthy trees and restoring forest health involves more than salvaging dead and dying timber. It must include riparian restoration, improvement of wildlife and fish habitat, and maintaining recreation opportunities and scenic values. In short, forest health means caring for all resources found in our national forests" (Lyons 1997).

Map # 2 in Appendix F displays the location and area of vegetative cover types found on the National Forest on the Kenai Peninsula. Eighty-one percent (951,700 acres) of the National Forest land base is in non-forest cover types which are not affected by the SBB epidemic. Forested cover types account for the remaining 19% (223,700 acres) of National Forest lands. Within the forested portion, slightly less than 50% of these cover types are also not susceptible to the SBB, except for scattered individual spruce trees or small groups of trees. In these forested areas, natural plant succession would continue unless treated under the fuels management or wildlife habitat strategies.

What is susceptible and/or already impacted by the SBB is slightly more than 50% of the forested (112,700 acres) acres that contain spruce or mixed spruce cover types with average tree diameters 5.0 inches and larger. The portion of the SBB susceptible forested acreage that receives high human use for a variety of reasons is the focus of our forest health and watershed restoration strategy.

The focus of the strategy is cost effective silvicultural and/or pest management treatments in high human use areas. Strategic objectives are to minimize public safety hazards, prevent or control additional SBB impacts in non-infested or lightly infested spruce stands, and to rehabilitate those stands already moderately to heavily infested or dead to meet vegetative setting objectives. The strategy specifically focuses on road and trail corridors, stands adjacent to utility corridors, campgrounds, recreational cabins, administrative facilities, stream and lake riparian zones, and personal/commercial use forest product areas.

Priorities for treatment are displayed in Figure 5 and include areas meeting the following criteria:

1. Removal of hazard trees in SBB impacted areas where human use and the possibility of tree failure poses an unacceptable risk. Refer to Appendix A, page A-29 for a discussion of how hazard trees and risk are determined. It is necessary to point out that in the context of the normal recreation hazard tree removal program for campgrounds, trails and recreation cabins; the SBB epidemic is a catastrophic event that has far surpassed the capability and funding of the normal hazard tree program. Additionally, the recreation hazard tree program is not responsible for hazard trees in road corridors or adjacent to utility corridors, which are incorporated into this strategy.

2. Insect & disease prevention or control in spruce stands with no or low levels of SBB infestation.

3. Restoration of spruce stands killed or moderate to heavily infested with SBB through site preparation and reforestation and/or re-vegetation where needed.

Figure 5 –Forest Health/Watershed Restoration Priorities and Estimated Acres

PRIORITY	Proposed Action(s) Criteria:	LOCATIONS	Estimated ACRES
3-1	**Hazard Tree Removal**	**SBB Infested Trees and/or Stands**	
3-1-A	Road Corridors	Within 100 feet of roads (Reference Map # 10 in Appendix F)	1,200
3-1-B	Trail Corridors	Within 100 feet of trails (Reference Map # 10 in Appendix F)	1,170
3-1-C	Utility Corridors	Within 100 feet of utility corridors (Reference Map # 10 in Appendix F)	700
3-1-D	Campgrounds	Within campgrounds & perimeter (Reference Map # 12 in Appendix F)	2,884
3-1-E	Facilities, Recreation Cabins	Within 500 feet of facilities (Reference Map # 12 in Appendix F)	130
3-1	**Subtotal Public Safety Hazard Tree Removal**		**6,084**
3-2	**Insect & Disease Prevention/Control**	**Spruce, mixed spruce/hardwood or hemlock stands with no to low SBB infestation levels.**	
3-2-A	Riparian Zones	Within 100 feet of streams (Reference Map # 9 in Appendix F)	2,810
3-2-B	Riparian Zones	Within 100 feet of lakes over 1 acre in size (Reference Map # 9 in Appendix F)	530
3-2-C	Road Corridors and Seward National Scenic Byway Road Corridor	Within 100 feet & Seward National Scenic Byway 1 mile (Reference Map # 10 in Appendix F)	13,630
3-2-D	Campgrounds	Within _ mile (Reference Map # 12 in Appendix F)	1,205
3-2-E	Facilities, Recreation Cabins	Within 500 feet (Reference Map # 12 in Appendix F)	80
3-2-F	Trail Corridors	Within 100 feet (Reference Map # 10 in Appendix F)	510
3-2-G	Personal Use Forest Product Areas	Designated Personal Use Areas (Reference Map # 14 in Appendix F)	460
3-2-H	Commercial Forest Products	Spruce/Mixed Spruce suitable timberlands (Reference Map # 14 in Appendix F)	7,520
3-2	**Subtotal Insect & Disease Prevent/Control**		**26,745**
3-3	**Restoration of Forest Conditions-Re-vegetation**	**Spruce, mixed spruce/hardwood or hemlock stands with moderate to high SBB infestation levels.**	
3-3-A	Re-vegetate Riparian Zones	Within 100 feet of streams (Reference Map # 9 in Appendix F)	5,810
3-3-B	Re-vegetate Riparian Zones	Within 100 feet of lakes over 1 acre in size(Reference Map # 9 in Appendix F)	720
3-3-C	Re-vegetate Road Corridors	Within 100 feet & Seward National Scenic Byway 1 mile (Reference Map # 10 in Appendix F)	20,250
3-3-D	Re-vegetate Campgrounds	Within _ mile (Reference Map # 12 in Appendix F)	3,395
3-3-E	Re-vegetate Facilities, Recreation Cabins	Within 500 feet (Reference Map # 12 in Appendix F)	220
3-3-F	Re-vegetate Trail Corridors	Within 100 feet (Reference Map # 10 in Appendix F)	1,870
3-3-G	Re-vegetate Personal Use Forest Product Areas	Within area (Reference Map # 14 in Appendix F)	915
3-3-H	Re-vegetate Commercial Forest Products Areas	Spruce/Mixed Spruce suitable timberlands (Reference Map # 14 in Appendix F)	17,415
3-3	**Subtotal Restoration of Forested Conditions**		**50,595**
3	**GRAND TOTAL**		**83,424**

Management Strategy 4 – Wildlife Habitat Management

Changes in vegetation resulting from both natural plant succession and the SBB epidemic have significant impacts on many wildlife species. In general, species that benefit from late successional spruce forests will experience habitat losses, while species that benefit from early seral vegetation may experience habitat gains. Shifts in acreage from mature spruce to early seral stages (in many cases blue-joint grass) will directly impact habitat carrying capacity for many species. Moose populations, for example, are very closely tied to browse availability.

Much of the concern with the beetle epidemic is the conversion of many stands to blue-joint grass. These beetle-killed stands would be considered early successional, but the blue-joint grass dominance is projected to reduce the ability of browse species to increase. Studies in Resurrection Creek on the Kenai Peninsula indicate that if browse species are not present on-site prior to SBB infestation, they are not likely to become established by natural regeneration (Schulz 1996). This suppression is likely to last at least 20 years and possibly longer.

The relative abundance of browse is dependent on the type, intensity, and timing of recent disturbances. Other types of disturbances include fire, timber harvest, and avalanches.

Hardwood stands on the Kenai Peninsula are seral and are replaced by spruce and hemlock over time if not set back by natural disturbances. Historically, natural and human-caused fires have interrupted this succession, thereby creating more hardwoods. With more efficient fire control, hardwood stands have matured and have become increasingly converted to conifer stands.

The current moose winter range condition is declining due to natural succession in older hardwood stands created by wildfire, spruce stand conversion to blue-joint grass following SBB kill, lack of new range being created by site disturbances and human development in the existing range. Although this is part of the natural cycle, a declining moose population is generally viewed as having negative affects on the predator complex, sport hunting opportunities, and wildlife viewing.

Moose winter range is generally considered to be the limiting factor in controlling numbers. Moose winter in the narrow low elevation valleys of the forest, and on higher south facing slopes where browse is present. Snow depth, as dictated by the elevation, slope, and aspect determines the amount of browse available.

As a general rule, land below 1,500 feet in elevation is considered winter range and those lands with hardwood seedling or sapling stages are primary winter range. Primary winter range has the potential to carry up to 7 moose/square mile. Winter range without the young hardwoods can support up to 2 moose/square mile (Spraker ADF&G personal communication 1999).

Hardwoods are useful as browse until they exceed approximately 2 inches in diameter at breast height, where they then become too large for moose to feed on directly or break over and then feed. This roughly equates to the seedling/sapling stages. For most hardwoods, the stands grow into pole class within 15 years.

The lack of seedling/sapling and pole sized hardwoods therefore has a significant impact on numbers of moose that the land can support. The quality of winter range also affects production and survival of calves. Calves are the segment of the population most susceptible to winter loss. In addition, cows debilitated by poor nutrition in winter may give birth to weakened calves and these calves are highly vulnerable to predators and other mortality factors (Vanderlinden, 1991).

As beetle-infested stands begin to unravel, with large amounts of downfall, availability of any browse is projected to decrease for up to 25 years and then slightly increase, as browse species become more dominant. Treatment of these stands can make significant improvements for moose and other early seral species much sooner than if left to natural plant succession.

An example can be seen in the Cooper Landing area along the West Juneau Road where the beetle killed spruce were cut and removed during the winter from a mixed spruce-hardwood stand. The following spring mature aspen in the stand were cut and left on-site. Two winters later, 15 moose were seen wintering in this stand, feeding on the down aspen and the newly regenerated seedlings which by then had grown to 5 feet in height.

Wildlife populations, which depend on live, mature spruce stands for habitat requirements may decline. Decreases in Red Squirrel, Spruce Grouse, Townsend's Warblers and possibly Marbled Murrelet populations are to be expected. In a recent study on the forest, Lance and Howell (in review) found decreases in Townsend's Warbler, Ruby-crowned Kinglets where the mature spruce canopy was lost, while Swainson's Thrush, Dark-eyed Junco, Yellow-rumped Warbler increased.

Northern Goshawk, Marbled Murrelet, and Bald Eagles have been impacted by the bark beetle epidemic. Nest sites of Northern Goshawk have been lost as trees have died, and stands which would have become potential nest sites are lost before they reach

acceptable diameter, size and have stand requirements needed by these birds. Marbled Murrelet have lost potential nest trees, as the mature trees are generally the first to be attacked by the bark beetle. While the coastal spruce has remained unaffected by the bark beetle on the forest so far, this condition could change. Inland spruce however, is significantly affected. Marbled Murrelets have been found up to 34 miles inland, near Trail Lake Fish Hatchery (Jones USFWS personal communication 1999). Marbled Murrelet and Bald Eagles have the potential of losing nest trees if the epidemic reaches the coastal stands of spruce. (Inland, the eagles use cottonwoods for nest trees almost exclusively).

The "SBB removal" of significant portions of the forest will impact to some degree the dynamics of stream flow, timing of peak flow, etc" (USDA Forest Service 1991). If salmon spawning streams are bordered by large diameter spruce and these trees are subsequently killed by spruce beetles, there is a concern as to the recruitment of large woody debris for the stream in the future. Large woody debris in spawning streams is a necessary component for spawning habitat integrity (USDA Forest Service 1991). Many of the Seward Ranger district's anadromous streams have lost riparian zone mature spruce. Russian River, Resurrection Creek, Johnson Creek, Quartz and Dave's Creek have experienced significant SBB mortality in the riparian zone.

The wildlife habitat strategy is concerned with all 223,700 acres of forested cover types on the Kenai Peninsula in addition to a portion of the 543,000 acres of non-forest (shrub and forb) cover types (Refer to Map # 2 in Appendix F).

The objective of this strategy is to manage forest vegetation affected by either the SBB epidemic or natural plant succession to provide the quantity and quality of habitat necessary to meet objectives for certain wildlife species. The strategy focuses on silvicultural treatments in vegetation types that specifically maintain or improve habitat for moose, sheep/goats, certain nesting birds, Brown Bear, and other species dependent on spruce and early seral hardwood plant communities.

Priorities for treatment are displayed in Figure 6 and include areas meeting the following criteria:

1. Moose winter range habitat that could draw moose away from highways and/or benefit subsistence users.
2. Sheep/goat timberline forest habitat.
3. Old-growth bird nesting habitat for Northern Goshawk, Bald Eagle, Marbled Murrelet, and cavity nesting species.
4. Brown bear travel corridor habitat that has reduced hiding cover.
5. Other wildlife species dependent on spruce plant communities (Red Squirrel, Spruce grouse, etc.).

Figure 6 –Wildlife Habitat Priorities and Estimated Treatment Acres

PRIORITY	HABITAT	Proposed Action(s) Criteria:	LOCATION	Estimated ACRES
4-1	**Early Successional Species Habitat Enhancement**	**Increase acreage of hardwood and mixed spruce/hardwood forest types in seral stage.**	**Willow, aspen, birch, mixed spruce/hardwood, and spruce stands (spruce stands must be SBB infested & unsuitable timberland) in PRIMARY moose winter range.**	
4-1-A			**AND** within zone > 1/4 mile from major highways **AND NOT** in 4-1-B. (Reference Map # 15 in Appendix F)	**28,100**
4-1-B			**AND** within zone > 1/4 mile from major highways **AND** within 5 miles of subsistence communities of Hope and Cooper Landing **AND NOT** in 4-1-A. (Reference Map # 15 in Appendix F)	**5,480**
4-1-C			**AND** within remaining primary moose winter range **AND NOT** in 4-1-A or B. (Reference Map # 15 in Appendix F)	**100**
4-1		**Subtotal Moose Habitat**		**33,680**
4-2	**Sheep/goat habitat**	**Improve quality of habitat.**	**Alpine, timberline stands** **(Reference Map # 2 in Appendix F)**	**625**
4-3	**Old-growth nesting habitat**	**Create or maintain nesting habitat for:**	**Spruce, Hemlock, Cottonwood and/or Birch Stands**	
4-3-A		Northern Goshawk	Spruce, Hemlock, Birch Stands	**300**
4-3-B		Bald Eagle	Spruce, Hemlock, Cottonwood Stands	**50**
4-3-C		Marbled Murrelet	Spruce, Hemlock Stands	**20**
4-3-D		Cavity Nesting Species	All stands	**10**
4-3		**Subtotal Bird Nesting Habitat**		**380**
4-4	**Brown Bear travel corridors**	**Maintain vegetation Hiding cover**	**All stands** **(Rough Estimate Only)**	**600**
4-5	**Species dependent on spruce plant communities**	**Maintain vegetation**	**Spruce, mixed spruce stands** (Reference Map # 3 in Appendix F)	**100**
4		**GRAND TOTAL**		**35,385**

CHUGACH NATIONAL FOREST FIVE YEAR ACTION SCHEDULE

Implementation of the four proposed strategies is summarized below in Figure 7 and may be accomplished through a combination of the fire protection/prescribed fire/fuels management program, the forest vegetation management program and/or the wildlife habitat improvement program on the Forest. Fiscal Year 1999 management treatments and project costs are not included in the 5-year action schedule which starts with Fiscal Year 2000.

Figure 7 – Five-Year Action Schedule Summary by Management Strategy

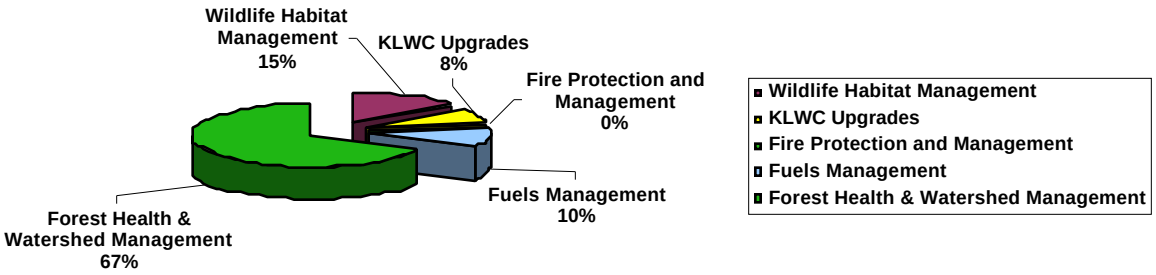
Strategy/Priority	Strategy Name	Total Proposed Acres	Total Proposed Cost
1	**Fire Protection and Management**	0	0
2	**Fuels Management**	4,364	$1,049,540
3 **	**Forest Health & Watershed Restoration**	83,424	$7,052,619
4	**Wildlife Habitat Management**	35,385	$1,512,661
ALL ***	Upgrade/Repair of Kenai Lake Work Center as Support Facility for Plan Implementation	0	$ 800,000
GRAND TOTAL ALL		**123,173**	**$10,414,821**

** As discussed earlier, this strategic plan is based on mapped information in the Forest GIS. In moving to plan implementation, we first need on-the-ground vegetation information for the specific areas identified in this strategic plan, i.e., riparian zones, road and trail corridors, stands adjacent to utility corridors, the Seward Scenic Byway corridor, campgrounds, recreation cabins, administrative facilities, personal use areas, and commercial use forest product areas within _ mile of existing roads. Accurate ground information will then be used to develop silvicultural/pest management prescriptions and plans. Priority 3 includes stand data collection, silvicultural prescriptions, and vegetation management plans for 68,930 of the 83,424 acres proposed in priority 3. With the exception of campgrounds (which are currently out-dated by the SBB infestation) vegetation management plans have never been developed before for these specific areas. Priority 3 also includes 14,494 acres of hazard tree removal, forest vegetation restoration, and stand thinning and pruning.

*** The current work force on the Chugach National Forest can accomplish a portion of this action schedule but full implementation would require additional staffing and facilities to support them. Currently, field operations for the Kenai Peninsula are centered at the Kenai Lake Work Center. This facility is no longer adequate to handle the staffing that will be required to fully implement this plan. Upgrades/repairs to the facility are estimated to cost $800,000. We are requesting $400,000 in the Fiscal Year 2000 and $400,000 in Fiscal Year 2001 action schedules located in Appendix B to get the Kenai Lake Center upgraded to a level that will support full implementation of this strategic plan.

Figure 8 below displays the cost distribution in the five-year action schedule by management strategy. Sixty-seven percent of the costs in the five-year action schedule are associated with the forest health & watershed restoration strategy.

Figure 8: Five Year Action Schedule Cost Distribution



Full implementation of the five-year action schedule will require out year funding by the fund codes displayed in Figure 9. FY 2000 and 2001 funding is approximately 10% percent higher that annual funding needs in FY 2002-2004 due to the need to upgrade the KLWC and the need to obtain on-the-ground data for developing vegetation management plans for the areas specified in the strategic plan.

Figure 9 – Funding Needs by Fiscal Year and Fund Code

Fund Code	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	Total Cost
NFER	$1,921,067	$ -	$ -	$ -	$ -	$ 1,921,067
NFFV -	$ 1,060,457	$ 391,924	$ 360,874	$ 372,274	$ 2,185,529	$
NFRN	$222,239	$ 70,000	$ 74,000	$ 77,500	$ 81,500	$ 525,239
NFTM	$123,239	$ 665,849	$ 35,060	$ 12,459	$ 20,210	$ 856,817
NFTR	$153,192	$ -	$ -	$ -	$ -	$ 153,192
NFWL	$107,628	$ 274,364	$ 310,486	$ 445,709	$ 342,951	$ 1,481,138
NFWL/WFHF	$19,439	$ -	$ -	$ -	$ -	$ 19,439
RTRT	$142,430	$ 545,899	$ 557,899	$ 496,104	$ 521,144	$ 2,263,476
WFHF	$33,252	$ 88,337	$ 312,927	$ 133,678	$ 428,646	$ 996,839
Total Cost	$2,722,486	$ 2,704,906	$ 1,682,296	$ 1,526,324	$ 1,766,725	$ 10,402,737
Percent of Total Cost	26%	26%	16%	15%	17%	100%

Changes in priorities or timing to accomplish actions can vary depending upon weather and availability of funding. More prescribed burns are included in each year's program than can be reasonably accomplished by the current organization. However, conditions could provide opportunities for burning that could exceed an average year, and the fire organization expects to be prepared to take advantage of those conditions if and when they occur assuming sufficient funding is available.

There is an opportunity to coordinate prescribed fires with State Forestry on small beetle killed spruce units within the Moose Pass area which are currently scheduled for Fiscal Year 2004. By themselves, they would serve little purpose for hazard reduction unless burned in conjunction with larger units of SBB killed spruce on adjacent State lands. All of these units are small and directly upslope above State lands. The Forest will be collaborating with the State on conducting prescribed burns for both State and National Forest units. These units are included in the five year schedule for FY 2004, but would not be burned unless the State decides to burn their down slope units.

The following tables display the proposed actions in each of the program areas for the 5-year period on the Kenai Peninsula. Direct costs for implementation plus overhead are included. Proposed actions and associated costs are subject to change for a variety of reasons, including specific direction and revisions to the Forest Plan.

In Figure 10 on page 26, the proposed acres and costs in the five-year action schedule are displayed by individual strategies. The number of acres of uninfested SBB spruce, infested SBB spruce, and the total acreage that could be treated in each strategy (treatment opportunity) from the assessment in Appendix A are also displayed.

Figures 11 and 12 display estimates of proposed acres to be treated (note: treated acres in these tables includes vegetation management plan development as footnoted in figure 7) and the estimated cost in dollars to accomplish treatment activities by strategy and general project type, i.e., site preparation, reforestation, etc.

For detailed five-year action schedule data, refer to Appendix B.

Figure 10: Appendix A Assessment Summary and Five-Year Action Schedule Summary by Strategy

Management Strategy Name	Strategy ID Number	Total Assessment Not infested	Total Assessment Infested	Total Assessment Opportunity	Total 5 Yr Plan Proposed Treatment	Total 5 Yr Plan Proposed Cost
FUELS MANAGEMENT		**ACRES**	**ACRES**	**ACRES**	ACRES	**DOLLARS**
ACTIVITY FUELS						
Total Activity Fuels -Timber Sales	2-1-A	0	100	100	100	$ 22,265
Total Activity Fuels Personal Use	2-1-B	0	190	190	80	$ 30,436
Total TSI Activity Fuels	2-1-C	255	350	605	40	$ 26,430
Total Activity Fuels	2-1	255	640	895	220	$ 79,131
INTERFACE-NATURAL FUELS						
1/2 mile PVT prop	2-2-A	-	15,350	15,350	590	$ 344,391
1/2 Mile campgrounds, 500 ft cabins	2-2-B	765	2,700	3,465	100	$ 31,731
1/2-1 mile PVT Prop	2-2-C	-	8,844	8,844	$ 216 89,096	
Total Interface Fuels	**2-2**	**765**	**26,894**	**27,659**	**906**	**$ 465,218**
FUEL BREAKS						
Total Fuel Breaks	**2-3**	**2,150**	**-**	**2,150**	**2,150**	**$ 16,430**
NATURAL FUELS						
1/2 mile Roads	2-4-A	7,980	17,470	25,450	194	$ 109,448
100 feet Trails	2-4-B	124	1,170	1,294	894	$ 379,314
Total Natural Fuels	2-4	8,104	18,640	26,744	1,088	$ 488,762
TOTAL FUELS MANAGEMENT		**11,274**	**46,174**	**57,448**	**4,364**	**$ 1,049,540**
FOREST HEALTH & WATERSHED RESTORATION		**ACRES**	**ACRES**	**ACRES**	**ACRES**	**DOLLARS**
Hazard Tree Removal						
Total Road Corridor 0-100ft	3-1-A	460	740	1,200	1,200	$ 418,188
Total Trail Corridor 0-100ft	3-1-B	-	1,170	1,170	1,170	$ 370,000
Total Utility Corridor 0-100ft	3-1-C	1,100	1,430	2,530	700	$ 251,368
Total Campground 0-1/2mi	3-1-D	790	2,690	3,480	2,884	$ 946,036
Total Cabins 0-500ft	3-1-E	40	90	130	130	$ 48,111
Total Hazard Tree Removal	3-1	2,390	6,120	8,510	6,084	$ 2,033,703
Vegetation & Pest Management						
Total Stream Riparian	3-2-A	2,400	-	2,400	2,810	$ 280,960
Total Lake Riparian	3-2-B	530	-	530	530	$ 18,232
Total Road Corridors 0-100 ft 1/2 mi SNS Byway	3-2-C	4860	-	4860	13,630	$ 581,360
Total Campground 0-1/2 Mile	3-2-D	790	-	790	1,205	$ 220,426
Total Cabins 0-500 ft	3-2-E	40	-	40	80	$ 24,576
Total Trail Corridor 0-100 ft	3-2-F	510	-	-	510	$ 17,544
Total Personal Use Areas	3-2-G	460	-	460	460	$ 15,824
Total Commercial Use Areas	3-2-H	7,520	-	7,520	7,520	$ 258,688
Total Veg & Pest Mgmt	**3-2**	**16,600**	**-**	**16,600**	**26,745**	**$ 1,417,610**
Restoration				-	$ 4,000	
Total Stream Riparian	3-3-A	-	3,590	3,590	5,810	$ 891,228
Total Lake Riparian	3-3-B	-	470	470	720	$ 109,562
Total Road Corridors 0-100 ft,SNC Byway	3-3-C	-	7940	7940	20,250	$ 1,114,960
Total Campground 0-1/2 Mile	3-3-D	-	2,690	2,690	3,395	$ 251,336
Total Cabins 0-500 ft	3-3-E	-	90	90	220	$ 42,876
Total Trail Corridor 0-100 ft	3-3-F	-	1,170	1,170	1,870	$ 183,648
Total Personal Use Areas	3-3-G	-	740	740	915	$ 175,256
Total Commercial Use Areas	3-3-H	-	16,730	16,730	17,415	$ 828,440
Total Restoration	3-3	-	33,420	33,420	50,595	$ 3,601,306
TOTAL FOREST HEALTH & WATERSHED RESTORATION3		**18,990**	**39,540**	**58,530**	**83,424**	**$ 7,052,619**
WILDLIFE HABITAT MANAGEMENT		**ACRES**	**ACRES**	**ACRES**	**ACRES**	**DOLLARS**
Total Moose > 1/4 mile	4-1-A	-	27,790	27,790	28,100	$ 981,512
Total Subsistence Moose	4-1-B	-	5,480	5,480	5,480	$ 133,315
Total Moose > 1/4 mile	4-1-C	13,530	-	13,530	100	$ 27,600
TOTAL MOOSE	4-1	13,530	33,270	46,800	33,680	$ 1,142,427
Total SHEEP/GOAT	4-2	625	-	625	625	$ 12,084
Total Goshawk	4-3-A	-	300	300	300	$ 146,300
Total Eagle Nesting	4-3-B	-	50	50	50	$ 27,700
Total Marbled Murrelet	4-3-C	-	20	20	20	$ 9,000
Total Cavity Nesters	4-3-D	-	10	10	10	$ 4,500
TOTAL BIRDS	4-3	-	380	380	380	$ 187,500
Total Brown Bear Travel Corridors	4-4	-	300	300	600	$ 144,700
Total Species Dependent on Spruce	4-5	-	50	50	100	$ 25,950
TOTAL WILDLIFE	**4**	**14,155**	**34,000**	**48,155**	**35,385**	**$ 1,512,661**
GRAND TOTAL ALL	**ALL**	**44,419**	**119,714**	**164,133**	**123,173**	**$ 9,614,821**

Figure 11: Five-Year Action Schedule Proposed Treatment Acres by Strategy and Project Type

Management Strategy Name	Strategy ID Number	Total 5 Year Plan Proposed Treatment	Vegetation and Pest Mgmt Plans Acres	Hazard Tree Removal Acres	Prescribed Burning Acres	Site Preparation for Reforestation Acres	Revegetation/ Reforestation Acres	Thinning, Pruning, Pest Mgmt TSI Acres	Personal and Comm. Permit and Sale Prep Acres	Personal and Comm. Permit and Sale Admin Acres
FUELS MANAGEMENT		**ACRES**								
ACTIVITY FUELS										
Total Activity Fuels -Timber Sales	2-1-A	100			100					
Total Activity Fuels Personal Use	2-1-B	80			80					
Total TSI Activity Fuels	2-1-C	40			40					
Total Activity Fuels	**2-1**	**220**	**-**	**-**	**220**	**-**	**-**	**0**	**0**	**0**
INTERFACE-NATURAL FUELS										
1/2 mile PVT prop	2-2-A	590			590					
1/2 Mile campgrounds, 500 ft cabins	2-2-B	100			100					
1/2-1 mile PVT Prop	2-2-C	216			216					
Total Interface Fuels	**2-2**	**906**	**-**	**-**	**906**	**-**	**-**	**0**	**0**	**0**
FUEL BREAKS										
Total Fuel Breaks	**2-3**	**2,150**				**2,150**				
NATURAL FUELS										
1/2 mile Roads	2-4-A	194			194					
100 feet Trails	2-4-B	894			894					
Total Natural Fuels	**2-4**	**1,088**	**-**	**-**	**1,088**	**-**	**-**	**0**	**0**	**0**
TOTAL FUELS MANAGEMENT		**4,364**	**0**	**0**	**2,214**	**2,150**	**0**	**0**	**0**	**0**
FOREST HEALTH & WATERSHED RESTORATION		**ACRES**								
Hazard Tree Removal										
Total Road Corridor 0-100ft	3-1-A	1,200		1,200					0	
Total Trail Corridor 0-100 ft	3-1-B	1,170		1,170						
Total Utility Corridor 0-100 ft	3-1-C	700		700						
Total Campground 0-1/2 Mile	3-1-D	2,884		2,884					0	
Total Cabins 0-500 ft	3-1-E	130		130					0	
Total Hazard Tree Removel	**3-1**	**6,084**	**-**	**6,084**	**0**	**0**	**0**	**0**	**0**	**0**
Vegetation & Pest Management										
Total Stream Riparian	3-2-A	2,810	2,400					410		
Total Lake Riparian	3-2-B	530	530							
Total Road Corridors 0-100 ft 1/2 mi SNS Byway	3-2-C	13,630	13,400					230		
Total Campground 0-1/2 Mile	3-2-D	1,205	790					415		
Total Cabins 0-500 ft	3-2-E	80	40					40		
Total Trail Corridor 0-100 ft	3-2-F	510	510							
Total Personal Use Areas	3-2-G	460	460							
Total Commercial Use Areas	3-2-H	7,520	7,520							
Total Veg & Pest Mgmt	**3-2**	**26,745**	**25,650**	**-**	**-**	**-**	**-**	**1,095**	**-**	**-**
Restoration		-	-				-			
Total Stream Riparian	3-3-A	5,810	3,590				2,220			
Total Lake Riparian	3-3-B	720	470				250			
Total Road Corridors 0-100 ft,SNC Byway	3-3-C	20,250	17,800				2,450			
Total Campground 0-1/2 Mile	3-3-D	3,395	2,690				705			
Total Cabins 0-500 ft	3-3-E	220	90				130			
Total Trail Corridor 0-100 ft	3-3-F	1,870	1,170				700			
Total Personal Use Areas	3-3-G	915	740				175			-
Total Commercial Use Areas	3-3-H	17,415	16,730				685		-	
Total Restoration	**3-3**	**50,595**	**43,280**	**-**	**-**	**-**	**7,315**	**-**	**-**	**-**
TOTAL FOREST HEALTH & WATERSHED RESTORATION		**83,424**	**68,930**	**6,084**	**-**	**-**	**7,315**	**1,095**	**-**	**-**
WILDLIFE HABITAT MANAGEMENT		**ACRES**								
Total Moose > 1/4 mile	4-1-A	28,100			26,960		350	160		
Total Subsistence Moose	4-1-B	5,480			5,480					
Total Moose > 1/4 mile	4-1-C	100			-		100			
TOTAL MOOSE	**4-1**	**33,680**	**-**	**-**	**32,440**	**-**	**450**	**160**	**-**	**-**
Total SHEEP/GOAT	**4-2**	**625**	**625**	**-**	**625**	**-**	**-**	**-**	**-**	**-**
Total Goshawk	4-3-A	300						300		
Total Eagle Nesting	4-3-B	50						50		
Total Marbled Murrelet	4-3-C	20						20		
Total Cavity Nesters	4-3-D	10						10		
TOTAL BIRDS	**4-3**	**380**						**380**		
Total Brown Bear Travel Corridors	**4-4**	**600**	**-**	**-**	**300**	**-**	**300**	**-**	**-**	**-**
Total Species Dependent on Spruce	**4-5**	**100**			50		50			
TOTAL WILDLIFE		**35,385**	**625**	**-**	**33,415**	**-**	**800**	**540**	**-**	**-**
GRAND TOTAL	**ALL**	**123,173**	**69,555**	**6,084**	**35,629**	**2,150**	**8,115**	**1,635**	**0**	**0**

Figure 12: Five-Year Action Schedule Proposed Cost by Strategy and Project Type

Management Strategy Name	Strategy ID Number	Total 5 Year Plan Proposed Cost	Vegetation and Pest Mgmt Plans Dollars	Hazard Tree Removal Dollars	Prescribed Burning Dollars	Site Preparation for Reforestation Dollars	Reforestation Dollars	Thinning, Pruning, Pest Mgmt TSI Dollars	Personal and Comm. Permit and Sale Prep Dollars	Personal and Comm. Permit and Sale Admin Dollars
FUELS MANAGEMENT		**DOLLARS**								
ACTIVITY FUELS										
Total Activity Fuels -Timber Sales	2-1-A	$22,265			$22,265					
Total Activity Fuels Personal Use	2-1-B	$30,436			$30,436					
Total TSI Activity Fuels	2-1-C	$26,430			$26,430					
Total Activity Fuels	**2-1**	**$79,131**	**$-**	**$-**	**$79,131**	**$-**	**$-**	**$-**	**$-**	**$-**
INTERFACE-NATURAL FUELS										
1/2 mile PVT prop	2-2-A	$344,391			$344,391					
1/2 Mile campgrounds, 500 ft cabins	2-2-B	$31,731			$31,731					
1/2-1 mile PVT Prop	2-2-C	$89,096			$89,096					
Total Interface Fuels	**2-2**	**$465,218**	**$-**	**$-**	**$465,218**	**$-**	**$-**	**$-**	**$-**	**$-**
FUEL BREAKS										
Total Fuel Breaks	**2-3**	**$16,430**				**$16,430**				
NATURAL FUELS										
1/2 mile Roads	2-4-A	$109,448			$109,448					
100 feet Trails	2-4-B	$379,314			$379,314					
Total Natural Fuels	**2-4**	**$488,762**	**$0**	**$0**	**$488,762**	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL FUELS MANAGEMENT		**$1,049,540**	**$-**	**$-**	**$1,033,110**	**$16,430**	**$-**	**$-**	**$-**	**$-**
FOREST HEALTH & WATERSHED RESTORATION		**DOLLARS**								
Hazard Tree Removal										
Total Road Corridor 0-100ft	3-1-A	$418,188		$379,488					$38,700	
Total Trail Corridor 0-100 ft	3-1-B	$370,000		$370,000						
Total Utility Corridor 0-100 ft	3-1-C	$251,368		$251,368						
Total Campground 0-1/2 Mile	3-1-D	$946,036		$912,036					$34,000	
Total Cabins 0-500 ft	3-1-E	$48,111		$41,111					$7,000	
Total Hazard Tree Removel	**3-1**	**$2,033,703**	**$-**	**$1,954,003**	**$-**	**$-**	**$-**	**$-**	**$79,700**	**$-**
Vegetation & Pest Management										
Total Stream Riparian	3-2-A	$280,960	$82,560					$198,400		
Total Lake Riparian	3-2-B	$18,232	$18,232							
Total Road Corridors 0-100 ft 1/2 mi SNS Byway	3-2-C	$581,360	$460,960					$120,400		
Total Campground 0-1/2 Mile	3-2-D	$220,426	$27,176					$193,250		
Total Cabins 0-500 ft	3-2-E	$24,576	$1,376					$23,200		
Total Trail Corridor 0-100 ft	3-2-F	$17,544	$17,544							
Total Personal Use Areas	3-2-G	$15,824	$15,824							
Total Commercial Use Areas	3-2-H	$258,688	$258,688							
Total Veg & Pest Mgmt	**3-2**	**$1,417,610**	**$882,360**	**$-**	**$-**	**$-**	**$-**	**$535,250**	**$-**	**$-**
Restoration		$4,000					$4,000			
Total Stream Riparian	3-3-A	$891,228	$123,496				$767,732			
Total Lake Riparian	3-3-B	$109,562	$16,168				$93,394			
Total Road Corridors 0-100 ft,SNC Byway	3-3-C	$1,114,960	$612,320				$502,640			
Total Campground 0-1/2 Mile	3-3-D	$251,336	$92,536				$158,800			
Total Cabins 0-500 ft	3-3-E	$42,876	$3,096				$39,780			
Total Trail Corridor 0-100 ft	3-3-F	$183,648	$40,248				$143,400			
Total Personal Use Areas	3-3-G	$175,256	$25,456				$48,600			$101,200
Total Commercial Use Areas	3-3-H	$828,440	$575,512				$163,228		$89,700	
Total Restoration	**3-3**	**$3,601,306**	**$1,488,832**	**$-**	**$-**	**$-**	**$1,921,574**	**$-**	**$89,700**	**$101,200**
TOTAL FOREST HEALTH & WATERSHED RESTORATION		**$7,052,619**	**$2,371,192**	**$1,954,003**	**$-**	**$-**	**$1,921,574**	**$535,250**	**$169,400**	**$101,200**
WILDLIFE HABITAT MANAGEMENT		**DOLLARS**								
Total Moose > 1/4 mile	4-1-A	$981,512			$652,112		$235,400	$94,000		
Total Subsistence Moose	4-1-B	$133,315			$133,315					
Total Moose > 1/4 mile	4-1-C	$27,600			$-		$27,600			
TOTAL MOOSE	**4-1**	**$1,142,427**	**$-**	**$-**	**$785,427**	**$-**	**$263,000**	**$94,000**	**$-**	**$-**
Total SHEEP/GOAT	**4-2**	**$12,084**			**$12,084**					
Total Goshawk	4-3-A	$146,300						$146,300		
Total Eagle Nesting	4-3-B	$27,700						$27,700		
Total Marbled Murrelet	4-3-C	$9,000						$9,000		
Total Cavity Nesters	4-3-D	$4,500						$4,500		
TOTAL BIRDS	**4-3**	**$187,500**	**$-**	**$-**	**$-**	**$-**	**$-**	**$187,500**	**$-**	**$-**
Total Brown Bear Travel Corridors	**4-4**	**$144,700**			**$37,700**		**$107,000**			
Total Species Dependent on Spruce	**4-5**	**$25,950**			**$6,450**		**$19,500**			
TOTAL WILDLIFE		**$1,512,661**	**$-**	**$-**	**$841,661**	**$-**	**$389,500**	**$281,500**	**$-**	**$-**
GRAND TOTAL	**ALL**	**$9,614,821**	**$2,371,192**	**$1,954,003**	**$1,874,771**	**$16,430**	**$2,311,074**	**$816,750**	**$169,400**	**$101,200**

ACTION SCHEDULE IMPLEMENTATION TOOLS

Project implementation strategies may include use of the following management tools for specific projects:

Hazard Tree Removal

Personal Use Forest Product Permit
Commercial Use Timber Sale
Personal Services Contract
Stewardship Contracting
Equipment Rental Contract with Skilled Operator(s)
Volunteer Projects with Public Interest Groups
Force Account (Forest Service Crews)

Site Preparation for Reforestation

Prescribed Burn Pre-felling for fuel placement

Tree Shear (Equipment Rental Contract) - Note: A demo project is included in the Five-year action schedule.
Personal Use Forest Product Permit
Commercial Use Timber Sale
Force Account (Forest Service Crews)

Reforestation

Personal Services Contract
Stewardship Contract
Volunteer Planting Projects with Interested Individuals, Groups or Organizations.
Force Account Forest Service Crews
Planting Contracts

Decadent Hardwood Cutting for Moose Habitat Improvement

Tree Shear (Equipment Rental Contract) - Note**:** A 100-acre demo project is included in the Five-year action schedule.

APPENDIX A

ASSESSMENT OF EXISTING ECOSYSTEM CONDITIONS ON THE

CHUGACH NATIONAL FOREST

PORTION OF THE KENAI PENINSULA LANDSCAPE

ASSESSMENT OF EXISTING ECOSYSTEM CONDITIONS ON THE CHUGACH NATIONAL FOREST PORTION OF THE KENAI PENINSULA

THE LANDSCAPE

Ecosystems and their components have temporal, spatial, and social dimensions. Ecosystems occur at different scales within hierarchies and their components interact with each other.

Spatially, vegetative patterns, human behavior, and disturbance processes all exist vertically and horizontally within each level. Temporal hierarchies can be portrayed by the example of a year nested within a decade, within a century, within an epoch. Within a social context, individuals who utilize the Kenai Peninsula are nested within the social structure of communities like Soldotna, Homer, Kenai, Hope, Cooper Landing, Seward, and Moose Pass, etc., within the Kenai Peninsula Borough and within the State of Alaska.

Assessments are made at several scales, looking at the larger scale (landscape) to set context and the smaller scale (Watershed Association, watershed, or ecological site) to understand processes. The impacts of disturbance in one level of the hierarchy are likely felt in other levels including the impacts of the past on the present and the future.

To set the context in terms of the Spruce Bark Beetle (SBB) epidemic in the State of Alaska, the Big Picture (Landscape) includes all lands containing spruce forest in the State of Alaska. Geographically, this is an area bounded on the north by the Brooks Range and the south by the state line at the end of the southeast Alaska panhandle. In 1998, the Spruce Bark Beetle Taskforce initiated a landscape level view of one section of the Big Picture—the Kenai Peninsula. This assessment is for a smaller portion of that landscape and is limited to Chugach National Forest system lands, which are nested within the larger Kenai Peninsula landscape. In some cases such as fire protection levels, private lands within the Forest boundary are also included in the analysis.

The National Forest – Kenai Peninsula Landscape View

Map # 1 (Shaded Relief Map) in Appendix F provides a landscape level view of Chugach National Forest System lands within the broader Kenai Peninsula landscape. In addition to getting a sense of the landform and topographic features for this mountainous portion of the Chugach National Forest, ownership and drainage patterns are also visible on the map. The gross area within the National Forest boundary is 1,317,620 acres. Private lands within the boundary currently total 86,250 acres. National Forest System lands total 1,231,740 acres. The communities of Hope, Sunrise, Girdwood, Cooper Landing, Moose Pass, and Seward all lie within the National Forest boundary.

The National Forest – Kenai Peninsula Watershed Association View

Major watersheds or drainage's, including smaller order watersheds within a drainage, are called Watershed Associations. As displayed on Map# 1 in Appendix F, the National Forest landscape has been subdivided into 26 Watershed Associations which are identified by red boundary lines (Refer to the Map Legend).

These Watershed Associations are listed in Figure A-1. Each Watershed Association (WA) has an ID number like K01 with a name, in this case Turnagain Arm. Focusing on individual WAs provides the viewer with a Watershed Association level view of the topography, ownership and drainage patterns within each piece of the broader National Forest landscape on the Kenai Peninsula. Refer to Map #1 and Figure A-1 for the gross acreage by ownership within each Watershed Association.

Figure A-1: Watershed Associations on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total National Forest Acres	Private Land Acres	Total Area Acres	Total Area Sq. Miles
K01	Turnagain Arm	56,900	40	56,940	89
K02	Resurrection Creek	110,120	1,900	112,020	175
K03	Sixmile Creek Lower	35,260	3,300	38,560	60
K04	Seattle & Ingram Creeks	28,400	3,600	32,000	50
K05	Portage Creek	34,100	700	34,800	54
K06	Placer River	79,860	800	80,660	126
K07	East Fork Sixmile Creek	78,230	1,100	79,330	124
K08	Canyon Creek	55,710	2,600	58,310	91
K09	Juneau Creek	43,560	1,600	45,160	71
K10	Quartz Creek	70,610	4,400	75,010	117
K11	Trail River	114,140	10,400	124,540	195
K12	Snow River	101,970	2,600	104,570	163
K13	Kenai Lake Southwest	13,480	5,800	19,280	30
K14	Cooper Creek	31,070	1,700	32,770	51
K15	Russian River	20,720	10	20,730	32
K16	Kenai Lake North	18,580	1,400	19,980	31
K17	Kenai Lake Southeast	66,310	1,300	67,610	106
K18	Resurrection River	43,470	-	43,470	68
K19	Lost Lake/Salmon River	23,720	7,500	31,220	49
K20	Cape Resurrection	15,900	27,100	43,000	67
K21	Eagle River	6,200	-	6,200	10
K22	Lake George	24,900	-	24,900	39
K23	Bird Creek	70	-	70	0
K24	Glacier Creek	31,250	8,000	39,250	61
K25	Twentymile River	106,520	400	106,920	167
K26	Chickaloon River	20,690	-	20,690	32
	Total Kenai Peninsula, CNF	**1,231,740**	**86,250**	**1,317,990**	**2,059**

Source: Chugach National Forest GIS

Note: This assessment relies primarily on an analysis of various combinations of mapped information contained in the Chugach National Forest Geographic Information System (GIS). In the tabular data displayed on maps and in figures in this Appendix, total acreage figures will be off by several hundred acres depending on what information is being portrayed. This is due to rounding and/or whether or not saltwater in Turnagain Arm is being included in or excluded from the information.

VEGETATION COVER TYPE COMPOSITION AND DISTRIBUTION

Map # 2 (Forest Vegetation Cover Types) in Appendix F and Figure A-2 display the composition and distribution of mapped (from aerial photography) forest vegetation cover types on National Forest lands on the Kenai Peninsula. These cover types were mapped in 1978 from 1974 aerial photography and represent the best available cover type data for the Forest.

Non-forested cover types (grass, brush, alpine (forb), rock, ice, etc.) dominate the landscape covering 82% (1,008,470 acres) of National Forest lands. The remaining 18% or 223,270 acres is in forested cover types of hemlock, spruce (Sitka, white (Lutz), black), aspen, paper birch, cottonwood, balsam poplar, mixed hemlock-spruce or mixed hardwoods-spruce. In Figure A-2, individual cover types have been aggregated into those types displayed. Watershed Associations are listed in descending order of the total acreage of combined spruce cover types.

Twelve of the 26 Watershed Associations have more than 5,000 acres of forest cover types with a spruce component. These 12 are highlighted in Figure A-2. Ten of the Associations have between 200 and 5,000 acres of spruce cover types and four contain no spruce cover types.

Figure A-2: Forest Cover Type Composition & Distribution by Watershed Association on National Forest Lands, Kenai Peninsula, CNF

WA ID	NO. Watershed Association Name	Total National Forest Acres	Total Hemlock Acres	Total Spruce Acres	Total Mixed Hemlock Spruce Acres	Total Mixed Hardwoods Spruce Acres	Total Combined Forest Types w/Spruce Acres	Total Mixed Hardwood Acres	Total Forest Cover Type Acres	Total Non-Forest Cover Type Acres
K12	Snow River	101,970	4,700	4,520	10,100	300	14,920	1,950	21,570	80,400
K02	Resurrection Creek	110,120	8,700	6,400	5,300	1,590	13,290	7,230	29,220	80,900
K09	Juneau Creek	43,560	2,000	3,000	2,700	6,200	11,900	1,460	15,360	28,200
K17	Kenai Lake Southeast	66,310	3,300	3,500	5,500	650	9,650	560	13,510	52,800
K11	Trail River	114,140	5,600	3,350	4,060	1,110	8,520	2,120	16,240	97,900
K10	Quartz Creek	70,610	3,400	3,700	2,800	1,600	8,100	3,910	15,410	55,200
K18	Resurrection River	43,470	3,000	2,700	3,800	370	6,870	500	10,370	33,100
K03	Sixmile Creek Lower	35,260	2,800	410	5,800	120	6,330	530	9,660	25,600
K07	East Fork Sixmile Creek	78,230	4,900	1,220	3,000	1,460	5,680	1,050	11,630	66,600
K25	Twentymile River	106,520	8,900	1,800	2,400	1,400	5,600	5,620	20,120	86,400
K14	Cooper Creek	31,070	1,800	2,360	2,500	230	5,090	380	7,270	23,800
K15	Russian River	20,720	1,400	3,700	900	440	5,040	980	7,420	13,300
K04	Seattle & Ingram Creeks	28,400	3,500	1,100	2,600	-	3,700	-	7,200	21,200
K08	Canyon Creek	55,710	3,300	500	2,000	440	2,940	870	7,110	48,600
K16	Kenai Lake North	18,580	600	1,220	1,000	440	2,660	720	3,980	14,600
K26	Chickaloon River	20,690	2,000	700	1,400	20	2,120	270	4,390	16,300
K19	Lost Lake/Salmon River	23,720	3,000	700	1,200	-	1,900	20	4,920	18,800
K24	Glacier Creek	31,250	2,500	650	1,000	-	1,650	100	4,250	27,000
K13	Kenai Lake Southwest	13,480	1,000	390	490	300	1,180	-	2,180	11,300
K06	Placer River	79,860	4,700	700	400	60	1,160	1,200	7,060	72,800
K20	Cape Resurrection	15,900	500	100	200	-	300	-	800	15,100
K05	Portage Creek	34,100	1,600	100	100	-	200	1,800	3,600	30,500
K01	Turnagain Arm	56,900	-	-	-	-	-	-	-	56,900
K21	Eagle River	6,200	-	-	-	-	-	-	-	6,200
K22	Lake George	24,900	-	-	-	-	-	-	-	24,900
K23	Bird Creek	70	-	-	-	-	-	-	-	70
	Total Kenai Peninsula, CNF	**1,231,740**	**73,200**	**42,820**	**59,250**	**16,730**	**118,800**	**31,270**	**223,270**	**1,008,470**
	% of Total Acres	**100%**	**6%**	**3%**	**5%**	**1%**	**10%**	**3%**	**18%**	**82%**
	% of Total Forested Acres		**33%**	**19%**	**27%**	**7%**	**53%**	**14%**	**100%**	

Source: Chugach National Forest GIS

Based on the above mapped forest cover type grouping, conifer cover types account for 86% of the forested acreage and hardwood cove types account for the remaining 14%. In the conifer cover type group, 53% (118,800 acres) of all mapped conifer cover types contain spruce or a spruce component. An evaluation of actual species composition data from the 1987 Forest Inventory for available timberlands on National Forest lands on the Kenai Peninsula confirms the relative accuracy of the mapped forest cover types.

Looking at tree species data from the 1987 Forest Inventory of the Kenai Peninsula (PNW-RB-180

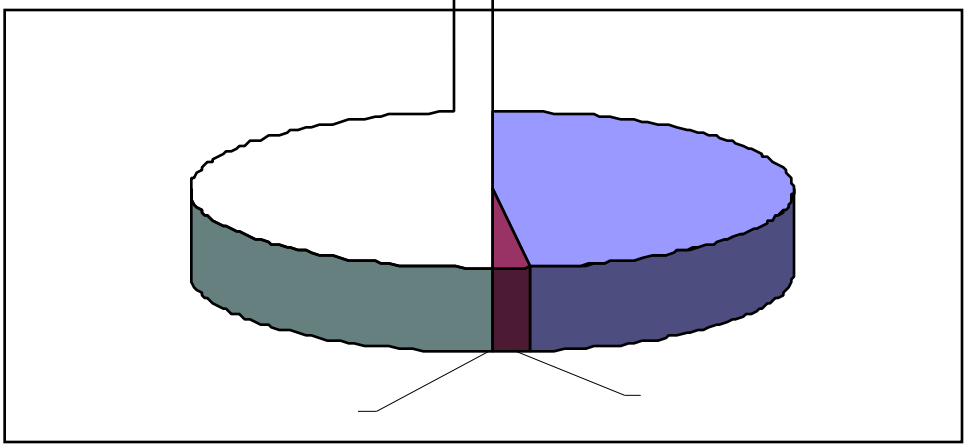
1991) (Figure A-3) reveals that conifer tree species account for 86% of all live trees 5.0 inches and larger growing on available timberlands. The remaining 14% is hardwood tree species.

Figure A-3a and A-3b compare the tree species composition within the conifer group and hardwood group, respectively. In the conifer group, spruce (white, black, Sitka) account for 52% of all live conifer trees 5.0 inches d.b.h. and larger, while in the hardwood group, paper birch accounts of 79% of all live hardwood trees 5.0 inches d.b.h. and larger on available timberlands.

Although this inventory only looked at lands classified as available timberlands, it is reasonable to assume that the same species composition would apply to other forested lands.

(see next page for figures A-3, A-3a, A-3b)

Source: Timberland Resources of the Kenai Peninsula, Alaska, 1987



REFORESTATION OF KENAI PENINSULA FOREST COVER

In 1993, the Chugach National Forest (CNF) conducted reforestation surveys in the Cooper Landing Project area to meet monitoring requirements of the CNF Land and Resource Management Plan. Surveyed areas had been harvested or treated to reduce fuel loads of accumulated spruce beetle-killed timber. Most areas also received site preparation and/or planting.

An understanding of the potential successional pathways for a particular site and the ecology of the major tree species involved is crucial for successful long-term forest vegetation management. The primary treatment objective in response to beetle impacts was fuel reduction, with secondary objectives of reforestation and wildlife habitat enhancement. Regeneration of spruce, birch, and aspen was considered in the management prescriptions. A brief review of how these three species respond to disturbance follows:

White spruce can become established under mature stands (spruce, birch, or aspen), but stocking levels and distribution are often highly variable (Nienstadt and Zasada 1990). When spruce beetle outbreaks occur in stands dominated by large diameter spruce, the affected stands convert to open spruce or open spruce-hardwood stands (Holsten et al 1995). In the absence of further site disturbance, this type of stand can be self-perpetuating (Viereck et al 1992). After a disturbance that results in a mineral or mixed mineral-organic seedbed, spruce will readily establish in greater numbers if seed is available (Nienstadt and Zasada 1990). Initial spruce recruitment is greatest in the first five years after site disturbance. Seedlings are considered established when they reach the hard-seedling or "free to grow" stage (Packee 1990). As time since disturbance increases, seedbed quality declines, especially if bluejoint reed grass is present on the site (Fox 1980).

Paper birch is a shade intolerant pioneer species, but can retain a position in mixed spruce stands on some sites (Safford et al 1990). Birch produces abundant seed on a regular basis, with good crops every other year, on average. Seed germinates best on exposed mineral soil, but seedlings will also become established on rotting logs, stumps, and tree boles (Safford et al 1990). In south-central Alaska, sites that were scarified following timber harvest produced the most regeneration (Densmore and Page 1992, Collins 1996). The majority of seedlings become established during the first growing season after disturbance. Paper birch will sprout from stumps following cutting or fire, but sprouts tend to mature and decline sooner than trees originating from seed (Safford et al 1990). Young regenerating stands provide browse and cover for moose, with peak browse production occurring 10-16 years after disturbance.

Quaking aspen is a very shade intolerant species and a very aggressive pioneer, especially after fire. Aspen produce good crops of highly viable seed every 4 or 5 years. The fresh seeds are not dormant and will germinate within a few days if they reach a good seedbed of moist exposed mineral soil (Perala 1990). However, few aspen seedlings survive; the main method of reproduction is by root-sprouting. Most aspen stands are clones of one or several sexually produced individuals. Sprouting is encouraged by cutting and/or fire. Dormant season cutting produces the most vigorous sprouting. Summer cutting produces few sprouts initially, but after two years the number of sprouts is the same regardless of the cutting season (Perala 1990). Soil temperature is the most critical environmental factor affecting sprouting. High temperatures promote the growth hormones that encourage sprouting while degrading those that repress it. In general, the amount of sprouting is proportional to the degree of cutting, and so light burning following heavy cutting will produce the most new sprouts. Aspen provides habitat and browse to a wide variety of wildlife, and is also highly valued for its esthetic qualities (Perala 1990). According to Collins (1996), felling all aspen in stands dominated by birch or spruce will do more to enhance wildlife habitat via browse production than any other single practice in those stand types.

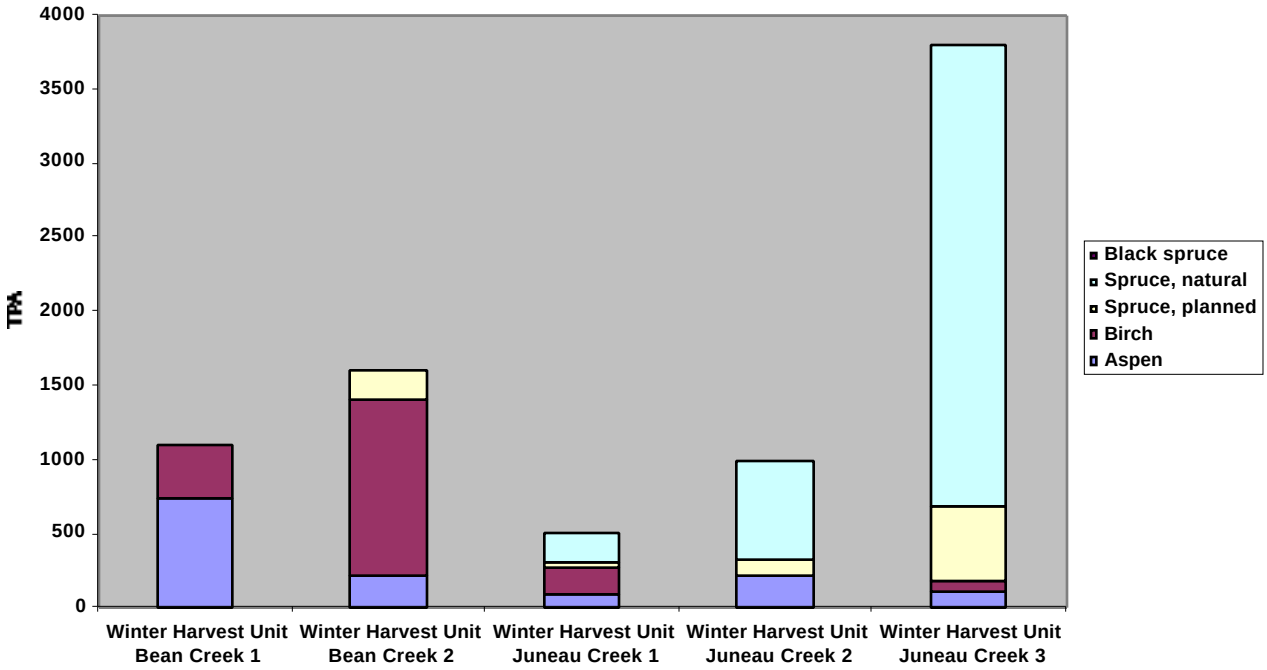
Results of the surveys to date indicate the following (Schultz 1996):

1. Hardwoods are more abundant in harvested areas, and most abundant in areas harvested in the summer (Figure A-4).
2. Burning encourages hardwoods.
3. If 300 spruce per acre is the desired level of stocking, planting may not be necessary in some areas. Continuing surveys will help identify the factors determining favorable

conditions for natural regeneration.

4. Results from the Resurrection Creek study (Schultz 1995) illustrate the following basic stand dynamics following site disturbance:
    - Species of regenerating trees are dependent on species present prior to disturbance.
    - Abundance of a tree species on a site is dependent on the type of disturbance:
    - Hardwood and spruce advanced regeneration are not susceptible to spruce beetles.
    - All ages of all species are susceptible to fire.
    - Fire encourages hardwood regeneration.

Figure A-4: Comparison of Regeneration Results in Winter and Summer Fuel Reduction Timber Harvest Units in the Cooper Landing Cooperative Project Area



TPA = Trees per Acre

One way to re-establish spruce stands is to allow a disturbance to occur that will expose mineral soil seed beds where spruce seed will germinate. One such form of disturbance is an intense, or stand replacement fire (Zasada 1972). The fire history of the Kenai Peninsula includes infrequent, but large fires (Vanderlinden 1991). The fuels resulting from beetle-impacted stands are of a nature that would encourage a stand replacement fire which may be appropriate for remote areas, but not for stands in close proximity to human communities.

THE ROLE OF DISTURBANCE IN ECOSYSTEM MANAGEMENT

One premise of ecosystem management is that native species are adapted to the natural disturbances common to an area. Disturbance events are responsible for the way the current landscape appears and functions, and will determine the structure and composition of future landscapes. In Alaska, glaciation, earthquakes, severe windstorms, fire, flooding, avalanches and landslides greatly affect ecological processes. These types of disturbances remove existing vegetation and often expose mineral soil for new plants to become established.

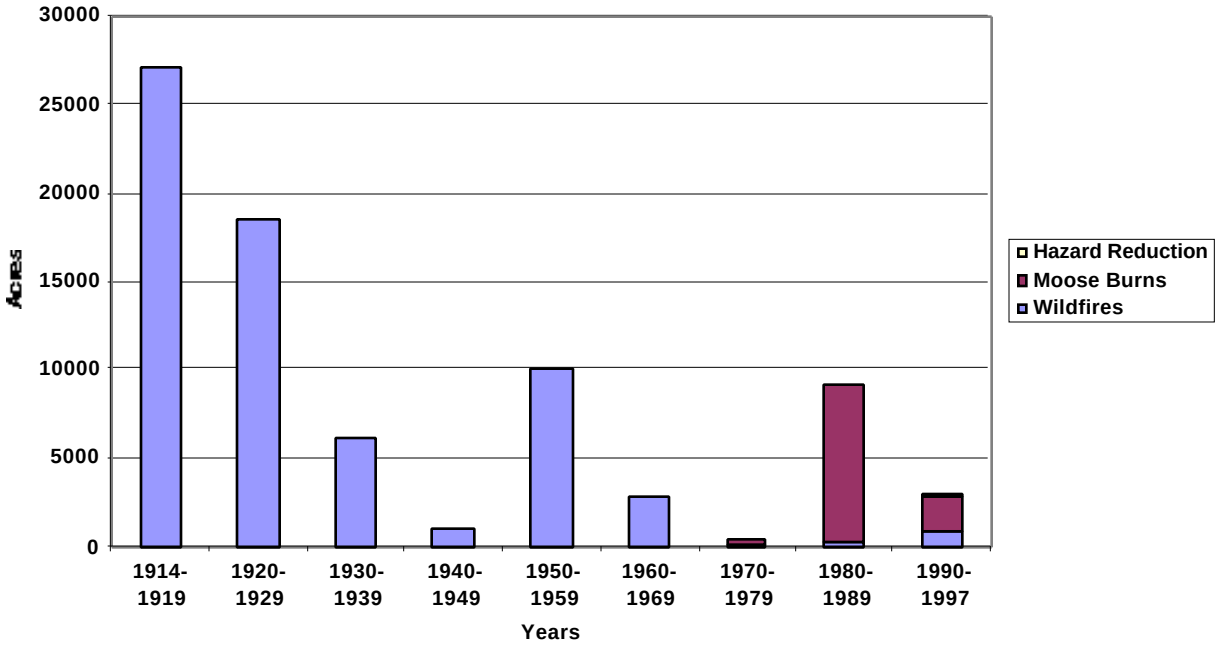
Disturbances such as insects and disease outbreaks also result in shifting landscape patterns. These disturbances usually affect only a few species directly, while indirectly affecting the remaining species through reduced competition or changes in forest structure. Changes resulting from these types of disturbances often occur over varying time periods, but can be very dramatic and cover large areas. Spruce beetles have radically affected the landscape in a single decade, while heartrots and other internal decay fungi operate over decades (GTR R10-TP-74 1998).

Disturbance agents and patterns are generally tied to geography, climate, and vegetation. When we understand the complexities of these relationships, we are able to predict and respond to natural disturbances and mimic the desirable effects with management activities.

Fire Disturbance

Fire, as a natural occurrence, has contributed to the landscape diversity most recently in the settlement period on the Kenai Peninsula portion of the Chugach National Forest and periodically for the last several thousand years. Prior to the settlement period of the late 1800's, the majority of the age structures of coniferous forests surveyed were recorded to be in late successional stages. The Forest's fire history is described in three distinct periods of fire frequency - prehistoric (pre 1740), settlement (1741-1913), and post-settlement (1914-1997). Potkin suggests the vegetation community component of landscape diversity on the Kenai Peninsula was lower prior to the settlement period and increased in the late 1800's and early 1900's during a period of major fire occurrences. Figure A-5 indicates that the largest fires on the Forest occurred during the settlement period with mining and mineral exploration from 1849-1902, followed by railroad development between 1903-1953 (Potkin 1997).

Figure A-5: Fire History of National Forest Lands on the Kenai Peninsula between 1914-1997 as indicated by the Number of Acres Burned by Decade and Purpose



The present landscape mosaic reflects past human-caused wildfires over the last 150 years (Refer to the Map # 2 - Forest Vegetation Cover Types in Appendix F), creating vast areas of successional ecosystems. These wildfires and prescribed fire in the last few decades, (primarily small moose burn fires) has generally increased the richness and patchiness of the vegetation types, while the

natural fire regime generally decreases vegetation diversity. The richness of the vegetation mosaic resulting from fire disturbances in this century has significantly influenced wildlife habitat from a caribou to a moose dominated system. The richness of the vegetation community component supporting seral species appears to have decreased during the last half-century as a result of fire suppression. Present spruce bark beetle effects present a new sequence of vegetation mosaics.

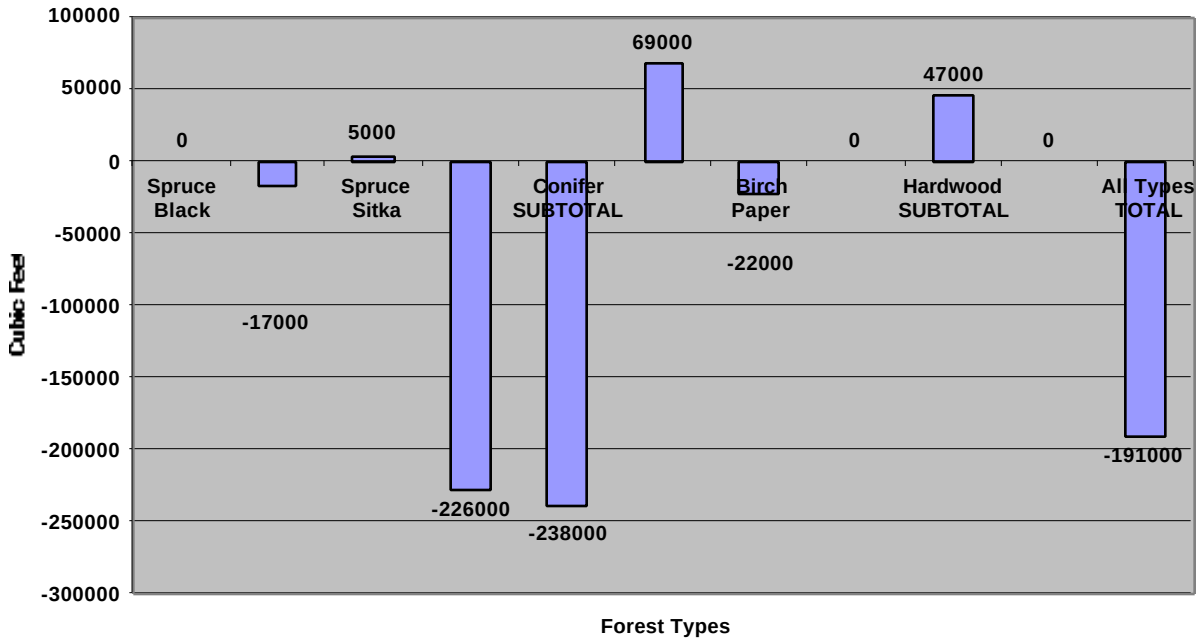
The frequency of fire is variable throughout the Forest watersheds. The eastern portion of the Kenai mountains has a coastal influence and limited fire occurrences are reported while the western portion sits in a rainshadow, with an interior drier climate, and the fire cycle is predicted to have more frequent fires. The settlement period reflects large acreage's burned more extensively in this area. Although lightning is rare on the Peninsula, limited documented occurrences have been reported in this portion of the Forest.

Abiotic disturbances such as wind, snow avalanche, landslides, glacial recession, and flooding have been recognized for the important ways in which they influence the pattern of vegetation and tree recruitment on the Forest. Potkin's fire history study indicates the role of fire is also an important disturbance process over many millennia in this transition climate. Study results illustrate a long interval fire cycle that could have controlled the recruitment and mortality of most spruce and probably most hemlock trees in this forest over the past 500-3,000 years. Historical records of fires and tree ages, together with the present mature forests and beetle kill fuel loads, suggest that the next interval of stand-regenerating fires is near. Present forest conditions resulting in increasing fuel loads from beetle kill, careless human-caused ignitions and drought weather conditions are important mechanisms for fire managers to evaluate for predicting risks and hazardous large scale fire occurrences on the Forest (Potkin 1997).

Insect and Disease Disturbance

Insect and disease-caused stresses may have long-lasting effects on forest stands because of their influences on species composition, diversity, density, nutrient cycling and plant succession (Zasada, Van Cleve, Werner, McQueen, Nyland 1977). On the Chugach National Forest, insects and disease are major disturbance agents on the Kenai Peninsula. At a landscape level, 1987 inventory measures of net annual cubic foot growth (Figure A-6) for hemlock, white spruce, and paper birch forest types were negative. Total conifer growth was negative well total hardwood growth was positive. Net annual growth for all forest types combined was negative.

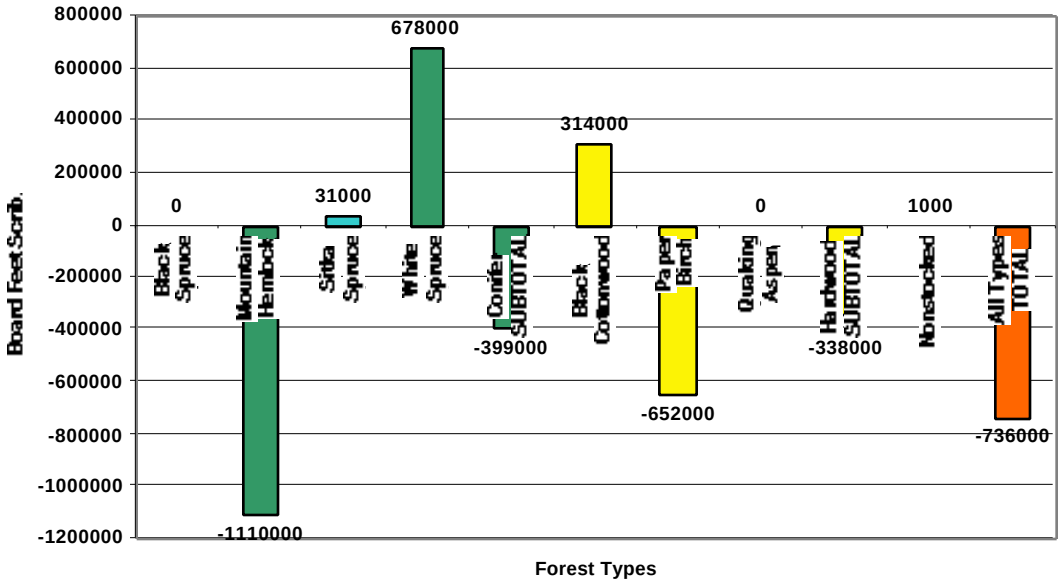
Figure A-6: Net Annual Cubic Foot Volume Growth of Growing Stock on CNF Available Timberland by Forest Type, Kenai Peninsula, 1987



of the Kenai Peninsula, Alaska, 1987

In Figure A-7, the net annual board foot growth of sawtimber is negative for mountain hemlock and paper birch sawtimber, but positive for white spruce. Cumulatively, net annual growth is negative for all types combined. The positive growth for white spruce sawtimber reflects the fact that the SBB population was just starting to increase dramatically in 1987. If re-inventoried today, net sawtimber growth for white spruce would undoubtedly be very negative due to SBB mortality over the last 12 years. Negative annual growth in both growing stock and sawtimber in 1987 is symptomatic of decadent forest conditions on the Kenai Peninsula in a large landscape context.

Figure A-7: Net Annual Board Foot Volume Growth of Sawtimber on CNF Available Timberland by Forest Type, Kenai Peninsula, 1987



Source: Timberland Resources of the Kenai Peninsula, Alaska, 1987

Insects

Map #5 in Appendix F displays the location and cumulative distribution of the SBB infestation between 1957 and 1998 on National Forest lands on the Kenai Peninsula. Map # 3 in Appendix F displays the location and distribution of only those forest cover types containing a spruce component that **are susceptible** to SBB infestation (already infested or have the potential to be infested). These are poletimber and sawtimber size stands containing spruce with average tree diameters of 5.0 inches and larger. The total estimated acreage that is susceptible to SBB infestation is **112,700 acres or 50 % of all forested lands**. Seedling and sapling spruce stands are generally not susceptible, although if SBB populations are extremely high in an area, spruce sapling stands can experience significant mortality.

Map # 4 in Appendix F displays the location and distribution of vegetation cover types on National Forest lands on the Kenai Peninsula that are **not susceptible** to SBB infestation. On forested land, these include hardwood types, hemlock, seedling/sapling spruce, and areas currently not certified as being adequately stocked with trees. The total acreage of forested land not susceptible to SBB infestation is estimated to be **111,100 acres or 50 % of all forested lands**. Additionally, there are 951,700 acres of non-forest cover types which are also not susceptible to SBB infestation.

Spruce Bark Beetle

As agents of disturbance, spruce bark beetles (Dendroctonus rufipennis Kirby) are one of the most important mortality agents of mature spruce stands in Alaska. The Kenai Peninsula has experienced an on-going spruce beetle epidemic for more than two decades which has resulted in widespread spruce mortality across all ownership's.

Figure A-8 displays the cumulative SBB infestation within watershed associations on the Kenai Peninsula within the Forest boundary. Seventeen of the 26 Watershed associations have 1,000 or more acres of SBB infestation and are highlighted in Figure A-8.

Figure A8: Estimated Cumulative SBB Infestation on National Forest Lands between 1957-1998 by Watershed Association, Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total National Forest Acres	Total Combined Forest Types w/Spruce Acres	Total SBB Infested 1957-1998 Acres	Difference Between Spruce Type and Infested Acres
K02	Resurrection Creek	110,120	13,290	27,200	(13,910)
K10	Quartz Creek	70,610	8,100	15,910	(7,810)
K09	Juneau Creek	43,560	11,900	13,880	(1,980)
K11	Trail River	114,140	8,520	9,700	(1,180)
K15	Russian River	20,720	5,040	9,400	(4,360)
K17	Kenai Lake Southeast	66,310	9,650	7,900	1,750
K08	Canyon Creek	55,710	2,940	6,900	(3,960)
K14	Cooper Creek	31,070	5,090	6,600	(1,510)
K03	Sixmile Creek Lower	35,260	6,330	5,980	350
K07	East Fork Sixmile Creek	78,230	5,680	5,040	640
K16	Kenai Lake North	18,580	2,660	4,500	(1,840)
K26	Chickaloon River	20,690	2,120	4,310	(2,190)
K18	Resurrection River	43,470	6,870	3,770	3,100
K13	Kenai Lake Southwest	13,480	1,180	2,280	(1,100)
K12	Snow River	101,970	14,920	2,260	12,660
K04	Seattle & Ingram Creeks	28,400	3,700	1,200	2,500
K25	Twentymile River	106,520	5,600	1,110	4,490
K19	Lost Lake/Salmon River	23,720	1,900	510	1,390
K24	Glacier Creek	31,250	1,650	470	1,180
K06	Placer River	79,860	1,160	250	910
K01	Turnagain Arm	56,900	-	-	-
K05	Portage Creek	34,100	200	-	200
K20	Cape Resurrection	15,900	300	-	300
K21	Eagle River	6,200	-	-	-
K22	Lake George	24,900	-	-	-
K23	Bird Creek	70	-	-	-
	Total Kenai Peninsula, CNF	**1,231,740**	**118,800**	129,170	(10,370)

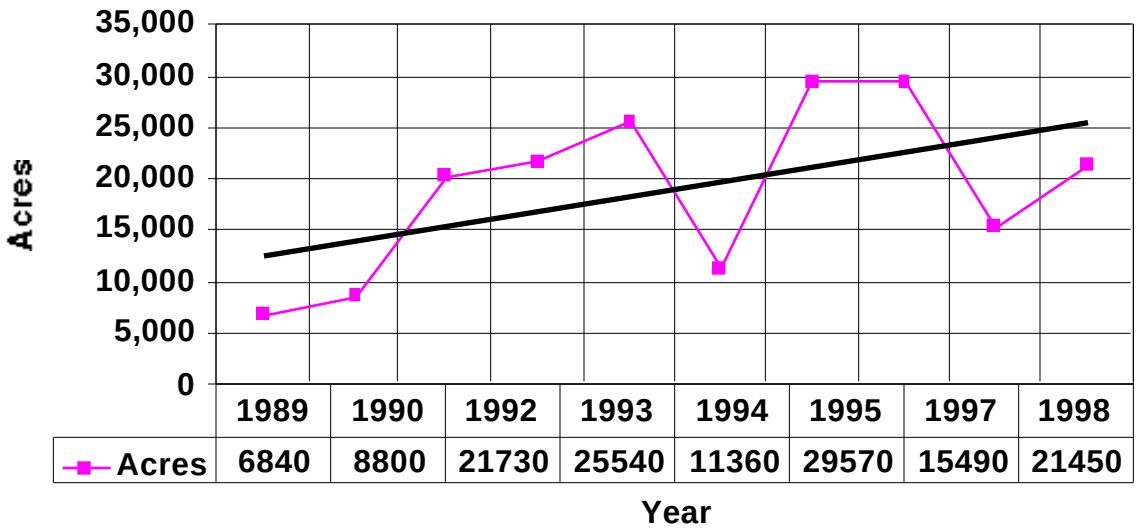
Source: Chugach National Forest GIS

Currently our data indicates the Forest has a cumulative total of 129,170 acres of SBB infestation between 1957 and 1998. However, our forest cover type data indicates that there are only 118,800 acres (approximately 7,000 acres of non-stocked and seedling/sapling spruce are included) of forest cover types with spruce. When you put the two data sets together, we have 10,370 acres more of SBB infested acres than we have of spruce cover types. There are three explanations for this discrepancy, which highlights the on-going difficulty in getting a precise picture of the total SBB situation. The first is the way in which annual SBB survey is conducted. The survey technique used is an aerial survey, i.e., somebody flies over an area and records on a U.S.G.S. map the locations of

active beetle infestations. Historically, the data recorded in these annual surveys has also been inconsistent in terms of what was recorded. While annual SBB surveys provide useful beetle population trend data, the accuracy of the annual acres infested is not precise and must be used accordingly. The second explanation is that forest cover type polygons contain inclusions of other types, which because of size where not mapped as separate polygons. An example would be a 50 acre hemlock cover type polygon that has 3 inclusions (pockets) of spruce too small to map as individual type polygons, but cumulatively total 27 acres. Aerial surveys can be counting these acres as infested, but they do not exist on the cover type map. The third explanation is that areas that have already been harvested or burned, and thus are no longer SBB infested, do not change the SBB infestation data or map. This makes it necessary to use other sets of data to adjust the estimated acres that are currently SBB infested.

Within the Forest boundary, the cumulative infestation has reached approximately 158,000 acres as of 1998 on all ownership's. Figure A-9 displays the acreage of active SBB infestation for all ownership's combined within the Forest boundary for each year over the last decade (1989-1998) based on annual aerial SBB surveys. A trend line is also plotted which indicates the infestation is still increasing over time, despite drops in beetle populations in 1994 and 1997.

Figure A-5: SBB Activity and Trend 1989-1998 on Kenai Peninsula, Chugach National Forest, All Ownerships



	1989	1990	1992	1993	1994	1995	1997	1998
Acres	6840	8800	21730	25540	11360	29570	15490	21450

Source: 1989-1998 Spruce Beetle Damage from I&D Aerial Surveys ADNR & USFS FHP

Disease

While tree diseases such as heart rot fungi have long been recognized for causing volume and economic value losses in commercial tree species, tree diseases are also key ecological factors in Alaska forest ecosystems. Tree disease alters forest structure, composition, and plant succession and plays an essential role in recycling nutrients in forests. Different diseases can enhance diversity and wildlife habitat as well.

Disease information for the forest is not currently mapped, however, disease is the most significant factor in the negative net annual growth of mountain hemlock and paper birch sawtimber on the Kenai Peninsula as displayed in Figure A-7.

Physical Disturbances

Windthrow Disturbance

While windthrow is a significant disturbance agent in old-growth forests of southeast Alaska, it does not appear to be a significant factor on the Kenai Peninsula.

Avalanche

Numerous snow avalanches occur every year on the Chugach; however, the overall acreage impacted is unknown. Generally, avalanches occur in the same area year after year. The loss of spruce stands due to SBB may increase the length of avalanche runs in certain places.

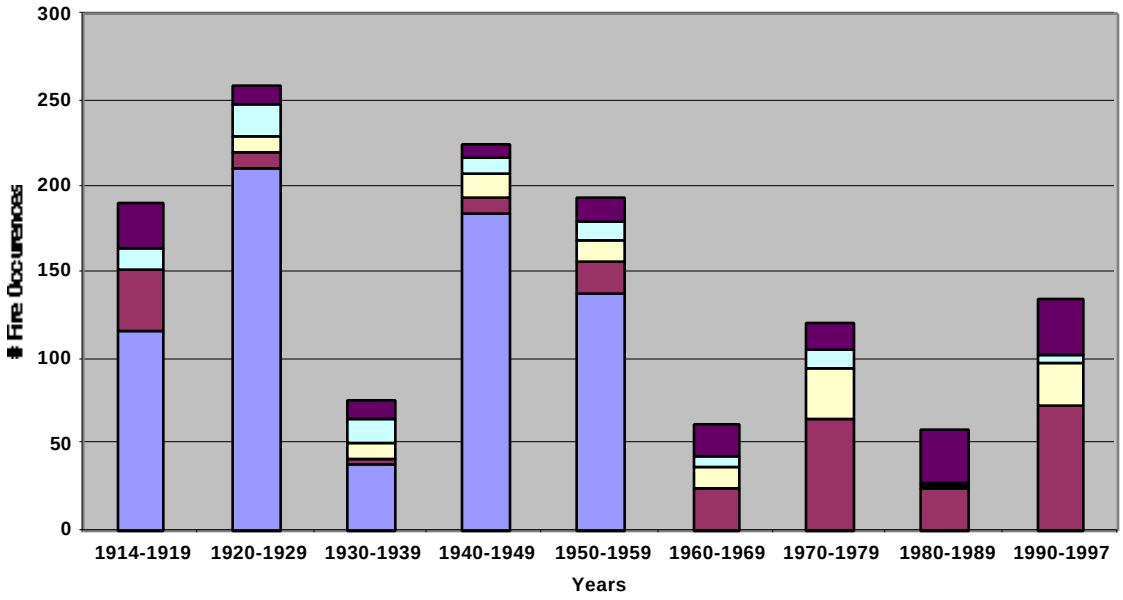
Human-Caused Disturbance

Human caused disturbances include construction of facilities such as roads, recreation trails, campgrounds, cabins, communication sites, pipelines, power lines, railroads; forestry related activities such as timber harvest, thinning, site preparation, and reforestation; wildlife habitat improvement activities such as prescribed burning and mechanical treatments of vegetation; wildfire suppression, residential or commercial construction in the urban interface; mineral exploration and mining, and human use and occupancy of the forest.

Human-Caused Wildfire

The major human-caused disturbance agent on the Forest is wildland fire. A total of approximately 1,400 fires burned a combined 75,000 acres within the Forest boundary from 1914 to 1997 (Figure A-5). Over 99.5% of the burned acres on the Forest are located on the Kenai Peninsula. Human-caused ignition accounts for over 99% (Figure A-10) of all fires on the Forest.

Figure A-10: Historical Causes of Wildfire on National Forest Lands on the Kenai Peninsula, CNF



Present conditions on the Kenai Peninsula include increasing fuel loads in spruce stands from beetle kill, a high frequency of human-caused ignitions, and the possibility of favorable weather conditions for ignition may increase the risk of large scale fire occurrences. Drought conditions occur on the average once every five years on the Kenai Peninsula. “Red Flag” weather conditions (high wind

speed and less than 30% humidity) occur on the average once every five years. The odds of both events occurring simultaneously are between 1 in 10 and 1 in 20 years (estimated, See 1997).

Wildfires greater than 600 acres in size have not been very common on the Forest in the last 25 years, with only two fires recorded greater than 100 acres. However, there has been a large fire on the Kenai Peninsula every 10 to 20 years. Fire data summarized on the Forest from 1971-1992 reported “high fire years” in pairs in 1973 and 1974 with 23 and 26 fire occurrences respectively (Rounsaville 1992). Fire data summarized for the present decade has 1993 and 1994 with 35 and 24 fire occurrences, respectively. In 1997 and 1998, there were 15 and 7 fires on the Forest respectively.

Management Activity Disturbance

Management activities that generate site disturbances include commercial timber harvest; personal use timber harvest, fuel break and fuel reduction timber harvest, prescribed burning and timber stand improvement.

The type, distribution and acreage of management activity disturbance between 1981 and 1998 is displayed by watershed association in Figure A-11. Watershed associations are listed in descending order based on the total acreage treated in each WA during the period. The total estimated acreage of management activity disturbance on the Kenai Peninsula between 1981-1998 is 11,967 acres. Because of the SBB epidemic, all most all treatments have occurred in forest cover types containing spruce. Thus, approximately 10% of the forest cover types with spruce (118,800 acres) have received some form of treatment since 1981.

Figure A-11: Management Activity Disturbance on the Kenai Peninsula by Watershed Association during 1981-1998, Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total Combined Forest Types w/Spruce	Total Commercial Use Timber Harvest	Total Personal Use Timber Harvest	Total Fuel Reduction Timber Harvest	Total All Timber Harvest	Total Prescribed Fire	Total Timber Stand Imrpv. Improvement	Total All Treatment	% Treated of Total Forest Types w/Spruce
		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
K09	Juneau Creek (Cooper Landing)	11,900	840	-	271	1111	4,060	-	5,171	43%
K02	Resurrection Creek (Hope)	13,290	124	30	-	154	1,727	39	1,920	14%
K10	Quartz Creek (Cooper Landing)	8,100	1,012	29	-	1041	692	140	1,873	23%
K13	Kenai Lake Southwest (Moose Pass)	1,180	167	-	345	512	-	169	681	58%
K07	East Fork Sixmile Creek	5,680	171	69	-	240	276	-	516	9%
K19	Lost Lake/Salmon River	1,900	343	-	-	343	-	-	343	18%
K14	Cooper Creek (Cooper Landing)	5,090	31	-	158	189	116	-	305	6%
K08	Canyon Creek	2,940	213	16	-	229	60	-	289	10%
K15	Russian River (Cooper Landing)	5,040	134	-	24	158	-	76	234	5%
K11	Trail River (Moose Pass)	8,520	189	10	4	203	-	9	212	2%
K16	Kenai Lake North (Moose Pass)	2,660	42	-	7	49	85	32	166	6%
K03	Sixmile Creek Lower	6,220	73	28		100	41		141	2%
K12	Snow River	14,020	73			73			73	0%
K17	Kenai Lake Southeast	9,650	26	2		28			28	0%
K18	Resurrection River	6,870	15			15			15	0%
K04	Seattle & Ingram Creeks	2,700				0				0%
K01	Turnagain Arm					0				0%
K05	Portage Creek	200				0				0%
K06	Placer River	1,160				0				0%
K20	Cape Resurrection	200				0				0%
K21	Eagle River					0				0%
K22	Lake George					0				0%
K23	Bird Creek					0				0%
K24	Glacier Creek	1,650				0				0%
K25	Twentymile River	5,600				0				0%
K26	Chickaloon River	2,120				0				0%
	Total Kenai Peninsula, CNF	**118,800**	3,453	184	808	**4445**	**7,057**	465	**11,967**	**10%**
	% of Total Acres	**10%**								
	% of Total Forested Acres	**53%**								
	% of Total Treated Acres		**29%**	**2%**	**7%**	**37%**	**59%**	**4%**	**100%**	

SourSource: Chugach National Forest GIS

Figure A-11 indicates that prescribed fire has been the dominant management disturbance activity accounting for 59 percent of all management activity acres. This is followed by timber harvest disturbance (37%) for commercial use, fuel reduction and personal use and timber stand improvement (4 %). Timber stand improvement consists of thinning and pruning over stocked immature spruce stands to improve stand and tree vigor to make them less susceptible to SBB mortality.

Figure A-11 also indicates that 85 % (10,161 acres) of all treatment acres are located in the first 5 watershed associations which are highlighted. Treated areas in these watershed associations are associated with the Cooper Landing and Moose Pass Cooperative Projects, the Hope area, and the Granite Creek salvage area. These 5 watershed associations also rank in the top eight Watershed Associations for road access as displayed in Figure A-12.

ROAD ACCESS

Watershed associations in Figure A-12 are listed in descending order of total road miles. The Kenai Peninsula portion of the Forest contains a total of 275 miles of road. Ninety-eight percent of the roads (268 miles) are state highway or Forest Service system road. Two percent (6.5 miles) is non-system road. The average road density on the Kenai Peninsula for public access, management activity or fire protection is **1 mile of road per 4,794 acres** or **1 mile of road per 7.2 sq. miles of land area**. This extremely low road density limits the amount of management activity that can feasibly, as well as economically occur.

With the current Forest Service road moratorium policy, it is unlikely the road density on the Forest will significantly increase in the foreseeable future. However, if new road access is required for emergency actions, such as wildland fire, the road policy provides enough flexibility to construct necessary access for public safety purposes.

Generally, the road moratorium would not significantly affect the use of prescribed fire as a management tool for fuels treatment, wildlife habitat improvement, or site preparation for natural regeneration. It would however, restrict the use of other management tools such as commercial timber sales, personal use permits, or mechanical site preparation in areas beyond _ mile from the existing road system. Treatment costs per acre can be expected to be higher in areas beyond _ mile than in areas that are within _ mile of road access.

Figure A-12: Road Miles and Density by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total National Forest Acres	Total Area Sq. Miles	Highway/ System Road Miles	Non-System Road Miles	Total All Road Miles	Road Density 1 Number of Acres per Mile of Road	Road Density 2 Area (Sq. Miles) Per Mile of Road
K10	Quartz Creek	70,610	117	38.9	3.5	42.4	1,771	3
K02	Resurrection Creek	110,120	175	33.3	0.0	33.3	3,364	5
K11	Trail River	114,140	195	25.8	0.0	25.8	4,827	8
K08	Canyon Creek	55,710	91	20.7	0.0	20.7	2,821	4
K07	East Fork Sixmile Creek	78,230	124	19.9	0.0	19.9	3,978	6
K09	Juneau Creek	43,560	71	16.3	2.6	18.9	2,394	4
K03	Sixmile Creek Lower	35,260	60	16.2	0.0	16.2	2,377	4
K13	Kenai Lake Southwest	13,480	30	16.0	0.0	16.0	1,204	2
K05	Portage Creek	34,100	54	12.0	0.0	12.0	2,893	5
K24	Glacier Creek	31,250	61	9.3	0.0	9.3	4,211	7
K12	Snow River	101,970	163	9.1	0.0	9.1	11,504	18
K19	Lost Lake/Salmon River	23,720	49	7.9	0.0	7.9	3,942	6
K04	Seattle & Ingram Creeks	28,400	50	7.6	0.0	7.6	4,238	7
K17	Kenai Lake Southeast	66,310	106	7.3	0.0	7.3	9,313	15
K15	Russian River	20,720	32	7.2	0.0	7.2	2,863	4
K14	Cooper Creek	31,070	51	6.5	0.0	6.5	5,026	8

K06	Placer River	79,860	126	6.3	0.2	6.5	12,428	19
K18	Resurrection River	43,470	68	3.5	0.0	3.5	12,491	20
K25	Twentymile River	106,520	167	2.3	0.0	2.3	46,895	73
K16	Kenai Lake North	18,580	31	1.2	0.3	1.5	13,320	21
K01	Turnagain Arm	56,900	89	0.7	0.0	0.7	78,000	122
K20	Cape Resurrection	15,900	67	0.3	0.0	0.3	148,276	232
K21	Eagle River	6,200	10	0.0	0.0	0.0	-	0
K22	Lake George	24,900	39	0.0	0.0	0.0	-	0
K23	Bird Creek	70	0	0.0	0.0	0.0	-	0
K26	Chickaloon River	20,690	32	0.0	0.0	0.0	-	0
	Total Kenai Peninsula, CNF	1,231,740	2,059	268	6	275	4,795	7
	% of Total Acres	93%						
	% of Tota Miles			98%	2%	100%		

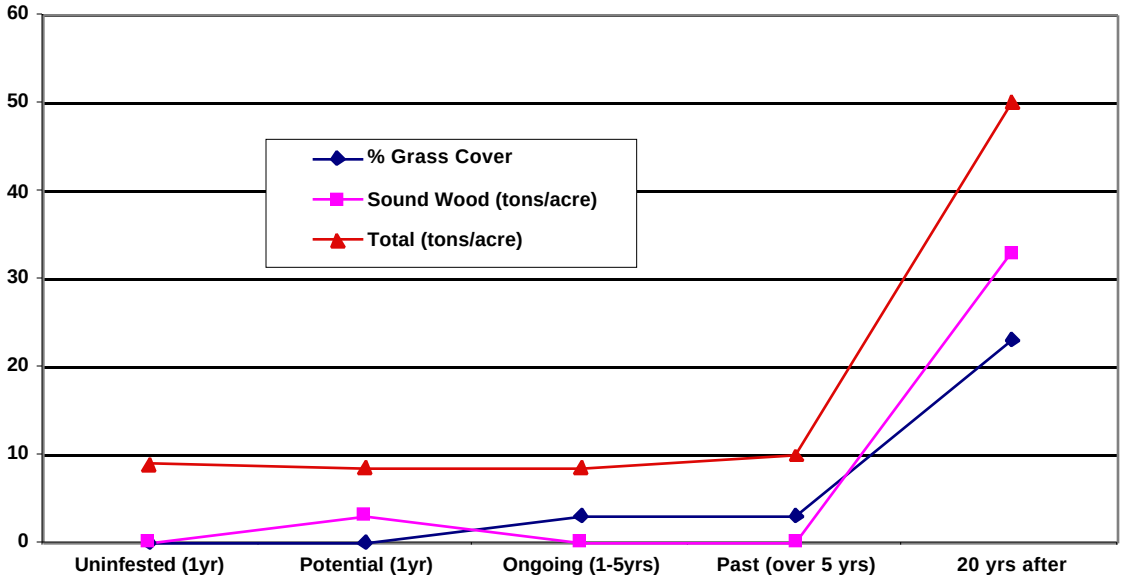
Source: Chugach National Forest GIS

FUELS MANAGEMENT AND FIRE

Fuel Loads

Among the impacts resulting from large scale spruce beetle epidemics in Alaskan forests is long-term stand conversion from closed-canopy spruce stands to open, grassy woodlands (Holsten et al 1994). In addition, **fuel loading in beetle impacted stands is dynamic over time**. However, data and studies for the different geographic regions of the Kenai Peninsula is limited. Currently, only two studies have been conducted on the Forest to determine fuel loading associated with beetle killed spruce stands. The 1994 study conducted in the Resurrection Creek drainage indicated a significant increase of fuel loads (up to 35 tons/acre) 20 years following the initial outbreak of spruce beetles in the Resurrection Creek drainage (Figure A-13).

Figure A-13: Total and sound wood fuel loads in tons/acre, and percent grass cover at different stages of a spruce beetle outbreak in Resurrection Creek WA on the Kenai Peninsula, CNF



Fire Behavior Fuel Models

A total of 8 fire behavior fuel models were identified from the Cooper Landing Project by John See (Cooper Landing Cooperative Project EA, 1990) and have been applied to the vegetation inventory data available for the Kenai Peninsula. Refer to Map# 6 in Appendix F for the Kenai Peninsula Fuel Model Map.

In decreasing order of fire intensity, the following fuel model narratives describe the local fuel types present on the Kenai Peninsula portion of the Forest. Fuel Model acres are for National Forest lands only. (Explanatory Notes: One chain equals 66 feet. Flame lengths 6 feet or longer cannot be safety attacked by hand crews with tools):

1. **Fuel Model 9:** 500 acres (difficult to contain) Fuel model 9 represents a very small amount of black spruce in the area. This type is extremely volatile mostly due to the low live fuel moisture in this species. Fire behavior is generally represented by moderate rates of spread with low intensities, however, prolific torching and spotting is the rule with this model, transforming it into Dr. Jekyll and Mr. Hyde types of fuel. At low humidity and average winds, fires in this type are very difficult to suppress. A correction factor of 1.21 must be used to reflect the rate of spread and fuel model 5 (NFFL) must be used to represent intensities correctly. (With a wind speed of 5 mph a fuel moisture content of 8 percent and live fuel moisture content of 100%, representative rates of spread are 7.5 chains per hour with a flame length of 2.6 feet).

2. **Fuel model 22:** 5,400 acres (difficult to contain) Fuel model 22 is a custom fuel model developed utilizing BEHAVE to create a non standard model that represents fire behavior in the white spruce stands that were attacked by spruce beetle over 5 years ago. Fuel loads in these stands are adjusted to reflect increased loading as the standing dead trees begin to fall and more grass and brush becomes established in the understory. This sequence varies from place to place. In some areas, a younger stand of white spruce that the beetles passed over is hit a decade or so later. The end result is generally the same, more live herbaceous and live woody loading in addition to increases in the 10 and 100 hour (and larger) fuel classes. This model was created liberally to show if anything, higher fire behavior to remain on the conservative side. There could be points in time, however, that fuel model 2, 3, or 6 would be more appropriate.

3. **Fuel Model 14:** 9,300 acres (difficult to contain). This fuel model is a custom fuel model developed in the Newmodel/Testmodel section of the BEHAVE computer program, and is non-standard. This type represents white spruce that has been attacked by spruce beetles within the last 5 years. A small component of live woody fuels are present which will increase dramatically as the stand opens up (see model 22). In relative ranking, this fuel model is hotter than fuel model 8, but significantly cooler than the grass and brush models. Rates of spread and intensities are manageable by firefighters in the full range of conditions, including winds. Exceptions apply to large jackpots (accumulations) of heavy fuels.

4. **Fuel Model 8**: 205,600 acres (moderately difficult to contain) Fuel model 8 represents a predominant timber overstory with a typical forest litter understory. The vegetation type in the area that best fits into this classification includes; healthy or lightly attacked spruce stands, hardwoods, hemlock and some of the mature stands of alder. Fire behavior is typically low, so low in the case of hardwoods that they can generally be relied upon as fuel breaks, unless drought conditions prevail. Then expect low intensity, creeping fires that do not pose a direct threat to life and property. (With a wind speed of 5 mph, a fuel moisture content of 8 percent, and a live fuel moisture of 100%, representative rates of spread are 1.6 chains per hour with a flame length of 1.0 feet).

5. **Fuel model 6:** 212,100 acres (moderately difficult to contain). Fuel model 6 represents primarily shrub tundra vegetation type comprised of mainly dwarf birch, willow, young alder and other shrubs. This model is generally not a problem until dry conditions prevail in Alaska and then only when wind plays a significant role in fire spread and behavior. The wind reduction factor, used for converting 20 foot wind speeds to mid-flame wind speed is .75 for this model, the highest for all Alaskan fuel models. This model also deserves healthy respect when it comes to fire behavior. Rapid rates of spread and high intensities are the rule which causes a threat to life and property, especially

in and around the urban wildland interface. (With a wind speed of 5 mph, a fuel moisture content of 8 percent, and a live fuel moisture content of 100%, representative rates of spread are 32 chains per hour with a flame length of 6 feet).

6. **Fuel Model 3:** 57,100 acres (easily contained). Fuel model 3 represents a grass fuel model without any overstory. The primary species is blue-joint reedgrass (Calamagrostis canadensis) which is a coarse, tall bunchgrass that burns intensely, particularly when wind is applied. Like fuel model 2, associated fire behavior includes rapid rates of spread causing a severe threat to life and property. A characteristic of this model in Alaska is that our normal winter snowfall packs down the fuel compressing it to a fraction (1/2 or more) of the depth during the previous fall. This lowers the flammability of this model rapidly as the season progresses (early June). This fuel model is commonly found in areas where timber harvest has occurred in south-central Alaska and scarification or herbicide treatments have not been utilized. (With a wind speed of 5 mph and a moisture content of 8 percent, representative rates of spread are 104 chains per hour with a flame length of 12 feet).

7. **Fuel Model 2:** 2,100 acres (easily contained). Fuel model 2 represents a grass fuel type beneath a spruce, mixed spruce hardwood or mixed spruce and hemlock overstory. The key element in this model is that grass carries the fire, not forest litter. Timber stands are sparse but cover at least 33% of the area in this model. Fire behavior is characterized as having relatively fast rates of spread with moderate intensities until wind is applied, then expect intense fires that outrun all suppression efforts causing a severe threat to life and property. This is a seasonal model becoming progressively less burnable following green-up. The model is generally less flammable under a tree overstory due to the shading afforded by the overstory. (With a wind speed of 5 mph and a moisture content of 8 percent, representative rates of spread are 35 chains per hour with a flame length of 6 feet).

8. **Fuel Model 0**: 280,400 acres. Fire resistant vegetation (high elevation moss).

9. **Fuel Model 00:** No fuels-366,800 acres, water-33,400 acres, no data-2,000 acres. This model was developed to represent a no fuels condition, such as water, icefields, rock outcroppings, etc.

In Figure A-14, fuel models on for all acres within the Forest boundary including private lands have been aggregated and then ranked by watershed association based on the number of acres in each fuel model aggregation.

Figure A-14: Acres of Fuel Model Types for All Lands (Includes Private lands) by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	TOTAL ACRES	Total Acres of Difficult to Contain Fuel Models 9+14+22	RANK OF Difficult to Contain Fuel Model 9+14+22	Total Acres of Moderately Difficult to Contain Fuel Model 6+8	RANK OF Moderately Difficult to Contain Fuel Model 6+8	Total Acres of Easy to Contain Fuel Model 2+3	RANK OF Easy to Contain Fuel Model 2+3	Total Acres of Fire Resistant, No fuels, No Data, Water Fuel Model HA+ND+NF+W
K11	Trail River	124,520	3,790	1	45,000	2	5,020	3	70,710
K15	Russian River	20,890	2,600	2	8,600	18	690	20	9,000
K14	Cooper Creek	32,900	2,100	3	12,400	16	1,700	16	16,700
K10	Quartz Creek	74,900	1,900	4	30,400	6	4,400	4	38,200
K17	Kenai Lake SE	67,600	1,900	5	24,700	8	2,300	11	38,700
K13	Kenai Lake SW	19,350	1,550	6	8,200	20	800	19	8,800
K18	Resurrection River	43,590	1,290	7	18,900	12	2,100	12	21,300
K16	Kenai Lake N	20,050	1,250	8	7,400	21	1,100	18	10,300
K02	Resurrection Creek	111,740	1,240	9	46,100	1	10,900	1	53,500
K09	Juneau Creek	45,180	580	10	23,200	9	2,500	9	18,900
K07	East Fork Sixmile Creek	79,310	440	11	32,400	5	6,970	2	39,500
K03	Sixmile Creek Lower	38,470	320	12	20,300	10	1,850	15	16,000
K04	Seattle & Ingram Creeks	31,840	230	13	16,100	13	2,600	8	12,910
K12	Snow River	104,530	230	14	35,900	4	4,000	6	64,400
K25	Glacier Creek	106,800	200	15	39,600	3	3,100	7	63,900
K08	Canyon Creek	58,060	160	16	19,600	11	4,300	5	34,000
K24	Twentymile River	39,180	100	17	15,600	14	2,100	13	21,380
K06	Placer River	80,730	30	18	25,100	7	1,900	14	53,700
K26	Bird Creek	20,810	10	19	9,200	17	1,200	17	10,400
K01	Turnagain Arm	56,910	-	-	70	23	-	-	56,840
K05	Portage Creek	34,700	-	-	8,600	19	400	22	25,700
K19	Lost Lake/Salmon River	31,200	-	-	14,900	15	2,400	10	13,900
K20	Cape Resurrection	42,970	-	-	4,300	22	500	21	38,170
K21	Eagle River	6,200	-	-	-	-	-	-	6,200
K22	Lake George	24,910	-	-	-	-	-	-	24,910
K23	Chickaloon River	70	-	-	-	-	-	-	70
	Total Acres Kenai Peninsula, CNF	1,317,410	19,920		466,570		62,830		768,090
	% of Total Acres (All Ownerships)	100%	2%		35%		5%		58%

Source: Chugach National Forest GIS

Wildland Fire Occurrences

Map # 7 (Wildland fire Occurrences) in Appendix F displays the location of wildfire occurrence on all lands within the Forest boundary during the last ten years by cause of fire. During the last decade, there have been a total of 145 fire occurrences on the Forest. However, 77 % of the fires have been less than _ in size.

As indicated in Figure A-15, the primary cause of wildfires is campfires which accounts for 53% of all wildfires. Most locations chosen for campfires are relatively flat, close to road or trail access, and are generally found early, in the smoldering stage, at less than 10 feet in diameter.

Figure A-15: Number of Wildland Fire Occurrences between 1988-1998 on All Lands within the Forest Boundary by Cause, Kenai Peninsula, CNF

Wildfire Cause	No. Wildfire Occurances National Forest	No. Wildfire Occurances Other Owners	No. Wildfire Occurances Total	% of Total
Campfire	54	23	77	53%
Miscellaneous	13	12	25	17%
Debris Burning	7	12	19	13%
Smoking	5	4	9	6%
Arson	5	1	6	4%
Children	4	1	5	3%
Equipment Use/Railroad	3	1	4	3%
Total Kenai Peninsula, CNF	91	54	145	100%
% of Total Wildfire Occurances	63%	37%	100%	

Source: Chugach National Forest GIS

Wildland Fire Risk

There is a concern that fire hazard in spruce beetle impacted stands will increase over time. After a spruce beetle outbreak, grass or other fine vegetation ground cover increases and fire spreads rapidly through these vegetation types. As the dead trees break or blow down (5-10 years after an outbreak), large woody debris begins to accumulate on the forest floor. This wood is the heaviest component of the fuels complex. Heavy fuels do not readily ignite, but once ignited they burn at higher temperatures for a longer period. The combination of fine, flashy fuels and abundant large woody debris results in a dangerous fuels situation. Observations from recent fires on the Kenai Peninsula have shown an increase in crown fires. This fire behavior is caused by fire traveling up the recently dead spruce trees still having needles and spotting into the crowns of adjacent trees. In some areas, there may be an increase in the lower level winds because of a "reduction" of the wind-break characteristics of a green forest, thus augmenting fire crowning behavior. It should be noted, however, that although current levels of infestation have declined, the spruce beetle has impacted 2-3 million acres of forested land over the last ten years. The challenges stemming from past beetle activity, such as fuel-loading, habitat changes, hydrological changes and liability issues remain for forest managers and private landowners alike" (GTR R10-TP-74, 1998).

The Forest Service wildland fire initial attack organization consists of a total of 7 people who provide protection to the Seward and Glacier Ranger Districts during a normal fire season from mid April through mid July. There are still wildland fires from mid July to the end of September, but they seldom have much potential to spread. This organization also implements the Forest prescribed fire program.

This organization, in conjunction with agreements with local volunteer fire departments and a joint initial attack responsibility with Alaska State Forestry in the Cooper Landing area, is currently adequate to take care of initial attack wildland fire suppression within Forest Service fire protection boundaries on the Kenai Peninsula. The majority of wildfires on the Forest are less than 1/10th acre in size, occur within 1/4-1/2 mile of the transportation system. Since 1910, there have been only 3 documented lightning fires within Forest Service protection. The last, in 1997, was allowed to burn, but went out by itself within 2 days.

The Kenai Peninsula is divided into two distinct zones for fire protection purposes. The Western half, which includes a portion of the Kenai Mountains on the Kenai National Wildlife Refuge, is protected by State Forestry. The eastern half, which is entirely within the Kenai Mountains, is

protected by the Forest Service. Each agency protects the lands within it's jurisdiction, regardless of actual land ownership. The Community of Cooper Landing and surrounding area is under a joint protection agreement by both agencies.

The designated fire season on the Kenai Peninsula can be described as having 4 distinct periods for fire suppression and fire effects purposes. From the annual April 15th declaration of fire season on the Kenai Peninsula by the State Forester, fires carry predominantly in a combination of Calamagrostis grass (bluejoint reedgrass) a fine fuel growing in dense continuous clumps found in most areas of the Kenai Peninsula, and black or white spruce (USDA-Forest Service 1993). Calamagrostis grass, frost killed the previous winter, and matted down by snow, can dry rapidly in direct sunlight to carry a fire within 1 hour of having been too wet to burn. At that time of year, the lower duff layer is saturated. Large dead and down woody debris is saturated. Fire spread can be rapid, involve major crowning of tree canopies, and attain large acreage’s. Fire suppression containment efforts are difficult to achieve. However, while fire acreage’s may be large, there is little consumption of the large dead and down woody debris and little mineral soil exposure due to their high moisture content.

Towards the beginning of June, Calamagrostis grass greens up and holds moisture, making it fire resistant. Fires slow down in these fuels, provided the fires don't have an aerial component driven by wind. By this time, dead and down woody debris have dried considerably, and the soil moisture is drier. Fires are not usually as large after green-up, but consumption of the large dead and down woody debris takes place, as well as increased exposure of mineral soil. This is the time of year when prescribed fires are more likely to meet their management objectives. These conditions exist until mid July when the peninsula is usually hit by periodic rains.

Once the mid July rains occur, the Alaska Interagency Fire Group declares that Modified suppression zones convert to Limited suppression zones. Open areas are saturated. The lower duff layer and large dead and down woody debris start accumulating moisture again. Fires still occur, but generally spread slowly, and do not present much of a containment problem. It is interesting to note that at the beginning of the rainy period, the duff layer under timbered canopies is dry. Rain hangs up on the tree canopies but does not always penetrate the canopy to make it to the ground. It evaporates directly into the atmosphere. Surrounding grass and brush fields are saturated. Fire within these stands at this time will spread so slowly it presents no containment problem. It will burn slowly straight down through the duff layer with little lateral spread and expose mineral soil, killing the stand. This is a stand regenerating fire seldom identified. It is also an opportunity for prescribed burning that has little risk of escape.

In September or October, after continuous periodic rains, the Calamagrostis grass is frost killed. During late Fall there are often warm days when the sun is shining, and when Calamagrostis grass becomes cured and dry, or even freeze dried, and can carry fire similarly to the beginning period of fire season. Sometimes also at this time of year, timber understories are dry. Fire in the understory will burn straight down though the lower duff layer to mineral soil without much lateral spread. In 1995, a fire at Gull Rock which started in a Limited suppression zone in August on the Kenai National Wildlife Refuge was allowed to burn. It continued to burn through mid December, in full view of the city of Anchorage, before going out naturally. All trees within the stand were killed, creating a 14 acre stand regenerating fire with mineral soil exposure.

The spruce bark beetle has impacted both areas of the Kenai Peninsula extensively, and has increased fuel loading in both areas, but the hazard and risk of wildland fire differs greatly between the two areas. The Kenai Peninsula is a transitional zone between boreal forest merging with the coastal rainforest. The western Peninsula is similar to the natural fire cycles of the boreal forest, which burn every 75-150 years. The eastern Peninsula is similar to the fire cycles of the maritime ecosystem, with disturbance between 300-500 years. Here, some evidence does exist for natural fire cycles in some areas. Fire cycles are considered natural processes, but were sometimes influenced by human presence in prehistoric periods, which is difficult to prove at present. It must be remembered that even where natural fire cycles existed, they seldom exist in a pure state anywhere anymore due to the ability of humans to interrupt them by fire suppression. The key to the

differences in fire behavior and risk between the two areas is the Kenai Mountains, which separates the Kenai Peninsula into east and west halves.

Major weather patterns during fire season normally move onto the Kenai Peninsula from the Southwest. Unobstructed by significant terrain features, they move to the Northeast, abruptly hit the Kenai Mountains on the Kenai National Wildlife refuge, and lift. The one exception to this is the break in terrain caused by the Kenai River flowing out of the mountains into Skilak Lake, which allows weather patterns to move unobstructed into the interior of the mountains, maintaining increased temperatures and drier conditions sometimes as far East as the Tern Lake Wye. Within this area is the urban interface community of Cooper Landing, as well as some of the highest recreational use areas within Forest Service protection. Weather patterns and risk from human activity are the two main reasons why the Western half of the Peninsula and Cooper Landing may have a daily fire danger classification of high and extreme during fire season, while the rest of the Kenai Peninsula is classified as low or moderate. This is also the reason behind the Forest closure order for campfires outside of designated campgrounds within 1/2 mile of the section of Sterling Highway under Forest Service protection.

The western Peninsula is also subject to occasional dry Northerly winds during fire season. These winds insignificantly affect the eastern Peninsula under Forest Service protection due to the protection afforded by the Kenai Mountains, but cause an accelerated drying of dead and down fuels on the western Peninsula.

The normal daily movement of air, which is onshore in the morning, and offshore at night, has a much greater impact on the drying of wildland fuels on the western Peninsula than it does in the Kenai Mountains. There, the daily movement of air reacts more like rivers, channeling airflow upstream in the morning and downstream at night.

Unobstructed winds from frontal passages tend to dry the western Peninsula, lift and become high elevation transport winds over the eastern Peninsula. This lifting action cools the air to generate high clouds over the interior mountains which partially shades the landscape from direct sunlight. Shading reduces average temperatures and maintains higher relative humidity in mountainous broken terrain, which because of its multitude of aspects, dries fuels at slower rates than the flat terrain on the western Peninsula. In addition, the eastern Peninsula has consistently lower temperatures and higher relative humidity resulting from the natural dry adiabatic lapse rate. In the adiabatic lifting process, unsaturated air cools at approx. 5.5 degrees Fahrenheit per 1,000 ft. gain in altitude. The eastern Peninsula is higher in elevation than the western half, and therefore will have lower average daily temperatures and higher relative humidity. Snow accumulates deeper in the mountains, and stays longer before melting than in the western Peninsula. Therefore, dead and down fuels have a longer period in which to dry on the western Peninsula.

The terrain within Forest Service protection is mountainous, subject to wildland fires driven more by slope and aspect than by wind. Wind driven fires have a higher potential to become large where there are no breaks in terrain or fuel type. The terrain of the western Peninsula is more conducive to wind driven wildland fires, and winds there are a daily occurrence. The mountainous terrain within Forest Service protection is higher elevation, with steep slopes and narrow valleys providing more shade, and with lower average temperatures and higher average relative humidity than the lands within State protection. The mountainous terrain provide many natural fuel breaks, including rockfields, hanging glaciers, and snowfields which last much longer into fire season.

The western Peninsula has a larger more spread out population than the eastern half. The population is also increasing at a higher rate there. Lightning fires on the Kenai Peninsula are rare, but some occur every decade on the western half. On the eastern half, lightning fires are considered an anomaly. There have been only 3 documented lightning fires there since 1910. The western Peninsula has continuous fuels of beetle killed spruce, as well as large areas of black spruce, a more volatile fuel type. The western Peninsula has more wildland fires annually. The fires that do occur are larger, and are a greater threat to life and property on the average.

There are fire seasons on the Kenai Peninsula where the risk from wildland fire lasts from April 15th to the end of August. Within every 12-14 year period, there are usually 2 years in a row where these conditions exist. These conditions existed last in 1993 and 1994. There are occasionally fire seasons on the eastern Peninsula where the conditions are so wet that wildland fire numbers are low, will not spread when they do occur, and prescribed fires would not meet management objectives if ignited. This condition last existed in 1995.

Prior to the outbreak of the spruce bark beetle epidemic, historical records indicate that the Kenai Peninsula had at least 1 large fire every 11 years on the average. Since the early 1990's, the western Kenai Peninsula has had 3 larger fires, which are listed in Figure A-16. Estimated fire suppression costs for larger fires range between a low of $125 per acre to a high of $463 per acre with an average cost of approximately $221 per acre. These fires were all in bark beetle killed stands. The average number of annual fires on the western Kenai Peninsula prior to the 1990's was 40-60 fires a year. That average is now between 70-90 annually. Annual fire numbers on the eastern Peninsula have stayed roughly the same as the previous decade.

Figure A-16: Fire Suppression Costs per Acre for Fires Greater Than 5,000 Acres on the Kenai Peninsula

Fire Name	Year	Total Estimated Acres Burned	Total Estimated Suppression Cost	Average Suppression Cost per Acre
Pothole Lake	1991	7,900	$ 3,654,095	$ 463
Crooked Creek	1996	17,510	$ 2,470,314	$ 141
Hidden Creek	1996	5,200	$ 838,649	$ 161
Total		**30,610**	**$ 6,963,058**	**$ 227**

Source: Alaska Interagency Fire Coordination Center, 1999

The two areas within Forest Service fire protection at highest risk to life and property from wildland fire are the urban interface communities of Cooper Landing and Moose Pass. Both communities are surrounded by beetle killed spruce stands on State or Kenai Peninsula Borough land, all of which is surrounded by the same stand conditions on National Forest lands. **However, the greatest potential threat is not from a wildland fire burning in from the outside, but from a fire started inside the communities.**

While the fire protection analysis jointly being worked on by the Forest Service and State Forestry will not be complete until mid summer 1999, neither community will likely merit determination of high risk when compared to communities located in the western Kenai Peninsula. Moose Pass has considerably more annual rainfall than Cooper Landing. Interpretation of John See's weather and fire behavior analysis for the Cooper Landing Project indicated less than a 2% chance of having a wind event occurring on a day dry enough to support a large fire in Cooper Landing each fire season, based on a 150 day fire season.

Areas of Management Concern

Fire Hazard

Even though hazardous fuels may exist, as long as there is no ignition, there is no immediate threat to forest resources. However, with human use increasing primarily for recreation on the National Forest, in addition to adjacent public lands, the increasing potential for ignition remains a management concern.

Fuels treatment projects were completed on State, Borough, National Forest and private lands within the Cooper Landing area between 1990 and 1995, as part of the Cooper Landing Cooperative

Project. Prescribed burning units have not been completed yet and fuel breaks and fuel reduction areas haven't been evaluated since 1995 for continued effectiveness. Blue-joint reedgrass cover, having increased significantly in the area, is a flashy fuel in spring and fall months and remains a management concern.

To address wildfire concerns in the community of Moose Pass, the Forest, State and Borough initiated the Moose Pass Cooperative Project in 1993. The State completed several salvage timber sales to break up continuous stands of dying spruce and reduce SBB killed timber in the project area. On National Forest lands in the Moose Pass Project area, the LV Ray and Mile 34 Sales were completed. The larger North Shore Salvage Sale was appealed and eventually dropped, with the harvest units converted to broadcast burn units that are in the 5-year action plan. The only other management activity on the National Forest in the project area since 1995 has been campground vegetation management at Trail River, Ptarmigan Creek, and Primrose Creek campgrounds. Beetle populations are still active and increasing fuel loads over time will continue to remain a management concern.

Fuels Management Treatment Opportunities

Pre-treatment of hazardous fuels complexes reduces risk and overall costs of wildland fire suppression within the same area. Hazard reduction constitutes removal of 0-3 inch in diameter woody material (fine fuels). Fine fuels are the prime contributors to high rates of fire spread and intensity. In order to be cost effective, hazard reduction should take place where statistical fires occur, and in areas that have a higher potential threat to life, property and higher resource values from wildland fire starts. For the Kenai Peninsula within Forest Service protection, this predominantly means that in order to be effective, hazard reduction should occur within 1/4 to 1/2 mile of the transportation system. (Those areas accessible by boat, trail, or road). Burning beyond those distances serves limited hazard reduction objectives, except to break up fuel continuity.

Hazard reduction opportunities exist in the following to address management and public concerns about the fire hazard associated with the SBB epidemic.

Management of Activity Fuels

Activity fuels management occurs in timber sale areas, personal use permit areas, and areas where spruce stands are thinned and pruned to improve tree and stand growth and vigor. Treating these types of fuels is on going and varies by the level of management activity. Fuels are generally treated by hand or mechanical piling of slash which is then burned at an appropriate time to minimize chance for fire escape. In some cases, it may be desirable to broadcast burn timber sale units that have received total tree removal after harvest completion to both reduce activity fuels and prepare a mineral soil seed bed (site preparation) for natural regeneration.

Management of Natural Fuels

1. Urban Interface Fuels

These are natural fuels in close proximity to areas of human habitation and/or private property. Four Forest Service administrative sites, 19 recreation cabins, and 17 campgrounds on the Kenai Peninsula are included in the urban interface. The urban interface fuel treatment zones discussed below are recommended by the Seward District fire specialist and provide a safe distance in which fuels and fire risk are minimized. Due to their location, a broadcast burn treatment is generally not a treatment option. This makes fuel treatment by hand or mechanical means necessary to remove and pile slash which is then burned at an appropriate time to minimize chance for fire escape. If road access is available, timber sales, personal use permits, or end may be used as a management tool to accomplish the fuel treatment objective while meeting commercial or personal use forest product objectives.

a. Human Habitation and Private Property
Map # 13 in Appendix F displays the location where urban interface fuel treatment opportunities exist in Forest vegetation that is already SBB infested and located within distance zones of 0-_ mile and _-1 mile of private property boundaries within the Forest boundary.

Figure A-17 displays the acreage of SBB infested poletimber and sawtimber spruce stands in each of the above zones by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB infested spruce within the entire 1 mile zone. Eighteen of 26 watershed associations have acreage in the urban interface distance zones ranging from a low of 40 acres to a high of 4,800 acres. All eighteen watershed associations are highlighted as potential urban interface fuel treatment opportunities in order of their ranking (1-18).

Figure A-17: Acres of Forest Vegetation SBB Infested within 0 to _ mile and _ to 1 mile distance zones of Private Land Boundaries by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Private Land Acres	SBB Infested Size Class 2-4 Spruce 0-1/2 mile Pvt Land Acres	SBB Infested Size Class 2-4 Spruce 1/2-1 mile Pvt Land Acres	Total SBB Infested Size Class 2-4 Spruce w/1 mi Pvt Lands Acres	Rank for Total SBB Infested Size Class 2-4 Spruce w/1 mi Pvt Lands
K10	Quartz Creek	4,400	3,000	1,800	4,800	1
K11	Trail River	10,400	2,600	1,000	3,600	2
K02	Resurrection Creek	1,900	1,200	1,500	2,700	3
K09	Juneau Creek	1,600	1,900	400	2,300	4
K03	Sixmile Creek Lower	3,300	1,300	800	2,100	5
K12	Snow River	2,600	1,000	600	1,600	6
K14	Cooper Creek	1,700	700	600	1,300	7
K08	Canyon Creek	2,600	800	400	1,200	8
K16	Kenai Lake North	1,400	600	300	900	9
K17	Kenai Lake Southeast	1,300	300	600	900	10
K15	Russian River	10	400	400	800	11
K07	East Fork Sixmile Creek	1,100	500	200	700	12
K13	Kenai Lake Southwest	5,800	300	80	380	13
K19	Lost Lake/Salmon River	7,500	300	-	300	14
K24	Glacier Creek	8,000	200	90	290	15
K04	Seattle & Ingram Creeks	3,600	200	40	240	16
K25	Twentymile River	400	30	30	60	17
K06	Placer River	800	20	20	40	18
	Total Kenai Peninsula, CNF	86,250	15,350	8,860	24,210	
	% of Total Acres		63%	37%	100%	

Source: Chugach National Forest GIS

b. Administrative Facilities and Forest Service Recreation Cabins
Map # 12 in Appendix F displays the location where fuel treatment opportunities exist in SBB susceptible Forest vegetation located within distance zones of 0-500 feet from Forest Service recreation cabins and within 1/2 mile of Forest Service campgrounds on the Kenai Peninsula. There are four administrative sites located at Kenai Lake Work Center, Hope Guard Station, Kenai Bend, and adjacent to Ptarmigan Creek campground. These sites are not currently mapped in the

Forest GIS. A rough estimate of the acreage is 10 acres. There are 19 recreation cabins on the National Forest on the Kenai Peninsula.

Figure A-18 displays the acreage of SBB susceptible poletimber and sawtimber spruce in the 0-500 foot zone around recreation cabins by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Six of 26 associations have susceptible acreage in the 0-500 foot zone around recreation cabins and 69 % of the 130 susceptible spruce acres is SBB infested. All six associations are highlighted as potential fuel treatment opportunities.

Figure A-18: Acres of Forest Vegetation Susceptible to SBB within 500 feet of Forest Service Recreation Cabins by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Uninfested Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Infested Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Total Susceptible Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Rank for Susceptible Size Class 2-4 Spruce 0-500 feet FS Cabins
K02	Resurrection Creek	-	40	40	1
K15	Russian River	-	30	30	2
K09	Juneau Creek	10	10	20	3
K12	Snow River	20	-	20	4
K18	Resurrection River	10	-	10	5
K26	Chickaloon River	-	10	10	6
	Total Kenai Peninsula, CNF	**40**	**90**	130	
	% of Total Acres	**31%**	**69%**	**100%**	

Source: Chugach National Forest GIS

c. Forest Service Campgrounds

Figure A-19 displays the acreage of SBB susceptible poletimber and sawtimber spruce in the _ mile fuel treatment zone around Forest Service campgrounds by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within zone. Thirteen of 26 watershed associations have SBB susceptible spruce in the _ mile zone around campgrounds and 77% of 3,480 susceptible spruce acres is SBB infested. All thirteen associations are highlighted as potential fuel treatment opportunities around campgrounds.

Figure A-19: Acres of Forest Vegetation Susceptible to SBB within _ mile of Forest Service Campgrounds by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Un-infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Total Susceptible Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Rank for Susceptible Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds
K07	East Fork Sixmile Creek	300	600	900	1
K17	Kenai Lake Southeast	100	600	700	2
K15	Russian River	0	600	600	3
K09	Juneau Creek	0	400	400	4
K02	Resurrection Creek	200	20	220	5
K14	Cooper Creek	0	200	200	6
K16	Kenai Lake North	80	80	160	7
K10	Quartz Creek	20	90	110	8
K08	Canyon Creek	0	70	70	9
K11	Trail River	20	30	50	10
K06	Placer River	40	0	40	11
K05	Portage Creek	20	0	20	12
K12	Snow River	10	0	10	13
	Total Kenai Peninsula, CNF	790	2,690	3,480	
	% of Total Acres	**23%**	**77%**	**100%**	

Source: Chugach National Forest GIS

2. Maintaining Effective Fuel Break and Fuel Reduction Areas

Fuel breaks and fuel reduction areas totaling 2,150 acres were created near the communities of Cooper Landing and Moose Pass during their respective cooperative fire protection/fuel reduction projects. Maintenance of a mineral soil line is necessary in existing fuel breaks to provide effective fuel breaks in grass cover types. Water bars were installed in fuel break lines where necessary to minimize soil movement in the lines. These fuel breaks have not been maintained since they were created in the early 90's. These sites need to be evaluated and appropriate maintenance action taken where necessary to maintain their effectiveness. Note: Maps of these areas were not generated.

3. Road and Trail Corridor Fuels

Road and trail corridors are where most wildfire occurrences on the Forest take place. (Refer to Map # 7 – Wildfire Occurrences in Appendix F). Depending on location, broadcast burning may be used as a management tool for fuel treatment or treatment may be by hand or mechanical means necessary to remove and pile fuels which are then burned at an appropriate time to minimize chance for fire escape. If road access is available, timber sales or personal use permits may be used as a management tool to accomplish the fuel treatment objective in addition to meeting personal use or commercial forest product objectives.

a. Road Corridor Fuels
Map # 14 in Appendix F displays the location where road corridor fuel treatment opportunities exist in Forest vegetation that is susceptible to SBB and located within distance zones of 0-1/2 mile from existing roads on the Kenai Peninsula.

Figure A-20 displays the acreage of SBB susceptible poletimber and sawtimber spruce in _ mile road corridors by watershed association. Eighteen of 26 watershed associations have SBB susceptible spruce within the _ mile fuel treatment zone adjacent to existing roads. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. A total of 25,450 acres of SBB susceptible spruce is located in the fuel treatment zone and 69% is currently infested. All eighteen associations are highlighted as potential road corridor fuel treatment opportunities.

Figure A-20: Acres of Forest Vegetation Susceptible to SBB within 0-1/2 mile road corridors by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total Road Miles	Uninfested Size Class 2-4 Spruce 0-1/2 mile Roads Acres	Infested Size Class 2-4 Spruce 0-1/2 mile Roads Acres	Total Susceptible Size Class 2-4 Spruce 0-1/2 mile Roads Acres	Rank for Susceptible Size Class 2-4 Spruce 0-1/2 mile Roads
K10	Quartz Creek	42.4	200	3,900	4,100	1
K07	East Fork Sixmile Creek	19.9	900	2,300	3,200	2
K03	Sixmile Creek Lower	16.2	1,000	2,000	3,000	3
K02	Resurrection Creek	33.3	800	2,100	2,900	4
K08	Canyon Creek	20.7	200	2,000	2,200	5
K09	Juneau Creek	18.9	50	2,100	2,150	6
K12	Snow River	9.1	500	500	1,000	7
K24	Glacier Creek	9.3	900	100	1,000	8
K11	Trail River	25.8	70	800	870	9
K15	Russian River	7.2	-	800	800	11
K17	Kenai Lake Southeast	7.3	600	200	800	10
K04	Seattle & Ingram Creeks	7.6	700	10	710	12
K18	Resurrection River	3.5	700	-	700	13
K19	Lost Lake/Salmon River	7.9	500	100	600	14
K06	Placer River	6.5	500	20	520	15
K14	Cooper Creek	6.5	-	400	400	16
K25	Twentymile River	2.3	200	-	200	17
K16	Kenai Lake North	1.5	60	40	100	20
K05	Portage Creek	12.0	100	-	100	19
K13	Kenai Lake Southwest	16.0	-	100	100	18
K01	Turnagain Arm	0.7	-	-	-	
K20	Cape Resurrection	0.3	-	-	-	
K21	Eagle River	0.0	-	-	-	
K22	Lake George	0.0	-	-	-	
K23	Bird Creek	0.0	-	-	-	
K26	Chickaloon River	0.0	-	-	-	
	Total Kenai Peninsula, CNF	**275**	**7,980**	**17,470**	**25,450**	
	% of Total Acres		**31%**	**69%**	**100%**	

Source: Chugach National Forest GIS

b. Recreation Trail Corridor Fuels
Map # 10 in Appendix F displays the location where trail corridor fuel treatment opportunities exist in Forest vegetation that is susceptible to SBB and located within distance zones of 0-100 feet from existing recreation trails on the Kenai Peninsula. Because 100 foot zones will not display at the normal map scale being used, a representative area around Cooper Landing is displayed.

Figure A-21 displays the acreage of SBB infested poletimber and sawtimber spruce in 100 foot trail corridors (100 feet on either side of trails) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB infested spruce within the zone. Eleven of 26 watershed associations have SBB infested spruce in the 100 foot trail corridor zone. A total of 1,170 acres is SBB infested in the fuel treatment zone. All eleven associations are highlighted as potential trail corridor fuel treatment opportunities.

Figure A-21: Acres of Forest Vegetation Susceptible to SBB Infestation within 100 foot (200 feet total) Trail Corridors by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	SBB Un-infested Size Class 2-4 Spruce 0-100 feet Trails Acres	SBB Infested Size Class 2-4 Spruce 0-100 feet Trails Acres	Total SBB Susceptible Size Class 2-4 Spruce 0-100 feet Trails Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet Trails
K02	Resurrection Creek	20	300	320	1
K15	Russian River	0	300	300	2
K18	Resurrection River	190	80	270	3
K09	Juneau Creek	40	100	140	4
K10	Quartz Creek	50	80	130	5
K17	Kenai Lake Southeast	80	50	130	6
K14	Cooper Creek	0	100	100	7
K07	East Fork Sixmile Creek	60	20	80	8
K11	Trail River	10	70	80	9
K12	Snow River	30	30	60	10
K08	Canyon Creek	0	40	40	11
K24	Glacier Creek	20	-	20	12
K19	Lost Lake/Salmon River	10	-	10	13
	Total Kenai Peninsula, CNF	**510**	**1,170**	**1,680**	
	% of Total	**30%**	**70%**	**100%**	

Source: Chugach National Forest GIS

4. Backcountry Area Fuels (hazardous fuel concentrations)

These are areas of natural fuel concentrations in areas away from human habitation, private property, and Forest Service campgrounds and recreation cabins and generally not close to roads. Due to their location, a broadcast burn treatment is usually the best treatment option for treating larger areas. Pre-felling of trees prior to burning is sometimes necessary to establish uniform fuel continuity and to better control fire behavior. If road access is available, timber sales or personal use permits may be used as a management tool to accomplish the broadcast burn pre-felling objective while meeting personal use or commercial forest product objectives provided only the merchantable tree boles are removed from the site.

a. Existing Project Areas with NEPA Clearance

Several broadcast burn projects from the Cooper Landing and Moose Pass Cooperative Projects already have NEPA clearance for hazardous fuels treatment. All of these units are listed in the 5-year action plan. Several units in the Moose Pass Project area would not be practical to burn because of their location upslope above State lands, until the State initiates treatment on their lands.

Figure A-22: Acres of NEPA Cleared Prescribed Burns for Fuel Hazard Reduction In SBB Infested Forest Vegetation by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total Combined Forest Types w/Spruce Acres	Total Hazard Reduction Prescribed Burn NEPA Cleared Acres	Rank for Hazard Reduction Prescribed Burn NEPA Cleared
K01	Turnagain Arm	-	-	
K02	Resurrection Creek (Hope)	13,290	-	
K03	Sixmile Creek Lower	6,330	-	
K04	Seattle & Ingram Creeks	3,700	-	
K05	Portage Creek	200	-	
K06	Placer River	1,160	-	
K07	East Fork Sixmile Creek	5,680	-	
K08	Canyon Creek	2,940	-	
K09	Juneau Creek (Cooper Landing)	11,900	71	5
K10	Quartz Creek (Cooper Landing)	8,100	-	
K11	Trail River (Moose Pass)	8,520	466	2
K12	Snow River	14,920	-	
K13	Kenai Lake Southwest	1,180	325	4
K14	Cooper Creek (Cooper Landing)	5,090	-	
K15	Russian River (Cooper Landing)	5,040	-	
K16	Kenai Lake North (Moose Pass)	2,660	1,007	1
K17	Kenai Lake Southeast	9,650	325	3
K18	Resurrection River	6,870	-	
K19	Lost Lake/Salmon River	1,900	-	
K20	Cape Resurrection	300	-	
K21	Eagle River	-	-	
K22	Lake George	-	-	
K23	Bird Creek	-	-	
K24	Glacier Creek	1,650	-	
K25	Twentymile River	5,600	-	
K26	Chickaloon River	2,120	-	
	Total Kenai Peninsula, CNF	**118,800**	**2,194**	

Source: Chugach National Forest GIS

FOREST HEALTH AND WATERSHED RESTORATION

The expression "forest health" has been very controversial since the Forest first started dealing with the issue. One of the main reasons for the controversy is that the expression means different things to different people. To provide a common definition of the expression "forest health", we have adopted the definition that U.S.D.A.-Undersecretary Jim Lyons used in his testimony before the U.S. House of Representatives Committee on Agriculture on January 16, 1997.

"No matter how we define a healthy forest, two aspects of forest health remain constant. First, forest health is more than just healthy trees. A healthy forest is one that maintains the function, diversity, and resiliency of all its components, such as wildlife and fish habitat, riparian areas, soils, and rangelands. Healthy forests also provide for human needs and desires, including appearing the way people want them to look. Second, health must be based on science. Science provides information for the decision-making process by identifying the status of forest ecosystems with

options for addressing health issues. As science evolves, management practices must be modified accordingly.

A healthy forest is more than healthy trees and restoring forest health involves more than salvaging dead and dying timber. It must include riparian restoration, improvement of wildlife and fish habitat, and maintaining recreation opportunities and scenic values. In short, forest health means caring for all resources found in our national forests" (Lyons 1997).

Areas of Management Concern

Public Safety and Liability for Hazard Tree Injuries or Property Damage
There is a concern for public safety and the liability issue it raises with hundreds or thousands of SBB killed trees in areas that receive high human use such as campgrounds, recreation cabins, road corridors, trail corridors, administrative facilities, and riparian zones along popular fishing streams. Due to minimum clearing widths for some utility corridors on the Kenai Peninsula, hazard trees next to high voltage utility lines are also a concern. While utility corridor clearings are the responsibility of the utility, hazard trees in stands adjacent to cleared utility corridors that can reach utility lines is the responsibility of the Forest Service.

As a part of everyday management of the National Forest, forested areas that receive high human use are continually being evaluated for hazard trees that might pose a threat to public safety and property. This evaluation assesses the "target" (likelihood of humans, facilities, property) and the likelihood of tree failure (health and vigor of the tree, physical defects, size, direction of failure, etc.) to determine the risk. When a tree or group of trees posing an unacceptable risk are identified, they are removed as promptly as possible. Generally, these areas include campgrounds, campground perimeters, perimeters around Forest Service recreation cabins, perimeters around administrative facilities, recreation trail corridors, trailheads, and road corridors.

Hazard tree removal in all areas is generally done by hand (force account crews) if removing a small number of trees. If many trees need to be removed equipment rental contracts, personal service contracts, timber sales and personal use permits have all been used as management tools to accomplish hazard tree removal.

Impacts to Watersheds
Intense bark beetle outbreaks can kill large amounts of forest vegetation. The "removal" of significant portions of the forest will impact to some degree the dynamics of stream flow, time of peak flow, etc. There have been no hydrologic studies in Alaska quantifying or qualifying impacts associated with SBB outbreaks. Impact studies, however, have been done elsewhere. In a Montana watershed impacted by Mountain Pine Beetle, there was a 15% increase in annual water yield, a 2-3 week advance in snowmelt, and a 10-15% increase in low flows (Potts 1984).

Impacts to Fish Habitat
If salmon spawning streams are bordered by large diameter spruce and these trees are subsequently killed by SBB, there is a concern as to the future availability of large woody debris in the streams. Large woody debris in spawning streams is a necessary component for spawning habitat integrity.

Impacts to Scenic Quality
Scenic Beauty is an important forest resource. Several studies have demonstrated that there is a significant decline in public perception of scenic quality were SBB impacted stands adjoin corridors such as National Scenic Byways (Daniel et al 1991). Surveys have also shown that the public is evenly divided as to whether SBB outbreaks damage scenic quality in backcountry areas (University of Alaska-Anchorage 1991).

The SBB epidemic has and will continue to alter the scenic quality of all road corridors on the Kenai Peninsula, including the Seward National Scenic Byway, which runs through the Forest almost it's full length between Anchorage and Seward. The visual appearance of the forested

landscape on the National Forest in practically all road corridors on the Forest has and is continuing to change. The change is from one of lush, green hemlock and spruce forests, intermingled with patches of hardwoods covering mountain side slopes, to one of brown or gray dead standing spruce trees with no needles, intermingled with patches of green hemlock and hardwoods, covering mountain side slopes. Over the next decade, many of the SBB killed spruce trees will be broken off and jack-strawed on the ground. As trees adjacent to roads continue to die, people looking for easily accessible firewood, cut most of the dead trees that they can haul to the road, leaving stumps and slash adjacent to roads. Generally, this activity is uncontrolled.

The scenic quality of mature spruce forest settings that once existed in and around most of the Forest's campgrounds, recreation trails, and backcountry recreation cabins on the Kenai Peninsula has been and is continuing to be altered by the SBB epidemic.

Impacts on Recreation

a. Campgrounds and Recreation Cabins
Campground vegetation management plans were developed for all Forest Service campgrounds on the Kenai Peninsula between 1991 and 1993. Silvicultural prescriptions were prepared for improving campground spruce vegetation vigor and growth by thinning and pruning in concert with pest management techniques. However, campground trees are continuing to be killed every year by spruce bark beetles. To perform vegetation management, campground loops and sometimes, entire campgrounds may have to be closed to public use until project work is completed. Some, campgrounds, like Cooper Creek were so severely impacted by SBB that the entire campground had to be closed while a commercial timber sale was used to remove the overwhelming number of dead mature spruce trees from the campground.

Currently, backcountry recreation cabins do not have vegetation management plans for management of the vegetation and fuels around cabin settings, although hazard trees are removed as needed.

b. Recreation Trails
The maintained Kenai Peninsula trail system is 166.3 miles long. Of this, a large portion is located within SBB impacted spruce stands. The increase in SBB killed spruce breakage and blowdown in trail corridors currently costs an average of $67,000 per year to maintain access on the trails. Heavy snow or wind events can greatly increase both the amount of time and cost associated with keeping trails open. In addition, certain areas such as the Johnson Pass Trail are projected to have higher maintenance needs in the coming years due to the recent beetle epidemic which has swept through that trail corridor. Trail corridor fuel reduction and hazard tree removal would reduce annual trail maintenance costs once SBB killed trees in trail corridors have been removed and cleaned up.

Loss of Merchantable Value of SBB killed trees on Commercial Timberlands
In south-central Alaska, the economic value of spruce as saw timber is reduced within three years of SBB attack due to weather checking and sap rots. The value of SBB killed trees as house logs, chips, or firewood will continue for many years if SBB killed trees remain standing.

Long-term Stand Conversion in Riparian Zones, Road Corridors, Trail Corridors, Campgrounds, and Commercial Timberlands
The best regeneration of spruce and paper birch occurs on a seedbed of bare mineral soil with some organic material. Site disturbances such as fire, windthrow, flooding, or ground scarification; provide excellent sites for germination and establishment of seedlings if there is an adequate seed source. However, on some sites in south-central Alaska, grass and other competing vegetation quickly invade the sites where SBB have "opened up" the canopy. This delays re-establishment of tree species. The duration of this delay is unclear, but limited research indicates the delay could last 20 years or longer.

Forest Health and Watershed Restoration Management Opportunities

There are a variety of techniques that can be used to prevent, mitigate, or reduce impacts associated with SBB infestations. However, before vegetative and/or pest management options can be developed, the resource objective(s) for a particular stand, watershed, landscape, etc. must be determined. The forest manager must evaluate the resource and public 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 key to forest ecosystem management is to manage vegetation patterns in order to maintain species diversity, both plant and animal, while providing for a multitude of resources such as recreation, fisheries, wildlife, and the production of wood fiber for personal and commercial uses. Properly applied silvicultural practices as well as fuels and fire management on the Forest, can maintain the forest diversity needed to provide the range of amenities, wildlife habitats and products available in the forest for now and in the future.

Map # 4 in Appendix F displays the vegetative patterns, cover types, and location of approximately 111,100 acres of forested land and an additional 949,700 acres of non forest cover types that are not susceptible to SBB. While some of these acres, particularly decadent birch, aspen and hemlock stands, may benefit from vegetation management for other resource objectives such as wildlife, this set of acres is not the focus of forest health and watershed restoration treatment opportunities.

Map # 3 in Appendix F, displays the vegetative patterns, cover types and location of approximately 112,700 acres of spruce forest in poletimber and sawtimber size classes that are susceptible to SBB. In general, four sets of **stand conditions** can be found on this set of acres:

1. Live but no to lightly SBB Infested - Spruce stand is alive with no SBB infestation or 0-25% of the trees infested with SBB. Infestation is usually in pockets or clumps of trees. Stand color (from a distance) is a lush green. No mortality. All trees are standing. Canopy is tight, blue-joint reedgrass is not present in the stand. In general, this describes many spruce stands around Ingram Creek, Peterson Creek, Trail River, Ptmargain Creek, south of Girdwood along, Turnagain Arm, west side of Sixmile Creek, most stands in Twenty-mile and Placer Rivers and Snow River.

2. Live but Light to Heavily SBB Infested – Spruce stand is alive with 25-75% of the trees infested with SBB. Stand color (from a distance) is greenish-brown. Some mortality is starting to appear. All trees are still standing. Canopy is still tight, blue-joint reedgrass is likely, not present in the stand. All sawtimber size trees are still salvageable. In general, this describes many spruce stands around, Primrose Creek, and Sixmile Creek.

3. Recent Dead (less than 5 years) - Spruce stands have been dead less than 5 years. Stand appears brown (from a distance) in color. Stand mortality ranges between 50-99% of all spruce trees over 5.0 inches d.b.h. Almost all dead trees are still standing. On many sites, blue-joint reedgrass is just starting to invade the site. Stand doesn't have a lot of sap rot, but weather checking is starting to become prominent. Most sawtimber size trees are still salvageable. In general, this describes many spruce stands around Black Mountain, Primrose Creek, and Sixmile Creek and between the Hope Y and Turnagain Pass.

4. Older Dead (more than 5 years) - Spruce stands have been dead for more than 5 years. Stand appears gray (from a distance) in color. Stand mortality ranges between 75-99% of all spruce trees over 5.0 inches d.b.h. Stand structure is breaking up as more dead trees break off in high winds and from winter snow loads. On many sites, particularly wet-sites, blue-joint reedgrass is invading or has captured the site. Trees have advanced sap rot and weather checks and have lost any sawtimber value. Trees are still useable for chips, some house logs, and firewood. In general this describes many

spruce stands around Cooper Landing, Moose Pass, Palmer Creek, upper Resurrection River, upper Resurrection Creek, Seattle Creek, and the north and south shore of Kenai Lake.

Addressing management concerns and access limitations dictate what treatment opportunities can be practically and economically considered for prevention or mitigation of SBB impacts. In general, the Forest's forest health and watershed restoration strategy has the following 3 objectives:

1. **REMOVE** hazard trees in areas of high human use to address public safety and liability concerns.
2. **MAINTAIN** stand species diversity, cover, structure and function in existing green stands (Stand Conditions 1 or 2) to prevent or mitigate further SBB impacts to forest resources that are a management concern.
3. **RESTORE** stand species diversity, cover, structure and function where it has been lost (Stand Conditions 3 or 4) for forest resources that are a management concern.

.

Figure A-23 provides criteria for specific areas where the strategy is applied with potential treatments.

Figure A-23: Forest Health and Watershed Restoration Strategy

Management Concern(s)	Objective	Vegetative Function	Stand Conditions	Action	Locations	Potential Treatments
	HAZARD TREE REMOVAL					
Public Safety Liability	1. Keep high human use areas safe for public use.	Hazard free	1- 4	Hazard Tree Removal	Areas of High Human Use Road Corridors Trail Corridors Utility Corridors Campgrounds Administrative Sites Recreation Cabins	Cut Trees Pile & Burn Slash Chip Slash
	MAINTAIN EXISTING LIVING SPRUCE STANDS					
Watershed Streambank Stability Fish habitat	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Streambank stability Supply large woody debris to stream channel to maintain spawning habitat integrity. Recreation Setting	1 or 2	Integrated Vegetation and Pest management	Stream Riparian (100 feet either side) Lake Riparian (100 feet)	Thin Prune Pile & Burn Slash Chip Slash Fertilize Trap Tree Spray Pheromones Biological
Scenic Quality Long-term Stand Conversion	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Scenic Quality	1 or 2	Integrated Vegetation and Pest management	Road Corridors (0-100 feet either side) Seward National Scenic Byway (0-1 mile either side)	Full range of silvicultural and pest management practices
Impacts to Recreation Opportunities	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Scenic Quality Recreation Setting	1 or 2	Integrated Vegetation and Pest management	Campgrounds (0-1/2 mile)	Thin Prune Fertilize Trap Tree Spray Pheromones Biological
Impacts to Recreation Opportunities	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Scenic Quality Recreation Setting	1 or 2	Integrated Vegetation and Pest management	Trail Corridors and Trail Heads (0-100 feet either side)	Thin Prune Trap Tree Spray Pheromones Biological
Impacts to Recreation Opportunities	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Scenic Quality Recreation Setting	1 or 2	Integrated Vegetation and Pest management	Recreation Cabins (0-500 feet)	Thin Prune Fertilize Trap Tree Spray Pheromones Biological
Loss of short-term supply of available wood for personal use forest products	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Wood Fiber for Personal Use forest products	1 or 2	Integrated Vegetation and Pest management	Woodlands Commercial Timberlands	Full range of silvicultural and pest management practices

Loss of merchantable value for sawtimber	2. Maintain stand species diversity, cover, structure, and function to prevent or mitigate further SBB impacts.	Wood fiber for high quality commercial forest products	1 or 2	Integrated Vegetation and Pest management	Commercial Timberlands	Full range of silvicultural and pest management practices

Figure A-23: Forest Health and Watershed Restoration Strategy (Continued)

Management Concern(s)	Objective	Vegetative Function	Stand Conditions	Action	Locations	Potential Treatments
	RESTORE DEAD SPRUCE STANDS					
Watershed Streambank Stability Fish habitat Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Streambank stability Supply large woody debris to stream channel to maintain spawning habitat integrity. Recreation Setting	3 or 4	Revegetate	Stream Riparian (100 feet either side) Lake Riparian (100 feet)	**SITE PREP** Burn Hand Scalp **REVEGETATE** Natural Seed Hand Seed Plant Transplant
Scenic Quality Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Scenic Quality	3 or 4	Revegetate	Road Corridors (0-100 feet either side) Seward National Scenic Byway (0-1 mile either side)	**SITE PREP** Burn Hand Scalp **REVEGETATE** Natural Seed Hand Seed Plant, Transplant
Impacts to Recreation Opportunities Long-Term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Scenic Quality Recreation Setting	3 or 4	Revegetate	Campgrounds (0-1/2 mile)	**SITE PREP** Burn Hand Scalp **REVEGETATE** Natural Seed Hand Seed Plant, Transplant
Impacts to Recreation Opportunities Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Scenic Quality Recreation Setting	3 or 4	Revegetate	Trail Corridors and Trail Heads (0-100 feet either side)	**SITE PREP** Burn Hand Scalp **REVEGETATE** Natural Seed Hand Seed Plant, Transplant
Impacts to Recreation Opportunities Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Scenic Quality Recreation Setting	3 or 4	Revegetate	Recreation Cabins (0-500 feet)	**SITE PREP** Burn Hand Scalp **REVEGETATE** Natural Seed Hand Seed Plant, Transplant
Loss of long-term supply of available wood for personal use forest products. Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Wood Fiber for Personal Use forest products	3 or 4	Revegetate	Woodlands Commercial Timberlands	**SALVAGE IF ROAD ACCESSIBLE** **SITE PREP** Burn Hand Scalp Mechanical **REVEGETATE** Natural Seed Hand Seed Plant
Loss of long-term supply of available wood for commercial forest products. Long-term Stand Conversion	3. Restore stand species diversity, cover, structure, and function.	Wood fiber for high quality commercial forest products	3 or 4	Revegetate	Commercial Timberlands	**SALVAGE IF ROAD ACCESSIBLE** **SITE PREP** Burn Hand Scalp Mechanical **REVEGETATE** Natural Seed Hand Seed Plant

Hazard Tree Removal
Opportunities exist in the following areas for removal of hazard trees and treatment of associated fuels to address management and public concerns about the hazard trees associated with the SBB epidemic.

1. Road, Trail and Utility Corridor Hazard Trees
Map # 10 in Appendix F displays the location where road, trail and utility corridor hazard tree removal opportunities exist in SBB Susceptible Forest vegetation located within distance zones of 0-100 feet from
existing roads, trails and utilities on the Kenai Peninsula. Note: Because 100 foot zones will not display at the normal map scale being used, a representative area around Cooper Landing is displayed.

a. Road Corridor Hazard Trees
Figure A-24 displays the acreage of SBB susceptible poletimber and sawtimber spruce in 100 foot road corridors (100 feet on each side of roads) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Sixteen of 26 watershed associations have a total of 1,200 acres of SBB susceptible spruce in the 100 foot road corridor zone with 62 % of the acreage SBB infested. All sixteen associations are highlighted as potential road corridor hazard tree removal opportunities.

Figure A-24: Acres of Forest Vegetation Susceptible to SBB within 100 foot (200 total feet) Road Corridors by Watershed Association on the Kenai Peninsula, CNF

Watershed Association Name	Total Combined Forest Types w/Spruce Acres	Total Road Miles	Uninfested Size Class 2-4 Spruce 0-100 feet Roads Acres	Infested Size Class 2-4 Spruce 0-100 feet Roads Acres	Total Susceptible Size Class 2-4 Spruce 0-100 feet Roads Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet Roads
Quartz Creek	8,100	42.4	20	200	220	1
Resurrection Creek	13,290	33.3	80	80	160	2
East Fork Sixmile Creek	5,680	19.9	60	100	160	3
Sixmile Creek Lower	6,330	16.2	100	30	130	4
Canyon Creek	2,940	20.7	10	100	110	5
Juneau Creek	11,900	18.9	-	100	100	6
Russian River	5,040	7.2	-	70	70	7
Kenai Lake Southeast	9,650	7.3	20	20	40	8
Resurrection River	6,870	3.5	40	-	40	9
Trail River	8,520	25.8	10	20	30	10
Snow River	14,920	9.1	30	-	30	11
Kenai Lake North	2,660	1.5	30	-	30	12
Glacier Creek	1,650	9.3	30	-	30	13
Placer River	1,160	6.5	20	-	20	14
Cooper Creek	5,090	6.5	-	20	20	15
Portage Creek	200	12.0	10	-	10	16
Total Kenai Peninsula, CNF	**118,800**	**275**	**460**	**740**	**1,200**	
% of Total Acres			**38%**	**62%**	**100%**	

Source: Chugach National Forest GIS

b. Trail Corridor Hazard Trees

Figure A-25 displays the acreage of SBB Susceptible poletimber and sawtimber spruce in 100 foot trail corridors (100 feet on either side of trails) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB Susceptible spruce within the zone. Thirteen of 26 watershed associations have a total acreage of 1,680 acres of SBB Susceptible spruce in the 100 foot trail corridor zone with 70% of the acreage (1,170 acres) SBB infested. All thirteen associations are highlighted as potential trail corridor hazard tree removal opportunities.

Figure A-25: Acres of SBB Susceptible Forest Vegetation within 100 foot (200 feet total) trail corridors by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	SBB Un-infested Size Class 2-4 Spruce 0-100 feet Trails Acres	SBB Infested Size Class 2-4 Spruce 0-100 feet Trails Acres	Total SBB Susceptible Size Class 2-4 Spruce 0-100 feet Trails Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet
K02	Resurrection Creek	20	300	320	1
K15	Russian River	0	300	300	2
K18	Resurrection River	190	80	270	3
K09	Juneau Creek	40	100	140	4
K10	Quartz Creek	50	80	130	5
K17	Kenai Lake Southeast	80	50	130	6
K14	Cooper Creek	0	100	100	7
K07	East Fork Sixmile Creek	60	20	80	8
K11	Trail River	10	70	80	9
K12	Snow River	30	30	60	10
K08	Canyon Creek	0	40	40	11
K24	Glacier Creek	20	-	20	12
K19	Lost Lake/Salmon River	10	-	10	13
	Total Kenai Peninsula, CNF	**510**	**1,170**	**1,680**	
	% of Total	**30%**	**70%**	**100%**	

Source: Chugach National Forest GIS

c. Hazard Trees in stands adjacent to cleared Utility Corridors

Figure A-26 displays the acreage of SBB Susceptible Forest Vegetation in 100 foot zones that lie adjacent to cleared utility corridors (100 feet on either side of cleared utility corridors) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB infested spruce within the zone. Thirteen of 26 watershed associations have a total of 2,530 acres of SBB Susceptible forest vegetation in the 100 foot utility corridor zone with 57% of it SBB infested. All thirteen associations are highlighted as potential utility corridor hazard tree removal opportunities.

Figure A-26: Acres of SBB Susceptible Forest Vegetation within 100 foot zones (200 feet total) adjacent to cleared utility corridors by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Un-infested Size Class 2-4 Spruce 0-100 feet Utility Corridors Acres	SBB Infested Size Class 2-4 Spruce 0-100 feet Utility Corridors Acres	Total Susceptible Size Class 2-4 Spruce 0-100 feet Utility Corridors Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet Utility Corridors
K03	Sixmile Creek Lower	500	200	700	1
K10	Quartz Creek	100	400	500	2
K08	Canyon Creek	100	300	400	3
K07	East Fork Sixmile Creek	100	200	300	4
K09	Juneau Creek	90	60	150	5
K11	Trail River	100	50	150	6
K15	Russian River	50	100	150	7
K14	Cooper Creek	50	50	100	8
K12	Snow River	-	40	40	9
K16	Kenai Lake North	10	-	10	10
K17	Kenai Lake Southeast	-	10	10	11
K19	Lost Lake/Salmon River	-	10	10	12
K24	Glacier Creek	-	10	10	13
	Total Kenai Peninsula, CNF	**1,100**	**1,430**	**2,530**	
	% of Total Acres	**43%**	**57%**	**100%**	

Source: Chugach National Forest GIS

2. Campground Hazard Trees

Figure A-27 displays the acreage of SBB susceptible forest vegetation in a _ mile zone around Forest Service campgrounds by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within zone. Thirteen of 26 watershed associations have a total of 3,480 acres in SBB susceptible spruce in the _ mile zone around campgrounds with 77% SBB infested. All thirteen associations are highlighted as potential hazard tree removal opportunities around campgrounds. **Note: For the acreage of hazard tree removal in a 0-500 foot zone around campgrounds, 19% of the above acreage (659 acres) was calculated.**

Figure A-27: Acres of SBB Susceptible Forest Vegetation within _ mile of Forest Service Campgrounds by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Un-infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Total Susceptible Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Rank for Susceptible Size Class 2-4 Spruce 0-1/2 mile
K07	East Fork Sixmile Creek	300	600	900	1
K17	Kenai Lake Southeast	100	600	700	2
K15	Russian River	0	600	600	3
K09	Juneau Creek	0	400	400	4
K02	Resurrection Creek	200	20	220	5
K14	Cooper Creek	0	200	200	6
K16	Kenai Lake North	80	80	160	7
K10	Quartz Creek	20	90	110	8
K08	Canyon Creek	0	70	70	9
K11	Trail River	20	30	50	10
K06	Placer River	40	0	40	11
K05	Portage Creek	20	0	20	12
K12	Snow River	10	0	10	13
	Total Kenai Peninsula, CNF	790	2,690	3,480	
	% of Total Acres	**23%**	**77%**	**100%**	

Source: Chugach National Forest GIS

3. Recreation Cabins and Administrative Facility Hazard Trees

Map # 12 in Appendix F displays the location where hazard tree removal opportunities exist in Forest vegetation that is susceptible to SBB and located within distance zones of 0-500 feet from Forest Service recreation cabins on the Kenai Peninsula. There is a total of 19 Forest Service recreation cabins on the Kenai Peninsula. In addition, four administrative sites are located at Kenai Lake Work Center, Kenai Bend, Hope Guard Station, and temporary quarters adjacent to Ptarmigan Campground. Administrative sites are not currently mapped in the Forest GIS.

Figure A-28 displays the acreage of SBB susceptible forest vegetation in the 0-500 foot zone around recreation cabins by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Six of 26 associations have a total of 130 acres in SBB susceptible vegetation in the 0-500 foot zone around recreation cabins with 69% SBB infested. All six associations are highlighted as hazard tree removal opportunities. In addition, it is estimated that hazard tree removal within 500 feet of administrative sites would total an additional 10 acres.

Figure A-28: Acres of SBB Susceptible Forest Vegetation within 500 feet of Forest Service Recreation Cabins by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Uninfested Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Infested Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Total Susceptible Size Class 2-4 Spruce 0-500 feet FS Cabins Acres	Rank for Susceptible Size Class 2-4 Spruce 0-500 feet FS Cabins
K02	Resurrection Creek	-	40	40	1
K15	Russian River	-	30	30	2
K09	Juneau Creek	10	10	20	3
K12	Snow River	20	-	20	4
K18	Resurrection River	10	-	10	5
K26	Chickaloon River	-	10	10	6
	Total Kenai Peninsula, CNF	**40**	**90**	130	
	% of Total Acres	**31%**	**69%**	**100%**	

Source: Chugach National Forest GIS

Maintenance or Restoration of Stand Species Diversity, Cover, Structure and Function Treatment Opportunities

Areas where integrated vegetation and pest management opportunities exist to address management concerns include the following areas:

Riparian Vegetation

Loss of riparian vegetation to SBB mortality, particularly in stream riparian areas, is a management concern for several reasons. First, after tree death occurs, tree roots will eventually lose their soil holding capability which could result in stream bank destabilization. Second, SBB removal of significant portions of the forest can impact to some degree the dynamics of stream flow, timing of peak flow, etc. Third, if salmon spawning streams are bordered by large diameter spruce and these trees are subsequently killed by spruce beetles, there is a concern as to the future availability of large woody debris for input into the stream channel. Large woody debris in spawning streams is a necessary component for spawning habitat integrity (Cooper Landing Cooperative Project EA 1990). Many of district's anadromous streams have already lost mature spruce in the riparian zone. Russian River, Resurrection Creek, Johnson Creek, Quartz, Bean and Dave's Creek have all been impacted by SBB removal of riparian spruce. Loss of lake riparian spruce vegetation is usually more of a fuels and scenic quality concern.

1. Stream and Lake Riparian Vegetation

Map # 9 in Appendix F displays the location where integrated vegetation and pest management opportunities exist in Forest vegetation that is susceptible to SBB and located within distance zones of 0-100 feet from streams and lakes over 1 acre in size on the Kenai Peninsula. Note: Because 100 foot zones will not display at the normal map scale being used, a representative area around Cooper Landing is displayed.

a. Stream Riparian Vegetation

Figure A-29 displays the acreage of SBB susceptible forest vegetation in 100 foot stream riparian zones (100 feet on each side of streams) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Twenty-two of 26 watershed associations have 5,990 acres of SBB susceptible spruce in stream riparian zones with 60% SBB infested. All 22 associations are highlighted as potential integrated vegetation and pest management opportunities.

b. Lake Riparian Vegetation

Figure A-30 displays the acreage of SBB susceptible forest vegetation in 100 foot lake riparian zones (100 feet from lakeshores for lakes > 1 acre in size) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Sixteen of 26 watershed associations have SBB susceptible spruce in lake riparian zones and 62 % of the acreage is SBB infested. All sixteen associations are highlighted as potential integrated vegetation and pest management opportunities.

Figure A-29: Acres of SBB Susceptible Forest Vegetation within 100 Foot Stream Riparian Zones by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Uninfested Size Class 2-4 Spruce 0-100 feet Streams Acres	Infested Size Class 2-4 Spruce 0-100 feet Streams Acres	Total Susceptible Size Class 2-4 Spruce 0-100 feet Streams Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet
K02	Resurrection Creek	200	800	1,000	1
K17	Kenai Lake Southeast	200	300	500	2
K12	Snow River	400	90	490	3
K09	Juneau Creek	40	400	440	4
K10	Quartz Creek	20	400	420	5
K25	Twentymile River	400	10	410	6
K07	East Fork Sixmile Creek	200	200	400	7
K11	Trail River	200	200	400	8
K15	Russian River	-	300	300	9
K03	Sixmile Creek Lower	70	200	270	10
K18	Resurrection River	200	70	270	11
K08	Canyon Creek	50	200	250	12
K14	Cooper Creek	30	200	230	13
K26	Chickaloon River	60	100	160	14
K04	Seattle & Ingram Creeks	100	-	100	15
K16	Kenai Lake North	-	100	100	16
K19	Lost Lake/Salmon River	90	-	90	17
K06	Placer River	80	-	80	18
K24	Glacier Creek	30	10	40	19
K05	Portage Creek	20	-	20	20
K13	Kenai Lake Southwest	-	10	10	21
K20	Cape Resurrection	10	-	10	22
K01	Turnagain Arm	-	-	-	
K21	Eagle River	-	-	-	
K22	Lake George	-	-	-	
K23	Bird Creek	-	-	-	
	Total Kenai Peninsula, CNF	**2,400**	**3,590**	**5,990**	
	% of Total Acres	**40%**	**60%**	**100%**	

Source: Chugach National Forest GIS

Figure A-30: Acres of SBB Susceptible Forest Vegetation within 100 Foot Lake Riparian Zones by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Uninfested Size Class 2-4 Spruce 0-100 feet Lakes > 1 Acre Acres	Infested Size Class 2-4 Spruce 0-100 feet Lakes > 1 Acre Acres	Total Susceptible Size Class 2-4 Spruce 0-100 feet Lakes > 1 Acre Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet Lakes > 1 Acre
K12	Snow River	200	10	210	1
K17	Kenai Lake Southeast	80	90	170	2
K16	Kenai Lake North	40	100	140	3
K11	Trail River	80	40	120	4
K10	Quartz Creek	40	40	80	5
K14	Cooper Creek	10	40	50	6
K09	Juneau Creek	20	20	40	7
K13	Kenai Lake Southwest	-	40	40	8
K15	Russian River	-	40	40	9
K26	Chickaloon River	10	20	30	10
K25	Twentymile River	20	-	20	11
K06	Placer River	10	-	10	12
K07	East Fork Sixmile Creek	-	10	10	13
K08	Canyon Creek	-	10	10	14
K18	Resurrection River	-	10	10	15
K19	Lost Lake/Salmon River	10	-	10	16
K24	Glacier Creek	10	-	10	17
	Total Kenai Peninsula, CNF	**530**	**470**	**1,000**	
	% of Total Acres	**53%**	**47%**	**100%**	

Source: Chugach National Forest GIS

Road Corridor Vegetation

Map # 10 in Appendix F displays the location where road corridor potential integrated vegetation and pest management opportunities exist in that is SBB susceptible forest vegetation located within distance zones of 0-100 feet from existing roads on the Kenai Peninsula. Note: Because 100 foot zones will not display at the normal map scale being used, a representative area around Cooper Landing is displayed.

Figure A-31 displays the acreage of SBB forest vegetation in 100 foot road corridors (100 feet on each side of roads) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Sixteen of 26 watershed associations have a total of 1,200 acres of SBB susceptible spruce in the 100 foot road corridor zone with 62% SBB infested. All sixteen associations are highlighted as potential integrated vegetation and pest management opportunities.

Figure A-31: Acres of SBB Susceptible Forest Vegetation within 100 foot (200 total feet) Road Corridors by Watershed Association on the Kenai Peninsula, CNF

Watershed Association Name	Total Road Miles	Uninfested Size Class 2-4 Spruce 0-100 feet Roads Acres	Infested Size Class 2-4 Spruce 0-100 feet Roads Acres	Total Susceptible Size Class 2-4 Spruce 0-100 feet Roads Acres	Rank for Susceptible Size Class 2-4 Spruce 0-100 feet Roads
Quartz Creek	42.4	20	200	220	1
Resurrection Creek	33.3	80	80	160	2
East Fork Sixmile Creek	19.9	60	100	160	3
Sixmile Creek Lower	16.2	100	30	130	4
Canyon Creek	20.7	10	100	110	5
Juneau Creek	18.9	-	100	100	6
Russian River	7.2	-	70	70	7
Kenai Lake Southeast	7.3	20	20	40	8
Resurrection River	3.5	40	-	40	9
Trail River	25.8	10	20	30	10
Snow River	9.1	30	-	30	11
Kenai Lake North	1.5	30	-	30	12
Glacier Creek	9.3	30	-	30	13
Placer River	6.5	20	-	20	14
Cooper Creek	6.5	-	20	20	15
Portage Creek	12.0	10	-	10	16
Total Kenai Peninsula, CNF	**275**	**460**	**740**	**1,200**	
% of Total Acres		**38%**	**62%**	**100%**	

Source: Chugach National Forest GIS

Figure A-32 displays the acreage of SBB susceptible forest vegetation in 0-1/2 and _-1 mile distance zones in the Seward National Scenic Byway by watershed association. There are a total of 19,600 acres of SBB susceptible spruce in the 1mile road corridor zone with 54% of the susceptible acreage SBB infested. The entire acreage is considered for potential integrated vegetation and pest management opportunities.

Figure A-32: Acres of SBB Susceptible Forest Vegetation in 0-1/2 mile and _-1 mile distance zones in the Seward National Scenic Byway by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	SBB Un-infested Size Class 2-4 Spruce 0-1/2 Mile Scenic Byway Acres	SBB Un-infested Size Class 2-4 Spruce 1/2-1 Mile Scenic Byway Acres	Total SBB Un-infested Size Class 2-4 Spruce 0-1 Mile Scenic Byway Acres	SBB Infested Size Class 2-4 Spruce 0-1/2 Mile Scenic Byway Acres	SBB Infested Size Class 2-4 Spruce 1/2-1 Mile Scenic Byway Acres	Total SBB Infested Size Class 2-4 Spruce 0-1 Mile Scenic Byway Acres	Total SBB Susceptible Size Class 2-4 Spruce 0-1 Mile Scenic Byway Acres	Rank for Susceptible Size Class 2-4 Spruce 0-1 Mile Scenic Byway
K07	East Fork Sixmile	710	240	950	2,000	610	2,610	3,560	1
K10	Quartz Creek	100	80	180	2,000	710	2,710	2,890	2
K12	Snow River	400	1320	1,720	400	710	1,110	2,830	3
K08	Canyon Creek	200	110	310	1,900	510	2,410	2,720	4
K04	Seattle & Ingram	710	1200	1,910	10	110	120	2,030	5
K19	Lost Lake/Salm	500	440	940	100	110	210	1,150	6
K17	Kenai Lake	500	450	950	80	110	190	1,140	7
K24	Glacier Creek	710	130	840	100	110	210	1,050	8
K11	Trail River	40	20	60	610	110	720	780	9
K25	Twentymil	200	330	530		40	40	570	10
K06	Placer River	200	220	420			-	420	11
K03	Sixmile Creek	0	30	30		210	210	240	12
K16	Kenai Lake North	50	30	80		60	60	140	13
K05	Portage Creek	80	0	80				80	14
	Total Kenai	**4,400**	**4,600**	**9,000**	**7,200**	**3,400**	**10,600**	**19,600**	

Trail Corridor Vegetation

Figure A-33 displays the acreage of SBB Susceptible poletimber and sawtimber spruce in 100 foot trail corridors (100 feet on either side of trails) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB infested spruce within the zone. Thirteen of 26 watershed associations contain trail corridors. Eleven of 26 watershed associations have SBB infested spruce in the 100 foot trail corridor zone. A total of 1,170 acres is SBB infested. All eleven associations are highlighted as potential integrated vegetation and pest management opportunities.

0ls2ls

Figure A-33: Acres of SBB Susceptible Forest Vegetation within 100 foot (200 feet total) trail corridors by Watershed Association on the Kenai Peninsula, CNF

Rank for
Susceptible
Size Class 2-4
Spruce
0-100 feet
Trails

1

Spruce
0-100 feet

Size Class 2-4
Spruce
0-100 feet

Size Class 2-4
Spruce
0-100 feet

Figure A-34: Acres of SBB Susceptible Forest Vegetation within _ mile of Forest Service Campgrounds by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Un-infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Infested Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Total Susceptible Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds Acres	Rank for Susceptible Size Class 2-4 Spruce 0-1/2 mile of FS Cmpgrds
K07	East Fork Sixmile Creek	300	600	900	1
K17	Kenai Lake Southeast	100	600	700	2
K15	Russian River	0	600	600	3
K09	Juneau Creek	0	400	400	4
K02	Resurrection Creek	200	20	220	5
K14	Cooper Creek	0	200	200	6
K16	Kenai Lake North	80	80	160	7
K10	Quartz Creek	20	90	110	8
K08	Canyon Creek	0	70	70	9
K11	Trail River	20	30	50	10
K06	Placer River	40	0	40	11
K05	Portage Creek	20	0	20	12
K12	Snow River	10	0	10	13
	Total Kenai Peninsula, CNF	790	2,690	3,480	
	% of Total Acres	**23%**	**77%**	**100%**	

Source: Chugach National Forest GIS

Recreation Cabin and Administrative Facility Vegetation

Map # 12 in Appendix F displays the location where hazard tree removal opportunities exist in Forest vegetation that is susceptible to SBB and located within distance zones of 0-500 feet from Forest Service recreation cabins on the Kenai Peninsula.

Figure A-35 displays the acreage of SBB susceptible poletimber and sawtimber spruce in the 0-500 foot zone around recreation cabins by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within zone. Six of 26 associations have susceptible acreage in the 0-500 foot zone around recreation cabins and 68 % of the susceptible spruce is SBB infested. All six associations are highlighted as potential integrated vegetation and pest management opportunities.

Figure A-35: Acres of SBB Susceptible Forest Vegetation within 500 feet of Forest Service

790

Personal Use and Commercial Forest Products Opportunities
Map # 14 in Appendix F displays the location where personal use and commercial forest product opportunities exist in SBB susceptible forest vegetation located within distance zones of 0-100 feet, 100 feet to _ mile, and greater than _ mile from existing roads on the Kenai Peninsula.

1. Personal Use Forest Product Opportunities
Under the Alaska Free Use CFR 223.10, Alaska residents are each entitled to 10,000 board feet of green sawtimber and 25 cords of firewood for personal use free of charge. Permits are not required to cut dead and down trees under the CFR. Personal use forest products permits for saw logs, house logs, firewood, Christmas trees, etc. are generally limited to road accessible areas that people can get to, such as commercial timber sale areas after sale closure, fuel break or fuel reduction areas, or timber stand improvement areas. Most personal use forest products permits are issued to people living in the communities of Seward, Moose Pass, Hope, Cooper Landing, and Girdwood. Naturally, they don't want to travel any farther than they have to obtain their personal use wood. However, with annual personal use demand ranging between 0.3 – 0.6 million board feet per year and low road densities on the Kenai Peninsula, road accessible personal use opportunities are limited, particularly close to the above communities.

Figure A-36 displays the acreage of SBB susceptible forest vegetation in 100 foot road corridors (100 feet on each side of roads) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Sixteen of 26 watershed associations have a total of 1,200 acres of SBB susceptible spruce in the 100 foot road corridor zone with 62% SBB infested. All sixteen associations are highlighted as potential personal use forest product opportunities. Personal use permits in this zone could be used as a management tool to simultaneous meet fuel reduction, hazard tree removal, integrated vegetation and pest management, or wildlife habitat objectives at reduced cost.

Figure A-36: Acres of SBB Susceptible Forest Vegetation within 100 feet of Existing Roads by Watershed Association on the Kenai Peninsula, CNF

WA ID No.	Watershed Association Name	Total Road Miles	Uninfested Size Class 5-4 Spruce 0-100 feet Roads Acres	Infested Size Class 5-4 Spruce 0-100 feet Roads Acres	Total Susceptible Size Class 5-4 Spruce 0-100 feet Roads Acres	Rank for Susceptible Size Class 5-4 Spruce 0-100 feet Roads
K10	Gurney Creek	4.4	50	200	250	1
K02	Resurrection Creek	22.2	80	80	160	2
K01	East Fork Sixmile Creek	14.4	60	100	160	3
K03	Sixmile Creek Lower	18.5	100	30	130	4
K08	Canyon Creek	20.7	10	100	110	5
K06	Juneau Creek	18.4		100	100	6
K12	Kenai River	7.5		10	10	7
K11	Kenai Lake Southeast	7.3	50	50	40	8
K18	Resurrection River	3.2	40	-	40	9
K14	Trail River	52.8	10	50	30	10
K15	Snow River	9.1	30	-	30	11
K16	Kenai Lake North	1.2	30		30	12
K24	Glacier Creek	4.2	30		30	13
K05	Fivemile River	8.3	50	-	20	14
K14	Cooper Creek	6.2	-	20	20	15
K04	Porcupine Creek	15.0	10	-	10	16
	Total Kenai Peninsula, CNF	**2,13**	**480**	**1,140**	**1,500**	
	% of Total Acres		**38%**	**62%**	**100%**	

Source: Chugach National Forest GIS

2. Commercial Use Forest Product Opportunities
Figure A-37 displays the acreage of SBB susceptible forest vegetation in 100 foot to _ mile road corridors (on each side of roads) by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within the zone. Twenty of 26 watershed associations have a total of 24,250 acres of SBB susceptible spruce in the zone with 69% SBB infested. All twenty associations are highlighted as potential commercial forest product opportunities. Commercial timber sales in this zone could be used as a management tool to simultaneously meet fuel reduction, hazard tree removal, integrated vegetation and pest management opportunities, or wildlife habitat objectives at reduced cost and increase opportunities for personal use forest products.

With the interim road policy, it is unlikely new road construction would access any commercial forest product opportunities beyond the _ mile zone from existing roads.

Figure A-37: Acres of SBB Susceptible Forest Vegetation within 100 feet to _ mile of Existing Roads by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Total Road Miles	Uninfested Size Class 2-4 Spruce 100ft-1/2 mile Roads Acres	Infested Size Class 2-4 Spruce 100ft-1/2 mile Roads Acres	Total Susceptible Size Class 2-4 Spruce 100ft-1/2 mile Roads Acres	Rank for Susceptible Size Class 2-4 Spruce 100ft-1/2 mile Roads
K10	Quartz Creek	42.4	180	3,700	3,880	1
K07	East Fork Sixmile Creek	19.9	840	2,200	3,040	2
K03	Sixmile Creek Lower	16.2	900	1,970	2,870	3
K02	Resurrection Creek	33.3	720	2,020	2,740	4
K08	Canyon Creek	20.7	190	1,900	2,090	5
K09	Juneau Creek	18.9	50	2,000	2,050	6
K12	Snow River	9.1	470	500	970	7
K24	Glacier Creek	9.3	870	100	970	8
K11	Trail River	25.8	60	780	840	9
K17	Kenai Lake Southeast	7.3	580	180	760	10
K15	Russian River	7.2	-	730	730	11
K04	Seattle & Ingram Creeks	7.6	700	10	710	12
K18	Resurrection River	3.5	660	-	660	13
K19	Lost Lake/Salmon River	7.9	500	100	600	14
K06	Placer River	6.5	480	20	500	15
K14	Cooper Creek	6.5	-	380	380	16
K25	Twentymile River	2.3	200	-	200	17
K13	Kenai Lake Southwest	16.0	-	100	100	18
K05	Portage Creek	12.0	90	-	90	19
K16	Kenai Lake North	1.5	30	40	70	20
	Total Kenai Peninsula, CNF	**275**	**7,520**	**16,730**	**24,250**	
	% of Total Acres		**31%**	**69%**	**100%**	

Source: Chugach National Forest GIS

WILDLIFE HABITAT MANAGEMENT

Hardwood stands on the Kenai Peninsula are seral and are replaced by spruce and hemlock over time if not set back by natural disturbances. Historically, natural and human-caused fires have interrupted normal plant succession, thereby creating more hardwoods. With more efficient fire control, hardwood stands have matured and have become increasingly been converted to conifer.

The changes in vegetation as the result of the spruce bark beetle have significant direct and indirect impacts on many wildlife species. Shifts in acreage from mature spruce to early seral stages, and on many sites blue-joint reedgrass, will directly effect carrying capacity for many species. Moose populations, for example, are very closely tied to browse availability.

Areas of Management Concern

Long-term Stand Conversion
While fire managers are concerned about blue-joint reedgrass from a fuels perspective, wildlife biologists are concerned about it's effects on carrying capacity for wildlife species like moose and indirectly, their predators, like brown bears, which are already a species of concern on the Kenai Peninsula.

The best regeneration of spruce and paper birch occurs on a seedbed of bare mineral soil with some organic material. Site disturbances such as fire, windthrow, flooding, or ground scarification; provide excellent sites for germination and establishment of seedlings if there is an adequate seed source.

Normally, SBB-killed spruce stands would be considered early successional. However, on some sites in south-central Alaska, blue-joint reedgrass and other competing vegetation quickly invade the sites where SBB have "opened up" the canopy. This delays re-establishment of preferred tree and shrub browse species, thereby reducing vegetative diversity.

The duration of this delay is unclear. Limited research in SBB killed spruce stands in Resurrection Creek south of Hope indicate that if browse species were not present in spruce stands prior to being killed by SBB, they are not likely to seed in once blue-joint reedgrass captures the site (B.Schultz personal communication). This suppression is likely to last at least 20 years and possibly longer.

The relative abundance of browse is dependent on the type, intensity, and timing of recent disturbances.

Moose Habitat Decline
The current moose winter range condition is in a state of decline due to natural plant succession in old wildfire areas, lack of new range and human development in the existing range. Although this is part of the natural cycle, a declining moose population has negative affects on the predator complex, sport hunting opportunities, and wildlife viewing.

Moose winter range is generally considered to be the limiting factor in controlling numbers. Moose winter in the narrow low elevation valleys of the forest, and on higher south-facing slopes where browse is present. Snow depth, as dictated by the elevation, slope, and aspect determines the amount of browse available.

As a general rule, land below 1,500' elevation is considered winter range and those lands with hardwood seedling or sapling stages are primary winter range. Primary winter range has the potential to carry up to 7 moose/square mile. Winter range without young hardwoods can support up to 2 moose/square mile (Spraker ADF&G personal communication).

Hardwoods are useful as browse until they exceed 2" d.b.h., at which time they become too large for moose to feed on directly or break over and then feed. This roughly equates to the seedling/sapling stages. For most hardwoods, the stands grow into pole class within 15 years.

The lack of seedling/sapling and pole sized hardwoods therefore has a significant impact on numbers of moose that the land can support. The quality of winter range also affects production and survival of calves. Calves are the segment of the population most susceptible to winter loss. In addition, cows debilitated by poor nutrition in winter may give birth to weakened calves; these calves are highly vulnerable to predators and other mortality factors (Weixelman 1987).

As SBB infested stands begin to unravel, with large amounts of downfall, availability of any browse is projected to decrease for up to 25 years and then slightly increase, as browse species become more dominant. Vegetation management in these stands can make significant improvements for moose and other early seral species.

If we are going to maintain moose habitat on the Kenai Peninsula, an estimated 1,000 acres per year of late successional vegetation needs to be converted to early successional vegetation. This can be a combination of natural changes and habitat treatment. Treatments should be located within winter range and combined with other resource objectives where possible to minimize costs and maximize benefits. Other factors to consider in site selection include:

a) Proximity to subsistence communities of Hope and Cooper Landing,
b) Efficiency of treating unit size (the larger the unit, the lower the unit cost),
c) Access to the unit (generally unit costs are higher for more remote sites than for accessible sites),
d) Compatibility with other resources (i.e., heritage values, etc.), and
e) Practicality of treating the unit.

Maintenance of High Quality Dall Sheep and Mountain Goat Habitat
Sheep and mountain goats use timberline spruce and hemlock stands during certain periods of the year. While SBB have a minor impact on some of this habitat, maintenance of high quality browse species (forbs and mosses) for sheep and goats above timberline is a concern.

On the Kenai Peninsula, the Forest prescribe burns high elevation forbs and mosses above timberline to put nutrients back in the soil and invigorate sheep and goat browse. This fuel type and location are low risk for both wildland fires and prescribed fire escape.

Impacts to Bird Nesting Habitat
Northern Goshawk, Marbled Murrelet, and Bald Eagles have also been impacted by the SBB epidemic.

Nest sites of Northern Goshawk have been lost as trees have been killed by SBB. Stands which would have become potential nest sites are also being lost to SBB before they reach acceptable diameter, size and stocking levels needed by these birds. Most of the known nest sites have mature spruce in the stands. Their loss to SBB changes stand basal area, making the stands undesirable. Goshawks require a basal area ranging from 60-140 depending on species present (Shuster 1980, Reynolds et al. 1982).

Marbled Murrelet have lost potential nest trees, as mature spruce trees are generally the first to be attacked bark beetles. While coastal spruce remain unaffected by the bark beetle on the forest so far, this condition could change at any time. However, inland spruce is being significantly affected. Marbled Murrelets have been found up to 34 miles inland, near Trail Lake Fish Hatchery (Jones USFWS personal communication). The Snow River and Resurrection River stands with a spruce component are known to be used by Marbled Murrelets (Bryden 1996). Predawn surveys show high use in these watersheds, though no known nests have been found.

Marbled Murrelet and Bald Eagles have the potential of losing nest trees if the epidemic reaches the coastal stands of spruce. (Inland, the eagles use cottonwoods for nest trees almost exclusively).

Impacts on Brown Bear Travel Corridors
Brown bears are a species of concern on the Kenai Peninsula. Loss of forest vegetation in brown bear travel corridors is a management concern. Brown Bears are known to frequent certain travel corridors as they travel between core habitat areas (Jacobs, 1989). Loss of hiding cover in these travel corridors may diminish habitat quality if occurring near road corridors or or high human use areas. The State's Kenai Peninsula Land Use Plan (in Draft) recognizes this potential for impact and recommends a 1500 foot buffer along anadromous streams.

An interagency team is currently developing a brown bear conservation strategy for the Kenai Peninsula. In addition, for the Forest's plan revision, a brown bear assessment is being developed. We expect the assessment to provide more habitat information than is currently available and management direction for the conservation strategy.

Impacts to Wildlife Populations Dependent on Spruce Plant Communities
Wildlife populations, which depend on live, mature spruce stands for habitat requirements may decline.
There is a concern that wildlife population, which depend on live, mature spruce stands for their habitat requirements may decline. Decreases in Red Squirrel, Spruce Grouse, Townsend's Warblers and possibly Marbled Murrelet populations are to be expected. In a recent study on the forest, Lance and Howell (in review) found decreases in Townsend's Warbler, Ruby-crowned Kinglets where the mature spruce canopy was lost, while Swainson's Thrush, Dark-eyed Junco, Yellow-rumped Warbler increased.

Wildlife Habitat Improvement Management Tools

Use of Prescribed Fire for Improving Moose Habitat
Burning in the Kenai Mountains was originally implemented to improve moose winter range by increasing hardwood regeneration and basal sprouting. Moose, along with snowshoe hares and several species of sparrow, are early seral species. Many if not all of their life history requirements are tied to recently disturbed sites such as burns. Without frequent fire, the population is restricted to riparian shrubfields. Early seral stage conditions also benefit other a variety of other wildlife species. The program has been moderately successful in meeting browse regeneration objectives for those acres treated though browse production at the landscape level has continued to deteriorate.

From 1977 to 1987, 8,150 acres were burned on National Forest lands on the Kenai Peninsula for wildlife purposes. With adequate funding available, qualified burning personnel from the lower 48 were brought in to conduct the burns during those years when conditions were best for continuous large scale burning operations.

Since that time, large scale burning has become less frequent on the forest. Average treatment (including prescribed fire) has been around 600 acres per year. Funding for burning for wildlife and silviculture projects have been insufficient to meet the costs of burning operations. As a result, other less expensive habitat improvement treatments have been tried such as mechanical treatments where dozer drawn rollers were used to crush down and break up old spruce stands and herbicides. Post treatment monitoring indicated the results were not commensurate with the cost.

As more is learned about the boreal ecosystem, it becomes clear that many mid- and late seral species of wildlife benefit from seral stage vegetative conditions created by fire. As burned areas progress into mid-successional stages, they provide nesting habitat for a variety of birds and an abundant supply of highbush and lowbush cranberry, wild rose and devil's club. Even old growth species such as the northern goshawk need a mix of tree species and age classes within their territory for feeding habitat.

The Forest will continue to use prescribed fire as a wildlife enhancement tool by burning mixed spruce-hardwood and hardwood stands and brush to stimulate hardwood growth for winter range moose browse. The following five criteria are used in selecting wildlife prescribed burn sites:

1. Presence of a plant community which will give rise to hardwood regeneration,
2. High fuel load caused by SBB,
3. Remote location
4. Area larger than 100 acres
5. Topographic features which will contain the prescribed fire.

Burns which stimulate moose browse are conducted away from the highway systems (> _ mile) whenever possible. This attracts moose away from the highways, resulting in reduced moose kill by vehicles. This is an important safety issue, and another excellent reason for conducting these habitat improvement projects. An average of 271 vehicle/moose collisions occurs annually on the Kenai Peninsula (L.Lewis, AK F&G personnel communication). With average moose/vehicle collision repair costs exceeding $5,000 per collision (D. Weeks, Northern Adjusters personal communication), not to mention personal injury and occasional death to vehicle occupants, there are compelling economic and safety reasons to attempt to draw moose away from highway corridors wherever possible. Habitat improvement projects have that potential. (Note: Annual vehicle repair costs due to collisions with moose on the Kenai Peninsula are estimated to be $1,355,000.)

Prescribed burning remains the main management tool for moose habitat improvement for the following reasons:

- large acreage can be treated at one time
- low treatment cost per acre compared to other treatment methods
- not dependent on existing road access which limits other treatment methods
- benefits many additional wildlife species besides moose
- can simultaneously meet other resource objectives for fuels hazard reduction or site preparation for reforestation
- does not require new access development

When prescribed fire is integrated with other management objectives like fuels hazard reduction in SBB killed spruce stands or site preparation for reforestation on timber sale units, prescribed fire is even more cost-effective.

Use of Silvicultural Practices

Generally, silvicultural practices are used for smaller scale habitat improvements at the stand level where road access exists. Treatments that have been used or are planned for use include:

- Seeding of birch on newly disturbed sites where mature birch is not present. Birch seed has been annually collected in the fall and stored for dispersal in the following year. This seed is used in case of wildfire or planned vegetation treatment. Birch seed viability decreases rapidly after one year, so collection each year is necessary. This "insurance" assures us the ability to seed unplanned disturbed sites.

- Cutting and planting hardwoods has been a successful method for improving browse. While generally cost prohibitive, combining this treatment with other resource objectives can reduce the treatment costs to an acceptable level. An example is cutting mature aspen at the end of a commercial timber sale. (Aspen are cut at the end of treatment to reduce damage to the sprouts, which would come up immediately after cutting).

- Stand thinning and pruning to create and maintain stand densities Northern Goshawk, Bald Eagle, and Marbled Murrelet prefer for nesting sites.

- Restoration of SBB killed stands to replace lost nesting trees and stands for Northern Goshawk, Bald Eagle, and Marbled Murrelet.

A classic demonstration of integrating stand-level vegetation management objectives for fuels reduction and reforestation with wildlife habitat and other objectives can be observed in the Cooper Landing Cooperative Project area along the West Juneau Road. Implementation of the silvicultural

prescription resulted in simultaneously meeting objectives for road and trail corridor fuel reduction; wildlife habitat improvement, personal use forest products and reforestation in one treatment of a SBB killed mixed spruce-birch-aspen stand. As a bonus, Anchorage and Soldotna volunteers planted spruce underneath a residual birch overstory and Eagle Scout volunteers moved dead spruce fuels from the trail corridor to a personal use firewood landing for the public and planted willow along the creek for wildlife. The stand was fully restored back to a mixed spruce-aspen-birch stand. Two winters later, 15 moose were wintering in this stand, feeding on the down aspen and the newly regenerated seedlings which by then had grown to 5 feet in height.

Moose Habitat Improvement Opportunities
The Forest Plan (III-5) describes a desired future condition where habitat improvement will reverse the declining trend on the moose winter range on the Kenai Peninsula. In addition, management prescriptions for the Kenai Peninsula call for 1065 acres/year to be improved through burning, girdling, and timber harvest, (III-43). Budget levels however, have not allowed us to consistently reach that level.

Although an average of 600 acres per year have been treated for habitat improvement, this level of treatment is insufficient to maintain the loss of young hardwood stands through natural plant succession.

Map # 15 in Appendix F displays the location where moose habitat improvement opportunities exist in Forest vegetation that is susceptible to SBB and that is located > _ mile from the highway system on the Kenai Peninsula.

Figure A-38 displays the acreage of SBB susceptible poletimber and sawtimber spruce in zones more than _ from the existing highway system by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within zone. Six of 26 associations have susceptible acreage in the 0-500 foot zone around recreation cabins and 68 % of the susceptible spruce is SBB infested. All six associations are highlighted as potential moose habitat improvement opportunities.

Moose Habitat Improvement Opportunities around Subsistence Communities
Figure A-39 displays the acreage of SBB susceptible poletimber and sawtimber spruce in zones more than _ from the existing highway system but within a distance of 5 miles of the subsistence communities of Cooper Landing Hope by watershed association. The watershed associations are ranked in order of decreasing acreage of SBB susceptible spruce within zone. Six of 26 associations have susceptible acreage in the 0-500 foot zone around recreation cabins and 68 % of the susceptible spruce is SBB infested. Potential moose habitat improvement opportunities for subsistence communities are highlighted.

Figure A-38: Acres of SBB Susceptible Forest Vegetation > _ mile from the Highway system by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Opportunity to Improve Moose Habatit Un-infested Size Class 2-4 Spr/Spr-Hrdwd >1/4 mile from Hwys Acres	Opportunity to Improve Moose Habatit Infested Size Class 2-4 Spr/Spr-Hrdwd >1/4 mile from Hwys Acres	Total Opport. to Improve Moose Habatit SBB Susceptible Size Class 2-4 Spr/Spr-Hrdwd >1/4 mile Hwys Acres	Rank to Improve Moose Habatit SBB Susceptible Size Class 2-4 Spr/Spr-Hrdwd >1/4 mile Hwys
K02	Resurrection Creek	1,000	6,220	7,220	1
K09	Juneau Creek	1,700	4,600	6,300	2
K12	Snow River	3,600	900	4,500	3
K11	Trail River	1,500	2,300	3,800	4
K15	Russian River	50	3,100	3,150	5
K10	Quartz Creek	430	2,700	3,130	6
K25	Twentymile River	2,800	330	3,130	7
K17	Kenai Lake Southeast	1,100	2,000	3,100	8
K18	Resurrection River	1,300	950	2,250	9
K07	East Fork Sixmile Creek	800	700	1,500	10
K14	Cooper Creek	90	1,400	1,490	11
K16	Kenai Lake North	80	1,000	1,080	12
K04	Seattle & Ingram Creeks	700	300	1,000	13
K06	Placer River	700	20	720	14
K26	Chickaloon River	40	520	560	15
K19	Lost Lake/Salmon River	500	30	530	16
K03	Sixmile Creek Lower	100	310	410	17
K24	Glacier Creek	330	70	400	18
K08	Canyon Creek	20	170	190	19
K13	Kenai Lake Southwest	10	160	170	20
K20	Cape Resurrection	60		60	21
K05	Portage Creek	40		40	22
K01	Turnagain Arm	-			
K21	Eagle River	-			
K22	Lake George	-			
K23	Bird Creek	-			
	Total Kenai Peninsula, CNF	**15,950**	**27,790**	**44,740**	
	% of Total Acres	**36%**	**62%**	**100%**	

Source: Chugach National Forest GIS

Figure A-39: Acres of Forest Vegetation > _ mile from the Highway system and within 5 miles of the Subsistence Communities of Cooper Landing and Hope by Watershed Association on the Kenai Peninsula, CNF

WA ID NO.	Watershed Association Name	Uninfested Size Class 2-4 Spr,Mxd spr-Hrd Brush-grass >1/4 mile from Hwy and < 5 mile Cper Lndg and Hope Acres	Infested Size Class 2-4 Spr,Mxd spr-Hrd Brush-grass >1/4 mile from Hwy and < 5 mile Cper Lndg and Hope Acres	Total Size Class 2-4 Spr,Mxd spr-Hrd Brush-grass >1/4 mile from Hwy and < 5 mile Cper Lndg and Hope Acres	Rank for Size Class 2-4 Spr,Mxd spr-Hrd Brush-grass >1/4 mile from Hwy and < 5 mile Cper Lndg and Hope
K02	Resurrection Creek	10,350	1,600	11,950	1
K09	Juneau Creek	9,110	2,600	11,710	2
K14	Cooper Creek	5,720	730	6,450	3
K15	Russian River	3,470	500	3,970	4
K13	Kenai Lake Southwest	2,900	30	2,930	5
K03	Sixmile Creek Lower	840	-	840	6
K26	Chickaloon River	710	-	710	7
K10	Quartz Creek	470	20	490	8
	Total Kenai Peninsula, CNF	**33,570**	**5,480**	**39,050**	

Source: Chugach National Forest GIS

Sheep and Mountain Goat Habitat Improvement Opportunities
Sheep and goat habitat improvement opportunities are estimated to be 625 acres. This would be accomplished through the use of prescribed fire.

Bird Nesting Habitat Improvement Opportunities
Current projects in the five-year action plan for nesting habitat improvement total 300 acres for Northern Goshawk, 50 acres for Bald Eagle, and 10 acres for Marbled Murrelet. (See 5-year action schedule for detail on locations.) Emphasis will be on maintaining current habitat within watersheds of known use.

Brown Bear Travel Corridors
We expect this data to be available when the brown bear assessment for the Kenai Peninsula is completed. For planning purposes, we propose a rough estimate of 300 acres that could be potentially treated by prescribed fire and/or planting in locations to be determined after the brown bear assessment is completed.

Other Wildlife Species Dependent on Spruce and/or Aspen Plant Communities
Restoration of SBB killed stands will provide long-term habitat for these species. We estimate that 50 acres could be treated by prescribed fire followed by planting spruce. An additional 80 acres per year of aspen would be treated for aspen dependent species.

APPENDIX B

FIVE YEAR ACTION SCHEDULE DETAIL

Chugach National Forest

Five-Year Action Schedule Detail - Spreadsheet Column Name Descriptions

Column #	**Column Name**	**Column Description**
1	PROJECT TYPE	Code for type of project. HZTRE = hazard tree removal, PB=prescribed burn, REF=reforestation, etc.
2	STRATEGY	Strategy Code. Refer to figures 4, 5, and 6.
3	PROJECT NAME	Name of Project
4	PROJECT PURPOSE	Project purpose statement
5	FUND	Fund code that will be used to fund the project
6	PREP-YR	Fiscal year in which preparation work for project will take place if appropriate.
7	TRMT-YR	Fiscal year in which project is scheduled for treatment.
8	PREP-AC	Acres to be preped in prep-yr
9	TRMT-AC	Acres to be treated in trmt-yr
10	PREP-COST	Estimated Total Dollar cost to accomplish prep acres in prep-yr.
11	TRMT-COST	Estimated Total Dollar cost to accomplish trmt acres in trmt-yr.
12	CADM-COST	Estimated total Dollar cost to accomplish trmt acres in trmt-yr by contracting including contract admin.
13	NEPA-COST	Estimated total Dollar cost of NEPA work for the project.
14	HER-COST	Estimated total Dollar cost of Heritage Support work for the project.
15	BE-COST	Estimated total Dollar cost for preparing a Biological Evaluation for the project.
16	BP-COST	Estimated total Dollar cost for preparing a burn plan for prescribed fire projects.
17	REF-COST	Estimated total Dollar cost for reforestation of trmt-ac.
18	TOT-COST	Estimated total Dollar cost of all costs for the project.
19	MBF	Estimated MBF (thousands of board feet) of timber to be offered for sale.

Five-Year Action Schedule Detail - FY 2000

PROJECT TYI	STRATEGY	PROJECT NAME	PROJECT PUPOSE	FUND	PREP-YR	TRMT-YR	PREP-AC	TRMT-AC	PREP-COST	TRMT-COST	CADM-COST	NEPA-COST	HER-COST	BE-COST	BP-COST	REF-COST	TOT-COST	MBF
HZTREE	3-1-A	Road Corridor Hazard Tree Removal	Road Corridor Hazard Tree Removal	NFER	2000	2000	0	240	$ -	$ 75,898	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,898	0
HZTREE	3-1-B	SEWARD TRAIL ANNUAL TREE REMOVAL	Trail Corridor Hazard Tree Removal	NFTR	2000	2000	0	234		$ 67,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 67,000	0
HZTREE	3-1-C	Utility Corridor Hazard Tree Removal	Utility Corridor Hazard Tree Removal	NFER	2000	2000	0	140	$ -	$ 44,274	$ -	$ 5,000	$ 2,000	$ 1,000	$ -	$ 2,000	$ 54,274	0
HZTREE	3-1-D	Campground Hazard Tree Removal	Campground Hazard Tree Removal	NFRN	2000	2000	0	100	$ -	$ 31,624	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,624	0
HZTREE	3-1-E	Cabin, Admin Sites Hazard Tree Removal	Cabin, Admin Sites Hazard Tree Removal	NFRN	2000	2000	0	45	$ -	$ 14,231	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,231	0
HZTREE						**2000**	**0**	**759**	**$ -**	**$ 233,026**	**$ -**	**$ 5,000**	**$ 2,000**	**$ 1,000**	**$ -**	**$ 2,000**	**$ 243,026**	**0**
PB	2-1-B	personal use	burn slash from firewood cutters	NFTM	2000	2000	20	20	$ 5,676	$ 851	$ -	$ -	$ -	$ 627	$ 455	$ -	$ 7,609	0
PB	2-2-C	CL-35	prescribe burn handpiles for hazard reduction	WFHF	2000	2000	0	9	$ 360	$ 426	$ -	$ -	$ -	$ -	$ 455	$ -	$ 1,241	0
PB	2-2-C	CL-36	prescribe burn handpiles for hazard reduction	WFHF	2000	2000	0	8	$ 360	$ 426	$ -	$ -	$ -	$ -	$ 455	$ -	$ 1,241	0
PB	2-2-C	CL-37 Prescribed Burn	prescribe burn unit for hazard reduction	WFHF	2000	2000	54	54	$ 2,271	$ 11,333	$ -	$ -	$ -	$ -	$ 736	$ -	$ 14,340	0
PB	4-1-A	MP PB 1A/2A	burn winter range for moose	NFWL	2000	2000	643	643	$ 720	$ 6,822	$ -	$ -	$ 3,250	$ -	$ 736	$ -	$ 11,528	0
PB	4-1-A	Bean Cr	burn winter range for moose	NFWL/WFHF	2000	2000	1000	1000	$ 3,558	$ 12,893	$ -	$ -	$ 1,625	$ 627	$ 736	$ -	$ 19,439	0
PB						**2000**	**1717**	**1734**	**$ 12,945**	**$ 32,751**	**$ -**	**$ -**	**$ 4,875**	**$ 1,254**	**$ 3,573**	**$ -**	**$ 55,398**	**0**
REF	3-3-H	Summit W. TS	partial plant prescribe burn units for natural regen	RTRT	2000	2000	0	50	$ -	$ 17,875	$ -	$ -	$ -	$ -	$ -		$ 17,875	0
REF	3-3-H	CL-37 PLANT	partial plant prescribe burn units for natural regen	RTRT	2000	2000	0	54	$ -	$ 19,305	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,305	0
REF	3-3-A	JUNEAU CK RIP. PLANT #	plant within stream riparian corridor	NFER	2000	2000	0	20	$ -	$ 5,500	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 6,900	0
REF	3-3-C	WEST JUNEAU PLANT	plant spruce along new road corridor	NFER	2000	2000	0	50	$ -	$ 12,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 15,900	0
REF	3-3-G	plant spruce in personal use forest products areas	plant spruce in personal use forest products areas	RTRT	2000	2000	0	25	$ -	$ 6,250	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 9,650	0
REF	3-3-H	JOHN'S CREEK PLANT	plant spruce in timber sale	RTRT	2000	2000	0	70	$ -	$ 14,100	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 16,100	0
REF	4-1-A	GRD FELTLEAF PLANT *	plant willow for restoration and regeneration use	NFWL	2000	2000	0	5	$ -	$ 11,000	$ -	$ 2,000	$ 200	$ 200	$ -	$ -	$ 13,400	0
REF	3-3-D	Cooper Creek Campground Transplanting	Transplant 5-15 foot spruce/birch wildlings in Cooper Cre	NFRN	2000	2000	0	5	$ -	$ 12,000	$ 3,000	$ -	$ 200	$ 200	$ -	$ -	$ 15,400	0
REF						**2000**	**0**	**279**	**$ -**	**$ 98,530**	**$ 9,000**	**$ 5,000**	**$ 1,000**	**$ 1,000**	**$ -**	**$ -**	**$ 114,530**	**0**
REF	**3-3**	**SEED COLLECTION**	**collect seed for use on district**	**RTRT**	**2000**	**2000**	**0**	**0**	**$ -**	**$ 2,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,000**	**$ 4,000**	**0**
REF-SP	3-3-H	HOPE 22 (Commercial Forest Product Area)	site prep for natural regen, 23 PREP	RTRT	2000	2000	0	119	$ -	$ 25,700	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 28,700	0
REF-SP	3-3-H	HOPE 37 (Commercial Forest Product Area)	site prep for natural regen, 40 PREP	RTRT	2000	2000	0	64	$ -	$ 13,900	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 15,900	0
REF-SP	3-3-H	Summit W. TS (Commercial Forest Product Area)	prescribe burn units for natural regen and plant	NFTM	2000	2000	50	50	$ 2,991	$ 6,653	$ -	$ -	$ 3,250	$ -	$ 736	$ -	$ 13,630	0
REF-SP	4-1-A	ASPEN REGEN *	clearcut decadent stand for regeneration of new stand	NFWL	2000	2000	0	80	$ -	$ 41,600	$ -	$ 4,000	$ 200	$ 200	$ -	$ -	$ 46,000	0
REF-SP						**2000**	**50**	**313**	**$ 2,991**	**$ 87,853**	**$ 5,000**	**$ 4,000**	**$ 3,450**	**$ 200**	**$ 736**	**$ -**	**$ 104,230**	**0**
FBRK	2-3	Fuel Break Maintenance - Cooper Landing, Moose Pass	Maintain Fuel Break Mineral Lines	WFHF	2000	2000	0	10	$ -	$ 950	$ 500	$ -	$ -	$ -	$ -	$ -	$ 1,450	0
FBRK	2-3	Fuel Reduction area survey and evaluation - Cooper Lan	Maintain fuel break and reduction area effectiveness	WFHF	2000	2000	0	2140	$ -	$ 14,980	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,980	0
FBRK						**2000**	**0**	**2150**	**$ -**	**$ 15,930**	**$ 500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 16,430**	**0**
TSI	3-2-A	SNOW RIVER THIN	thin young spruce	RTRT	2000	2000	0	10	$ -	$ 5,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 6,800	0
TSI	3-2-C	AVALANCHE ACRE THIN	thin young spruce	RTRT	2000	2000	0	10	$ -	$ 5,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 6,800	0
TSI	3-2-C	WEST JUNEAU THIN	thin young spruce	RTRT	2000	2000	0	20	$ -	$ 11,000	$ 1,000	$ 5,000	$ 100	$ 200	$ -	$ -	$ 17,300	0
TSI	4-3-A	GOSHAWK NEST TSI *	thin stands for goshawk nesting	NFWL	2000	2000	0	60	$ -	$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000	0
TSI	4-3-B	HOPE EAGLE NEST TSI *	thin stand for future eagle nest use	NFWL	2000	2000	0	10	$ -	$ 4,500	$ -	$ 5,000	$ 100	$ 100	$ -	$ -	$ 9,700	0
TSI						**2000**	**0**	**110**	**$ -**	**$ 53,500**	**$ 1,000**	**$ 12,000**	**$ 400**	**$ 700**	**$ -**	**$ -**	**$ 67,600**	**0**
TSPREP	3-1-A	HOPE HOUSELOG	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 5,000	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 7,000	50
TSPREP	3-1-D	TRAIL CG (campground tree removal	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 5,000	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 8,000	100
TSPREP	3-1-D	PTARMIGAN CG (campground tree removal)	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 4,000	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 6,000	200
TSPREP	3-1-E	KLWC (admin site tree removal)	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 4,000	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 7,000	200
TSPREP	3-3-H	ALDER	small commercial sale for local needs	NFTM	1999	2000	0	0	$ -	$ -	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ 6,000	1300
TSPREP	3-3-H	UNIT 37	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 12,000	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ -	$ 24,000	250
TSPREP	3-3-H	UNIT 40	small commercial sale for local needs	NFTM	2000	2000	0	0	$ 12,000	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ -	$ 24,000	250
HA	3-3-G	HOPE AREA	administer free use permits in Hope area	NFTM	2000	2000	0	0	$ 10,000	$ -	$ 10,000	$ -	$ -	$ -	$ -	$ -	$ 20,000	200
TSPREP						**2000**	**0**	**0**	**$ 52,000**	**$ -**	**$ 50,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 102,000**	**2550**
VEG PLAN	3-2-A	Develop Veg/Pest Mgmt Plans	stream riparian, silv exam,rx,veg mgm plan	NFER	2000	2000	0	2400	$ -	$ 82,560	$ -	$ -	$ -	$ -	$ -	$ -	$ 82,560	0
VEG PLAN	3-2-B	Develop Veg/Pest Mgmt Plans	lake riparian, silv exam,rx,veg mgm plan	NFER	2000	2000	0	530	$ -	$ 18,232	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,232	0
VEG PLAN	3-2-C	Develop Veg/Pest Mgmt Plans	0-1/2 mile road corridor (includes SNScenic Byway), silv e	NFER	2000	2000	0	9000	$ -	$ 309,600	$ -	$ -	$ -	$ -	$ -	$ -	$ 309,600	0
VEG PLAN	3-2-D	Develop Veg/Pest Mgmt Plans	0-1/2 mi Campground, silv exam,rx,veg mgm plan	NFRN	2000	2000	0	790	$ -	$ 27,176	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,176	0
VEG PLAN	3-2-E	Develop Veg/Pest Mgmt Plans	0-500 ft cabins, admin facility, silv exam,rx,veg mgm plan	NFRN	2000	2000	0	40	$ -	$ 1,376	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,376	0
VEG PLAN	3-2-F	Develop Veg/Pest Mgmt Plans	0-100 ft trail corridor, silv exam,rx,veg mgm plan	NFTR	2000	2000	0	510	$ -	$ 17,544	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,544	0
VEG PLAN						**2000**	**0**	**13,270**	**$ -**	**$ 456,488**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 456,488**	**0**
VEG PLAN	3-3-A	Develop Veg/Pest Mgmt Plans	stream riparian, silv exam,rx,veg mgm plan	NFER	2000	2000	0	3590	$ -	$ 123,496	$ -	$ -	$ -	$ -	$ -	$ -	$ 123,496	0
VEG PLAN	3-3-B	Develop Veg/Pest Mgmt Plans	lake riparian, silv exam,rx,veg mgm plan	NFER	2000	2000	0	470	$ -	$ 16,168	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,168	0
VEG PLAN	3-3-C	Develop Veg/Pest Mgmt Plans	0-1/2 mile road corridor (includes SNScenic Byway), silv e	NFER	2000	2000	0	10600	$ -	$ 364,640	$ -	$ -	$ -	$ -	$ -	$ -	$ 364,640	0
VEG PLAN	3-3-D	Develop Veg/Pest Mgmt Plans	0-1/2 mi Campground, silv exam,rx,veg mgm plan	NFRN	2000	2000	0	2690	$ -	$ 92,536	$ -	$ -	$ -	$ -	$ -	$ -	$ 92,536	0
VEG PLAN	3-3-E	Develop Veg/Pest Mgmt Plans	0-500 ft cabins, admin facility, silv exam,rx,veg mgm plan	NFRN	2000	2000	0	90	$ -	$ 3,096	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,096	0
VEG PLAN	3-3-F	Develop Veg/Pest Mgmt Plans	0-100 ft trail corridor, silv exam,rx,veg mgm plan	NFTR	2000	2000	0	1170	$ -	$ 40,248	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,248	0
VEG PLAN						**2000**	**0**	**18,610**	**$ -**	**$ 640,184**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 640,184**	**0**
Facility Repai	**ALL**	**KLWC Repairs**	**Repair and upgrade KLWC for support personnel**	**NFER**	**2000**	**2000**	**0**	**0**	**$ -**	**$ -**	**$ 400,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 400,000**	**0**
TOTAL 2000							**1,767**	**37,225**	**$ 67,936**	**$ 1,620,262**	**$ 465,500**	**$ 26,000**	**$ 11,725**	**$ 4,154**	**$ 4,309**	**$ 4,000**	**$ 2,203,886**	**2550**

Five-Year Action Schedule Detail - FY 2001

PROJECT TY	STRATEGY	PROJECT NAME	PROJECT PUPOSE	FUND	PREP-YR	TRMT-YR	PREP-AC	TRMT-AC	PREP-COST	TRMT-COST	CADM-COST	NEPA-COST	HER-COST	BE-COST	BP-COST	REF-COST	TOT-COST	MBF
HZTREE	3-1-A	ROAD CORRIDOR HAZARD TREE REMVOAL	road corridor hazard tree removal	NFER	2001	2001	0	240	$ -	$ 75,898	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,898	0
HZTREE	3-1-B	SEWARD TRAIL ANNUAL TREE REMOVAL	fell dead hazard trees from trail corridor	NFRN	2001	2001	0	234	$ -	$ 70,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 70,000	0
HZTREE	3-1-C	UTILITY CORRIDOR HAZARD TREE REMVOAL	utility corridor hazard tree removal	NFER	2001	2001	0	140	$ -	$ 44,274	$ -	$ 5,000	$ 2,000	$ 1,000	$ -	$ 2,000	$ 54,274	0
HZTREE	3-1-D	CAMPGROUND HAZARD TREE REMVOAL	campground hazard tree removal	NFER	2001	2001	0	696	$ -	$ 220,103	$ -	$ -	$ -	$ -	$ -	$ -	$ 220,103	0
HZTREE	3-1-E	CABIN,ADMIN SITE HAZARD TREE REMVOAL	cabin, admin site hazard tree removal	NFER	2001	2001	0	45	$ -	$ 14,231	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,231	0
HZTREE						**2001**	**0**	**1355**	**$ -**	**$ 424,505**	**$ -**	**$ 5,000**	**$ 2,000**	**$ 1,000**	**$ -**	**$ 2,000**	**$ 434,505**	
PB	2-1-B	personal use	burn slash from firewood cutters	NFTM	2001	2001	20	20	$ 5,676	$ 851	$ -	$ -	$ -	$ 627	$ 455	$ -	$ 7,609	0
PB	2-1-C	SNOW RIVER THIN	hand piling TSI activity fuels for burning in Fy 2001	WFHF	2000	2001	10	0	$ 5,677	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,677	0
PB	2-1-C	AVALANCHE ACRE THIN	hand piling TSI activity fuels for burning in Fy 2001	WFHF	2000	2001	10	0	$ 5,677	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,677	0
PB	2-1-C	WEST JUNEAU THIN	hand piling TSI activity fuels for burning in Fy 2001	WFHF	2000	2001	20	0	$ 11,353	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,353	0
PB	2-1-C	SNOW RIVER THIN	prescribe burn handpiles for hazard reduction	WFHF	2000	2001	0	10	$ 360	$ 426	$ -	$ -	$ -	$ -	$ 455	$ -	$ 1,241	0
PB	2-1-C	AVALANCHE ACRE THIN	prescribe burn handpiles for hazard reduction	WFHF	2000	2001	0	10	$ 360	$ 426	$ -	$ -	$ -	$ -	$ 455	$ -	$ 1,241	0
PB	2-1-C	WEST JUNEAU THIN	prescribe burn handpiles for hazard reduction	WFHF	2000	2001	0	20	$ 360	$ 426	$ -	$ -	$ -	$ -	$ 455	$ -	$ 1,241	0
PB	2-4-C	MP 20'S	prescribe burn unit for hazard reduction	WFHF	2001	2001	116	116	$ 3,558	$ 12,893	$ -	$ -	$ 3,250	$ -	$ 736	$ 41,470	$ 61,907	0
PB	4-1-A	Russian 1 Reburn	burn winter range for moose	NFWL	2001	2001	5000	5000	$ 27,000	$ 82,900	$ -	$ 5,000	$ 3,250	$ 627	$ 736	$ -	$ 119,513	0
PB	4-1-A	Stetson S	burn winter range for moose	NFWL	2001	2001	760	760	$ 3,558	$ 12,893	$ -	$ -	$ -	$ 627	$ 736	$ -	$ 17,814	0
PB	4-1-A	MP PB 7A	burn winter range for moose	NFWL	2001	2001	1350	1350	$ 3,558	$ 12,893	$ -	$ -	$ 3,250	$ -	$ 736	$ -	$ 20,437	0
PB						**2001**	**7286**	**7286**	**$ 67,137**	**$ 123,708**	**$ -**	**$ 5,000**	**$ 9,750**	**$ 1,881**	**$ 4,764**	**$ 41,470**	**$ 253,710**	
REF	3-3-A	RESURRECTION CK PLANT #	plant within stream riparian corridor	RTRT	2001	2001	0	20	$ -	$ 5,500	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 6,900	0
REF	3-3-A	plant within stream riparian corridor	plant within stream riparian corridor	RTRT	2001	2001	0	400	$ -	$ 166,888	$ 3,000	$ 2,000	$ 200	$ 200	$ -	$ -	$ 172,288	0
REF	3-3-B	plant within lake riparian corridor	plant within lake riparian corridor	RTRT	2001	2001	0	50	$ -	$ 20,861	$ 3,000	$ 2,000	$ 200	$ 200	$ -	$ -	$ 26,261	0
REF	3-3-C	WEST JUNEAU PLANT	plant spruce along new road corridor	RTRT	2001	2001	0	50	$ -	$ 12,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 15,900	0
REF	3-3-C	plant spruce in 100 ft road corridors	plant spruce in 100 ft road corridors	RTRT	2001	2001	0	170	$ -	$ 42,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 45,900	0
REF	3-3-C	SNS Byway plant	plant spruce in SNS Byway corridor	RTRT	2001	2001	0	200	$ -	$ 50,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 53,400	0
REF	3-3-C	SNS Byway plant	plant spruce in SNS Byway corridor	NFER	2000	2000	0	200	$ -	$ 50,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 53,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	plant spruce in 1/2 mile campground buffers	NFRN	2000	2000	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	plant spruce in 1/2 mile campground buffers	RTRT	2001	2001	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-E	plant spruce in cabin, admin site 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	NFRN	2000	2000	0	20	$ -	$ 5,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 8,400	0
REF	3-3-E	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2001	2001	0	20	$ -	$ 5,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 8,400	0
REF	3-3-F	plant spruce in 100 ft trail corridors	plant spruce in 100 ft trail corridors	NFTR	2000	2000	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-F	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2001	2001	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-G	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2001	2001	0	25	$ -	$ 6,250	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 9,650	0
REF	3-3-H	P/R 22	prescribe burn units for natural regen and plant	NFTM	2001	2001	30	30	$ 3,558	$ 6,653	$ -	$ -	$ -	$ -	$ 736	$ -	$ 10,947	0
REF	3-3-H	WEST JUNEAU II PREP	site prep for spruce planting	RTRT	2001	2001	0	20	$ -	$ 11,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 14,400	0
REF	3-3-H	P/R 22	partial plant prescribe burn units for natural regen	NFTM	2001	2001	0	30	$ -	$ 10,725	$ -	$ -	$ -	$ -	$ -		$ 10,725	0
REF	4-1-A	GRD '20 MILE SITE PREP FOR WILLOW*	site prep for willow regeneration	NFWL	2001	2001	0	25	$ -	$ 13,000	$ 2,000	$ 2,000	$ 200	$ 200	$ -	$ -	$ 17,400	0
REF	4-1-A	GRD FELTLEAF PLANT *	plant willow for restoration and regeneration use	NFWL	2001	2001	0	5	$ -	$ 11,000	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 12,400	0
REF						**2001**	**30**	**1665**	**$ 3,558**	**$ 516,877**	**$ 32,000**	**$ 20,000**	**$ 3,400**	**$ 3,400**	**$ 736**	**$ -**	**$ 579,971**	
TSI	3-2-A	stream riparian veg & pest mgmt	stream riparian veg & pest mgmt	RTRT	2000	2001	0	100	$ -	$ 46,600	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 47,900	0
TSI	3-2-C	WEST JUNEAU PCT	remove part of stand for increased vigor of spruce	RTRT	2001	2001	0	40	$ -	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,000	0
TSI	3-2-C	HOPE TSI	thin overstory birch for spruce release	RTRT	2001	2001	0	40	$ -	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,000	0
TSI	3-2-D	TRAIL RIVER FIRE TSI	campground thinning,pruning, pest mgmt	RTRT	2001	2001	0	100	$ -	$ 45,000	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 46,300	0
TSI	3-2-E	TRAIL RIVER FIRE TSI	cabin, admin facility thinning, pruning, pest mgmt	RTRT	2001	2001	0	10	$ -	$ 4,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 5,800	0
TSI	4-1-A	ASPEN REGEN *	clearcut decadent stand for regeneration of new stand	NFWL	2001	2001	0	80	$ -	$ 44,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 44,000	0
TSI	4-3-A	GOSHAWK NEST TSI *	thin stands for goshawk nesting	NFWL	2001	2001	0	60	$ -	$ 27,000	$ 2,000	$ 9,000	$ 100	$ 200	$ -	$ -	$ 38,300	0
TSI	4-3-B	SNOW RIVER EAGLE TSI	thin stand for future eagle nest use	NFWL	2001	2001	0	10	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	0
TSI						**2001**	**0**	**440**	**$ -**	**$ 207,600**	**$ 2,000**	**$ 12,000**	**$ 400**	**$ 800**	**$ -**	**$ -**	**$ 222,800**	**0**
TSPREP	3-1-A	HOPE HWY HOUSE LOG	small commercial sale for local needs	NFTM	2001	2001	0	0	$ 2,500	$ -	$ 2,000	$ 7,500	$ 500	$ 200	$ -	$ -	$ 12,700	50
TSPREP	3-1-D	PRIMROSE CG	small commercial sale for local needs	NFTM	2001	2001	0	0	$ 8,500	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ 10,000	250
TSPREP	3-3-H	TRAIL RIDGE	small commercial sale for local needs	NFTM	2001	2001	0	0	$ 9,000	$ -	$ 1,500	$ 2,000	$ 200	$ 200	$ -	$ -	$ 12,900	100
TSPREP	3-3-H	FRENCHY	provide commercial firewood sale for local needs	NFER	2001	2001	0	0	$ 5,000	$ -	$ -	$ 2,000	$ 200	$ 200	$ -	$ -	$ 7,400	100
TSPREP	3-3-H	PALMER	provide commercial firewood sale for local needs	NFER	2001	2001	0	0	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,000	50
HA	3-3-G	HOPE AREA	administer free use permits in Hope area	NFER	2001	2001	0	0	$ 9,000	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 12,000	200
TSPREP						**2001**	**0**	**0**	**$ 37,000**	**$ -**	**$ 8,000**	**$ 11,500**	**$ 900**	**$ 600**	**$ -**	**$ -**	**$ 58,000**	**750**
VEG PLAN	3-2-C	Veg/Pest Mgmt Plans	0-1/2 mi SNC Byway, silv exam,rx,veg mgm plan	NFER	2001	2001	0	4400	$ -	$ 151,360	$ -	$ -	$ -	$ -	$ -	$ -	$ 151,360	0
VEG PLAN	3-2-G	Veg/Pest Mgmt Plans	personal use fp, silv exam,rx,veg mgm plan	NFER	2001	2001	0	460	$ -	$ 15,824	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,824	0
VEG PLAN	3-2-H	Veg/Pest Mgmt Plans	commercial use fp, silv exam,rx,veg mgm plan	NFER	2001	2001	0	7520	$ -	$ 258,688	$ -	$ -	$ -	$ -	$ -	$ -	$ 258,688	0
VEG PLAN	3-3-C	Veg/Pest Mgmt Plans	0-1/2 mi SNC Byway, silv exam,rx,veg mgm plan	NFER	2001	2001	0	7200	$ -	$ 247,680	$ -	$ -	$ -	$ -	$ -	$ -	$ 247,680	0
VEG PLAN	3-3-G	Veg/Pest Mgmt Plans	personal use fp, silv exam,rx,veg mgm plan	NFTM	2001	2001	0	740	$ -	$ 25,456	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,456	0
VEG PLAN	3-3-H	Veg/Pest Mgmt Plans	commercial use fp, silv exam,rx,veg mgm plan	NFTM	2001	2001	0	16730	$ -	$ 575,512	$ -	$ -	$ -	$ -	$ -	$ -	$ 575,512	0
VEG PLAN						**2001**	**0**	**37,050**	**$ -**	**$ 1,274,520**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,274,520**	**0**
Facility Repai	**ALL**	**KLWC Repairs**	**Repair and upgrade KLWC for support personnel**	**NFER**	**2001**	**2001**	**0**	**0**	**$ -**	**$ -**	**$ 400,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 400,000**	**0**
TOTAL 2001							**7,316**	**47,796**	**$ 107,695**	**$ 2,547,210**	**$ 442,000**	**$ 53,500**	**$ 16,450**	**$ 7,681**	**$ 5,500**	**$ 43,470**	**$ 3,223,506**	**750**

Five-Year Action Schedule Detail - FY 2002

PROJECT TY	STRATEGY	PROJECT NAME	PROJECT PUPOSE	FUND	PREP-YR	TRMT-YR	PREP-AC	TRMT-AC	PREP-COST	TRMT-COST	CADM-COST	NEPA-COST	HER-COST	BE-COST	BP-COST	REF-COST	TOT-COST	MBF
HZTREE	3-1-A	ROAD CORRIDOR HAZARD TREE REMVOAL	road corridor hazard tree removal	NFER	2002	2002	0	240	$ -	$ 75,898	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,898	0
HZTREE	3-1-B	SEWARD TRAIL ANNUAL TREE REMOVAL	trail corridor hazard tree removal	NFRN	2002	2002	0	234	$ -	$ 74,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 74,000	0
HZTREE	3-1-C	UTILITY CORRIDOR HAZARD TREE REMVOAL	utility corridor hazard tree removal	NFER	2002	2002	0	140	$ -	$ 44,274	$ -	$ 5,000	$ 2,000	$ 1,000	$ -	$ 2,000	$ 54,274	0
HZTREE	3-1-D	CAMPGROUND HAZARD TREE REMVOAL	campground hazard tree removal	NFER	2002	2002	0	696	$ -	$ 220,103	$ -	$ -	$ -	$ -	$ -	$ -	$ 220,103	0
HZTREE	3-1-E	CABIN, ADMIN SITE HAZARD TREE REMVOAL	cabin, admin site hazard tree removal	NFER	2002	2002	0	40	$ -	$ 12,650	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,650	0
HZTREE							**0**	**1350**	**$ -**	**$ 426,924**	**$ -**	**$ 5,000**	**$ 2,000**	**$ 1,000**	**$ -**	**$ 2,000**	**$ 436,924**	**0**
PB	2-1-A	P/R 23	burn slash from firewood cutters	NFTM	2002	2002	100	100	$ 3,953	$ 14,326	$ -	$ -	$ 3,250	$ -	$ 736	$ -	$ 22,265	0
PB	2-1-B	personal use	burn slash from firewood cutters	NFTM	2002	2002	20	20	$ 5,676	$ 851	$ -	$ -	$ -	$ 627	$ 455	$ -	$ 7,609	0
PB	2-2-C	MP 19'S	prescribe burn unit for hazard reduction	WFHF	2002	2002	145	145	$ 3,558	$ 12,893	$ -	$ -	$ 3,250	$ -	$ 736	$ 51,837	$ 72,274	0
PB	2-4-C	MP PB-13's-14's	prescribe burn unit for hazard reduction	WFHF	2002	2002	650	650	$ 720	$ 6,822	$ -	$ -	$ -	$ -	$ 736	$ 232,375	$ 240,653	0
PB	4-1-A	Quartz 35	burn winter range for moose	NFWL	2002	2002	5000	5000	$ 27,000	$ 82,900	$ -	$ 5,000	$ 3,250	$ 627	$ 736	$ -	$ 119,513	0
PB	4-1-A	Juneau 1	burn winter range for moose	NFWL	2002	2002	800	800	$ 6,418	$ 12,893	$ -	$ -	$ 3,250	$ -	$ 736	$ -	$ 23,297	0
PB	4-1-B	Subsisentce Moose Burn	burn winter range for moose in subsistence areas	NFWL	2002	2002	70	2000	$ 33,160	$ 6,653	$ -	$ 2,000	$ 2,000	$ 627	$ 736	$ -	$ 45,176	0
PB							**6785**	**8715**	**$ 80,485**	**$ 137,338**	**$ -**	**$ 7,000**	**$ 15,000**	**$ 1,881**	**$ 4,871**	**$ 284,212**	**$ 530,787**	**0**
REF	3-3-A	RUSSIAN RIVER PLANT #	plant within stream riparian corridor	RTRT	2002	2002	0	60	$ -	$ 19,600	$ 3,000	$ 2,000	$ 200	$ 200	$ -	$ -	$ 25,000	0
REF	3-3-A	DAVE'S CK RIP. PLANT #	plant within stream riparian corridor	RTRT	2002	2002	0	20	$ -	$ 6,500	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 7,900	0
REF	3-3-A	plant within stream riparian corridor	plant within stream riparian corridor	RTRT	2002	2002	0	400	$ -	$ 166,888	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 168,288	0
REF	3-3-B	plant within lake riparian corridor	plant within lake riparian corridor	RTRT	2002	2002	0	50	$ -	$ 20,861	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 22,261	0
REF	3-3-C	plant spruce in 100 ft road corridors	plant spruce in 100 ft road corridors	RTRT	2002	2002	0	170	$ -	$ 42,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 45,900	0
REF	3-3-C	SNS Byway plant	plant spruce in SNS Byway corridor	RTRT	2002	2002	0	200	$ -	$ 50,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 53,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	plant spruce in 1/2 mile campground buffers	RTRT	2002	2002	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-E	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2002	2002	0	20	$ -	$ 5,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 8,400	0
REF	3-3-F	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2002	2002	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-G	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2002	2002	0	25	$ -	$ 6,250	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 9,650	0
REF	4-1-C	Tree Shear Demo - Moose	tree shear aspen for moose browse demo project	NFWL	2002	2002	0	100	$ -	$ 23,600	$ -	$ 2,000	$ 2,000	$ -	$ -	$ -	$ 27,600	0
REF	4-1-A	GRD 20 MILE SITE PREP FOR WILLOW*	site prep for willow regeneration	NFWL	2002	2002	0	25	$ -	$ 14,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 17,400	0
REF	4-1-A	ASPEN REGEN JUNEAU *	clearcut decadent stand for regeneration of new stand	NFWL	2002	2002	0	80	$ -	$ 46,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 46,000	0
REF	3-3-H	Johns Cr TS 1	regeneration stocking surveys	NFTM	2002	2002	0	40	$ -	$ 280	$ -	$ -	$ -	$ -	$ -		$ 280	0
REF	3-3-H	Johns Cr TS 2	regeneration stocking surveys	NFTM	2002	2002	0	30	$ -	$ 210	$ -	$ -	$ -	$ -	$ -		$ 210	0
REF	3-3-H	Johns Cr TS 3	regeneration stocking surveys	NFTM	2002	2002	0	20	$ -	$ 140	$ -	$ -	$ -	$ -	$ -		$ 140	0
REF	3-3-H	Johns Cr TS 4	regeneration stocking surveys	NFTM	2002	2002	0	8	$ -	$ 56	$ -	$ -	$ -	$ -	$ -		$ 56	0
REF							**0**	**1448**	**$ -**	**$ 451,885**	**$ 17,000**	**$ 14,000**	**$ 4,200**	**$ 2,200**	**$ -**	**$ -**	**$ 489,285**	**0**
TSI	3-2-A	Stream riparian veg & pest mgmt	stream riparian veg & pest mgmt	RTRT	2000	2002	0	100	$ -	$ 46,600	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 47,900	0
TSI	3-2-C	HOPE Y TSI	remove part of stand for increased vigor of spruce	RTRT	2002	2002	0	40	$ -	$ 18,000	$ -	$ 2,000	$ 100	$ 200	$ -	$ -	$ 20,300	0
TSI	3-2-C	WEST JUNEAU RELEASE	thin young spruce	RTRT	2002	2002	0	80	$ -	$ 36,000	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 40,000	0
TSI	3-2-D	Campground Veg/Pest Mgmt	campground thinning,pruning, pest mgmt	RTRT	2002	2002	0	100	$ -	$ 45,000	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 46,300	0
TSI	3-2-E	Cabin, Admin site Veg/Pest Mgmt	cabin, admin facility thinning, pruning, pest mgmt	RTRT	2002	2002	0	10	$ -	$ 4,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 5,800	0
TSI	4-3-A	GOSHAWK NEST TSI *	thin stands for goshawk nesting	NFWL	2002	2002	0	60	$ -	$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000	0
TSI	4-3-B	KENAI LAKE EAGLE TSI *	thin stand for future eagle nest use	NFWL	2002	2002	0	10	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	0
TSI							**0**	**400**	**$ -**	**$ 181,600**	**$ 4,000**	**$ 5,000**	**$ 400**	**$ 800**	**$ -**	**$ -**	**$ 191,800**	**0**
TSPREP	3-1-A	HOPE HWY HOUSELOG II	small commercial sale for local needs	NFTM	2002	2002	0	0	$ 2,500	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 4,500	50
TSPREP	3-3-H	PALMER	provide commercial firewood sale for local needs	NFER	2002	2002	0	0	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,000	50
HA	3-3-G	HOPE AREA	administer free use permits in Hope area	NFER	2002	2002	0	0	$ 10,000	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 13,000	200
HA	3-3-G	HOPE AREA	administer free use permits in Hope area	NFER	2002	2002	0	0	$ 10,000	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ 13,000	200
TSPREP							**0**	**0**	**$ 25,500**	**$ -**	**$ 8,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 33,500**	**500**
TOTAL 2002							**6,785**	**11,913**	**$ 105,985**	**$ 1,197,747**	**$ 29,000**	**$ 31,000**	**$ 21,600**	**$ 5,881**	**$ 4,871**	**$ 286,212**	**$ 1,682,296**	**500**

Five-Year Action Schedule Detail - FY 2003

PROJECT TY	STRATEGY	PROJECT NAME	PROJECT PUPOSE	FUND	PREP-YR	TRMT-YR	PREP-AC	TRMT-AC	PREP-COST	TRMT-COST	CADM-COST	NEPA-COST	HER-COST	BE-COST	BP-COST	REF-COST	TOT-COST	MBF
HZTREE	3-1-A	ROAD CORRIDOR HAZARD TREE REMVOAL	road corridor hazard tree removal	NFER	2003	2003	0	240	$ -	$ 75,898	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,898	0
HZTREE	3-1-B	SEWARD TRAIL ANNUAL TREE REMOVAL	Trail corridor hazard tree removal	NFRN	2003	2003	0	234	$ -	$ 77,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 77,500	0
HZTREE	3-1-C	UTILITY CORRIDOR HAZARD TREE REMVOAL	utility corridor hazard tree removal	NFER	2003	2003	0	140	$ -	$ 44,274	$ -	$ -	$ -	$ -	$ -	$ -	$ 44,274	0
HZTREE	3-1-D	CAMPGROUND HAZARD TREE REMVOAL	campground hazard tree removal	NFER	2003	2003	0	696	$ -	$ 220,103	$ -	$ -	$ -	$ -	$ -	$ -	$ 220,103	0
HZTREE	3-1-E	CABIN, ADMIN SITE HAZARD TREE REMVOAL	cabin, admin site hazard tree removal	NFER	2003	2003	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
HZTREE							**0**	**1310**	**$ -**	**$ 417,774**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 417,774**	**0**
PB	2-1-B	personal use	burn slash from firewood cutters	NFTM	2003	2003	20	20	$ 5,676	$ 851	$ -	$ -	$ -	$ 627	$ 455	$ -	$ 7,609	0
PB	2-2-A	MP 13'S-18'S	prescribe burn unit for hazard reduction	WFHF	2003	2003	228	228	$ 3,558	$ 12,893	$ -	$ -	$ 3,250	$ -	$ 736	$ 81,510	$ 101,947	0
PB	2-2-B		prescribe burn unit for hazard reduction	WFHF	2003	2003	16	50	$ 11,119	$ 100	$ -	$ -	$ -	$ -	$ 736	$ 5,720	$ 17,675	0
PB	2-2-B		DEMO Tree shear for pre-felling trees for fuel continuity	WFHF	2003	2003	16	50	$ 7,500	$ 100	$ -	$ -	$ -	$ -	$ 736	$ 5,720	$ 14,056	0
PB	4-1-A	MP PB 1A/2A	burn winter range for moose	NFWL	2003	2003	5000	5000	$ 27,000	$ 82,900	$ -	$ 5,000	$ 3,250	$ 627	$ 736	$ -	$ 119,513	0
PB	4-1-A	Upper Russian	burn winter range for moose	NFWL	2003	2003	1050	1050	$ 3,558	$ 6,822	$ -	$ -	$ 3,250	$ 627	$ 736	$ -	$ 14,993	0
PB	4-1-A	P/R 20/21	burn winter range for moose	NFWL	2003	2003	440	440	$ 3,558	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ -	$ 17,187	0
PB	4-1-B	Quartz 35	burn winter range for moose in subsistence areas	NFWL	2003	2003	760	2000	$ 33,160	$ 12,893	$ -	$ 2,000	$ 2,000	$ 627	$ 736	$ -	$ 51,416	0
PB	4-4	Black Mtn Site Prep for plant brown Bear Travel corridro	burn Brown bear travel corridor	NFWL	2003	2003	0	300	$ -	$ 35,700	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ 37,700	0
PB							**7530**	**9138**	**$ 95,129**	**$ 165,152**	**$ -**	**$ 9,000**	**$ 11,750**	**$ 2,508**	**$ 5,607**	**$ 92,950**	**$ 382,096**	**0**
REF	3-3-A	QUARTZ CK PLANT #	plant within stream riparian corridor	RTRT	2003	2003	0	20	$ -	$ 12,000	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 13,400	0
REF	3-3-A	plant within stream riparian corridor	plant within stream riparian corridor	RTRT	2003	2003	0	400	$ -	$ 166,888	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 168,288	0
REF	3-3-B	plant within lake riparian corridor	plant within lake riparian corridor	RTRT	2003	2003	0	50	$ -	$ 20,861	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 22,261	0
REF	3-3-C	plant spruce in 100 ft road corridors	plant spruce in 100 ft road corridors	RTRT	2003	2003	0	170	$ -	$ 42,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 45,900	0
REF	3-3-C	SNS Byway plant	plant spruce in SNS Byway corridor	RTRT	2003	2003	0	200	$ -	$ 50,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 53,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	plant spruce in 1/2 mile campground buffers	RTRT	2003	2003	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-E	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2003	2003	0	20	$ -	$ 5,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 8,400	0
REF	3-3-F	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2003	2003	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-G	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2003	2003	0	25	$ -	$ 6,250	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 9,650	0
REF	4-4	Black Mtn Brown Bear Travel Corridor Plant Spruce	plant spruce in brown bear travel corridor	NFWL	2003	2003	0	300	$ -	$ 105,000	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 107,000	0
REF							**0**	**1385**	**$ -**	**$ 458,499**	**$ 14,000**	**$ 9,000**	**$ 1,800**	**$ 1,800**	**$ -**	**$ -**	**$ 485,099**	**0**
REF-SP	4-1-A	GRD 20 MILE SITE PREP FOR WILLOW*	site prep for willow regeneration	NFWL	2003	2003	0	25	$ -	$ 13,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 16,400	0
REF-SP	4-1-A	ASPEN REGEN *	clearcut decadent stand for regeneration of new stand	NFWL	2003	2003	0	80	$ -	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000	0
REF-SP	3-3-H	WEST JUNEAU III PREP	site prep for spruce planting	RTRT	2003	2003	0	20	$ -	$ 11,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 14,400	0
REF-SP							**0**	**125**	**$ -**	**$ 74,000**	**$ 4,000**	**$ 2,000**	**$ 400**	**$ 400**	**$ -**	**$ -**	**$ 80,800**	**0**
REF-ST SURV	3-3-A	JUNEAU CK RIP. PLANT #	regeneration stocking surveys	RTRT	2003	2003	0	20	$ -	$ 140	$ -	$ -	$ -	$ -	$ -	$ -	$ 140	0
REF-ST SURV	3-3-C	WEST JUNEAU PLANT	regeneration stocking surveys	RTRT	2003	2003	0	50	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ 350	0
REF-ST SURV	3-3-C	SNS Byway plant	regeneration stocking surveys	RTRT	2003	2003	0	200	$ -	$ 1,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,400	0
REF-ST SURV	3-3-D	plant spruce in 1/2 mile campground buffers	regeneration stocking surveys	RTRT	2003	2003	0	100	$ -	$ 700	$ -	$ -	$ -	$ -	$ -	$ -	$ 700	0
REF-ST SURV	3-3-E	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2003	2003	0	20	$ -	$ 140	$ -	$ -	$ -	$ -	$ -	$ -	$ 140	0
REF-ST SURV	3-3-F	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2003	2003	0	100	$ -	$ 700	$ -	$ -	$ -	$ -	$ -	$ -	$ 700	0
REF-ST SURV	3-3-G	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2003	2003	0	25	$ -	$ 175	$ -	$ -	$ -	$ -	$ -	$ -	$ 175	0
REF-ST SURV	3-3-H	Summit W. TS	regeneration stocking surveys	NFTM	2003	2003	0	50	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ 350	0
REF-ST SURVY							**0**	**565**	**$ -**	**$ 3,955**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,955**	**0**
TSI	3-2-A	stream riparian veg & pest mgmt	stream riparian veg & pest mgmt	RTRT	2000	2003	0	100	$ -	$ 46,600	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 47,900	0
TSI	3-2-D	TRAIL RIVER FIRE TSI	campground thinning,pruning, pest mgmt	RTRT	2003	2003	0	100	$ -	$ 45,000	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 46,300	0
TSI	3-2-E	TRAIL RIVER FIRE TSI	cabin, admin facility thinning, pruning, pest mgmt	RTRT	2003	2003	0	10	$ -	$ 4,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 5,800	0
TSI	4-3-A	GOSHAWK NEST TSI *	thin stands for goshawk nesting	NFWL	2003	2003	0	60	$ -	$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000	0
TSI	4-3-B	SWAN LAKE EAGLE NEST TSI *	thin stand for future eagle nest use	NFWL	2003	2003	0	10	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	0
TSI							**0**	**280**	**$ -**	**$ 127,600**	**$ -**	**$ 3,000**	**$ 300**	**$ 600**	**$ -**	**$ -**	**$ 131,500**	**0**
TSPREP	3-1-A	HOPE HWY HOUSELOG III	small commercial sale for local needs	NFTM	2003	2003	0	0	$ 2,500	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 4,500	50
TSPREP	3-3-H	GRANITE	provide commercial firewood sale for local needs	NFER	2003	2003	0	0	$ 3,000	$ -	$ -	$ 2,000	$ 200	$ 200	$ -	$ -	$ 5,400	50
HA	3-3-G	QUARTZ CK	administer free use permits in Quartz Ck. area	NFER	2003	2003	0	0	$ 10,000	$ -	$ 3,000	$ 2,000	$ 100	$ 100	$ -	$ -	$ 15,200	200
TSPREP							**0**	**0**	**$ 15,500**	**$ -**	**$ 5,000**	**$ 4,000**	**$ 300**	**$ 300**	**$ -**	**$ -**	**$ 25,100**	**300**
TOTAL 2003							**7,530**	**12,803**	**$ 110,629**	**$ 1,246,980**	**$ 23,000**	**$ 27,000**	**$ 14,550**	**$ 5,608**	**$ 5,607**	**$ 92,950**	**$ 1,526,324**	**300**

Five-Year Action Schedule Detail - FY 2004

PROJECT TY	STRATEGY	PROJECT NAME	PROJECT PUPOSE	FUND	PREP-YR	TRMT-YR	PREP-AC	TRMT-AC	PREP-COST	TRMT-COST	CADM-COST	NEPA-COST	HER-COST	BE-COST	BP-COST	REF-COST	TOT-COST	MBF
HZTREE	3-1-A	ROAD CORRIDOR HAZARD TREE REMVOAL	road corridor hazard tree removal	NFER	2004	2004	0	240	$ -	$ 75,898	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,898	0
HZTREE	3-1-B	SEWARD TRAIL ANNUAL TREE REMOVAL	Trail corridor hazard tree removal	NFRN	2004	2004	0	234	$ -	$ 81,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 81,500	0
HZTREE	3-1-C	Utility CORRIDOR HAZARD TREE REMVOAL	utility corridor hazard tree removal	NFER	2004	2004	0	140	$ -	$ 44,274	$ -	$ -	$ -	$ -	$ -	$ -	$ 44,274	0
HZTREE	3-1-D	Campground HAZARD TREE REMVOAL	campground hazard tree removal	NFER	2004	2004	0	696	$ -	$ 220,103	$ -	$ -	$ -	$ -	$ -	$ -	$ 220,103	0
HZTREE	3-1-E	Cabin, Admin Site HAZARD TREE REMVOAL	cabin, admin site hazard tree removal	NFER	2004	2004	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
HZTREE							**0**	**1310**	**$ -**	**$ 421,774**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 421,774**	**0**
PB	2-2-A	MP 58 A-B	prescribe burn unit for hazard reduction	WFHF	2004	2004	16	16	$ 3,558	$ 6,653	$ -	$ -	$ -	$ -	$ 736	$ 5,720	$ 16,667	0
PB	2-2-A	MP 59A	prescribe burn unit for hazard reduction	WFHF	2004	2004	13	13	$ 3,558	$ 6,653	$ -	$ -	$ -	$ -	$ 736	$ 4,647	$ 15,594	0
PB	2-4-B	MP 32A	prescribe burn unit for hazard reduction	WFHF	2004	2004	103	103	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 36,822	$ 56,869	0
PB	2-4-B	MP 38A	prescribe burn unit for hazard reduction	WFHF	2004	2004	91	91	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 32,532	$ 52,579	0
PB	2-4-C	MP 64A-B	prescribe burn unit for hazard reduction	WFHF	2004	2004	108	108	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 38,610	$ 58,657	0
PB	4-1-A	MP PB 1A/2A	burn winter range for moose	NFWL	2004	2004	5347	5347	$ 28,874	$ 88,653	$ -	$ 5,000	$ 3,250	$ 627	$ 736	$ -	$ 127,140	0
PB	4-1-A	East Fork 16/17	burn winter range for moose	NFWL	2004	2004	170	170	$ 3,558	$ 12,893	$ -	$ -	$ -	$ 627	$ 736	$ -	$ 17,814	0
PB	4-1-A	Fox Cr	burn winter range for moose	NFWL	2004	2004	400	400	$ 6,418	$ 12,893	$ -	$ -	$ 3,250	$ 627	$ 736	$ -	$ 23,924	0
PB	4-1-B	MP PB 1A/2A	burn winter range for moose in subsistence areas	NFWL	2004	2004	643	1480	$ 24,538	$ 6,822	$ -	$ 2,000	$ 2,000	$ 627	$ 736	$ -	$ 36,723	0
PB	2-2-A	MP 6's	prescribe burn unit for hazard reduction	WFHF	2004	2004	49	49	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 17,518	$ 37,565	0
PB	2-2-A	MP 7D-K	prescribe burn unit for hazard reduction	WFHF	2004	2004	40	40	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 14,300	$ 34,347	0
PB	2-2-A	MP 8D	prescribe burn unit for hazard reduction	WFHF	2004	2004	46	46	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 16,445	$ 36,492	0
PB	2-2-A	MP 11C	prescribe burn unit for hazard reduction	WFHF	2004	2004	9	9	$ 3,558	$ 6,653	$ -	$ -	$ -	$ -	$ 736	$ 3,218	$ 14,165	0
PB	2-2-A	MP 13 A-F	prescribe burn unit for hazard reduction	WFHF	2004	2004	189	189	$ 6,418	$ 12,893	$ -	$ -	$ -	$ -	$ 736	$ 67,568	$ 87,615	0
PB	2-4-C	MP 11AC	prescribe burn unit for hazard reduction	WFHF	2004	2004	20	20	$ 3,558	$ 6,653	$ -	$ -	$ -	$ -	$ 736	$ 7,150	$ 18,097	0
PB	4-5		site prep burn for spruce dependent species	NFWL	2004	2004	0	50	$ -	$ 5,950	$ -	$ 500	$ -	$ -	$ -	$ -	$ 6,450	0
PB							**7244**	**8131**	**$ 122,546**	**$ 244,074**	**$ -**	**$ 7,500**	**$ 8,500**	**$ 2,508**	**$ 11,040**	**$ 244,529**	**$ 640,697**	**0**
REF	4-5		plant spruce in for spruce dependent species	NFWL	2004	2004	0	50	$ -	$ 17,500	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 19,500	0
REF	3-3-A	GRANITE CK PLANT #	plant within stream riparian corridor	RTRT	2004	2004	0	40	$ -	$ 26,000	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 27,400	0
REF	3-3-A	plant within stream riparian corridor	plant within stream riparian corridor	RTRT	2004	2004	0	400	$ -	$ 166,888	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 168,288	0
REF	3-3-B	plant within lake riparian corridor	plant within lake riparian corridor	RTRT	2004	2004	0	50	$ -	$ 20,861	$ -	$ 1,000	$ 200	$ 200	$ -	$ -	$ 22,261	0
REF	3-3-C	plant spruce in 100 ft road corridors	plant spruce in 100 ft road corridors	RTRT	2004	2004	0	170	$ -	$ 42,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 45,900	0
REF	3-3-C	SNS Byway plant	plant spruce in SNS Byway corridor	RTRT	2004	2004	0	200	$ -	$ 50,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 53,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	plant spruce in 1/2 mile campground buffers	RTRT	2004	2004	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-E	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2004	2004	0	10	$ -	$ 2,500	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 5,900	0
REF	3-3-F	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2004	2004	0	100	$ -	$ 25,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 28,400	0
REF	3-3-G	plant spruce in cabin, admin 500 ft buffers	plant spruce in cabin, admin 500 ft buffers	RTRT	2004	2004	0	25	$ -	$ 6,250	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 9,650	0
REF	4-1-A	GRD 20 MILE SITE PREP FOR WILLOW *	site prep for willow regeneration	NFWL	2004	2004	0	25	$ -	$ 13,000	$ 2,000	$ 1,000	$ 200	$ 200	$ -	$ -	$ 16,400	0
REF	3-3-A	RESURRECTION CK PLANT #	regeneration stocking surveys	RTRT	2004	2004	0	20	$ -	$ 140	$ -	$ -	$ -	$ -	$ -	$ -	$ 140	0
REF	3-3-A	plant within stream riparian corridor	regeneration stocking surveys	RTRT	2004	2004	0	400	$ -	$ 2,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,800	0
REF	3-3-B	plant within lake riparian corridor	regeneration stocking surveys	RTRT	2004	2004	0	50	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ 350	0
REF	3-3-C	WEST JUNEAU PLANT	regeneration stocking surveys	RTRT	2004	2004	0	50	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ 350	0
REF	3-3-C	plant spruce in 100 ft road corridors	regeneration stocking surveys	RTRT	2004	2004	0	170	$ -	$ 1,190	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,190	0
REF	3-3-C	SNS Byway plant	regeneration stocking surveys	RTRT	2004	2004	0	200	$ -	$ 1,400	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,400	0
REF	3-3-D	plant spruce in 1/2 mile campground buffers	regeneration stocking surveys	RTRT	2004	2004	0	100	$ -	$ 700	$ -	$ -	$ -	$ -	$ -	$ -	$ 700	0
REF	3-3-E	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2004	2004	0	20	$ -	$ 140	$ -	$ -	$ -	$ -	$ -	$ -	$ 140	0
REF	3-3-F	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2004	2004	0	100	$ -	$ 700	$ -	$ -	$ -	$ -	$ -	$ -	$ 700	0
REF	3-3-G	plant spruce in cabin, admin 500 ft buffers	regeneration stocking surveys	RTRT	2004	2004	0	25	$ -	$ 175	$ -	$ -	$ -	$ -	$ -	$ -	$ 175	0
REF	3-3-H	P/R 22	regeneration stocking surveys	NFTM	2004	2004	0	30	$ -	$ 210	$ -	$ -	$ -	$ -	$ -		$ 210	0
REF							**0**	**2335**	**$ -**	**$ 403,654**	**$ 16,000**	**$ 10,000**	**$ 2,000**	**$ 2,000**	**$ -**	**$ -**	**$ 433,654**	**0**
TSI	3-2-A	stream riparian veg & pest mgmt	stream riparian veg & pest mgmt	RTRT	2000	2004	0	100	$ -	$ 46,600	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 47,900	0
TSI	3-2-D	TRAIL RIVER FIRE TSI	thin young spruce	RTRT	2004	2004	0	15	$ -	$ 6,750	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 8,050	0
TSI	3-2-D	TRAIL RIVER FIRE TSI	campground thinning,pruning, pest mgmt	RTRT	2004	2004	0	100	$ -	$ 45,000	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 46,300	0
TSI	3-2-E	TRAIL RIVER FIRE TSI	cabin, admin facility thinning, pruning, pest mgmt	RTRT	2004	2004	0	10	$ -	$ 4,500	$ -	$ 1,000	$ 100	$ 200	$ -	$ -	$ 5,800	0
TSI	4-3-A	GOSHAWK NEST TSI *	thin stands for goshawk nesting	NFWL	2004	2004	0	60	$ -	$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000	0
TSI	4-3-B	RES. RIV. EAGLE NEST TSI *	thin stand for future eagle nest use	NFWL	2004	2004	0	10	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	0
TSI	4-3-C	HOPE EAGLE NEST TSI *	thin stand for future murrelt nest use	NFWL	2004	2004	0	20	$ -	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,000	0
TSI	4-3-D	HOPE EAGLE NEST TSI *	thin stand for future cavity nesters	NFWL	2004	2004	0	10	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	0
TSI	4-1-A	ASPEN REGEN JUNEAU *	clearcut decadent stand for regeneration of new stand	NFWL	2004	2004	0	80	$ -	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000	0
TSI							**0**	**405**	**$ -**	**$ 197,850**	**$ -**	**$ 4,000**	**$ 400**	**$ 800**	**$ -**	**$ -**	**$ 203,050**	**0**
TSPREP	3-1-D	PTARMIGAN HOUSELOG	small commercial sale for local needs	NFTM	2004	2004	0	0	$ 3,000	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 5,000	50
TSPREP	3-1-D	PORCUPINE CG	small commercial sale for local needs	NFTM	2004	2004	0	0	$ 3,000	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ -	$ 5,000	50
TSPREP	3-3-H	GRANITE	provide commercial firewood sale for local needs	NFER	2004	2004	0	0	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,000	50
TSPREP	3-1-A	STERLING HWY ROW	small commercial sale for local needs	NFTM	2004	2004	0	0	$ 5,000	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	400
HA	3-3-G	QUARTZ CK	administer free use permits in Quartz Ck. area	NFER	2004	2004	0	0	$ 10,000	$ -	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 14,000	200
HA	3-3-G	HOPE AREA	administer free use permits in Hope Ck. area	NFER	2004	2004	0	0	$ 10,000	$ -	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 14,000	200
TSPREP							**0**	**0**	**$ 35,000**	**$ -**	**$ 17,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 52,000**	**950**
TOTAL 2004							**7,244**	**12,181**	**$ 157,546**	**$ 1,267,353**	**$ 33,000**	**$ 21,500**	**$ 10,900**	**$ 5,308**	**$ 11,040**	**$ 244,529**	**$ 1,751,175**	**950**

APPENDIX C

DISCUSSION OF TREATMENT OPTIONS

TREATMENT OPTIONS

There are a variety of techniques that can be used to prevent, mitigate, or reduce impacts associated with SBB infestations. However, before pest management options 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.

The Chugach National Forest believes the key to forest ecosystem management is to manage vegetation patterns in order to maintain species diversity, both plant and animal, while providing for a multitude of resources such as recreation, fisheries, wildlife and the production of wood fiber for personal and commercial uses. Properly applied silvicultural practices as well as fuels and fire management on the Forest can maintain the forest diversity needed to provide the range of amenities, wildlife habitats and products available in the forest for now and in the future.

Treatment objectives may include one or a number of the following: fuel reduction, fire protection, protection of high-value residual trees and scenic quality, personal or commercial use forest products, commercial use forest restoration of a forest cover on severely impacted sites, and maintaining or enhancing wildlife habitat.

FOREST HEALTH

A. Natural Plant Succession (No Treatment)
B. Vegetation Manipulation
1. Silvicultural System
a. Even-aged
Regeneration Methods
a. Clearcut
i. Stand
ii. Patch
b. Shelterwood

c. Intermediate Treatments
i. Thinning
ii. Pruning
iii. Fertilization
b. Uneven-aged
a. Selection
i. Group Selection
ii. Individual Tree Selection

2. Site Preparation Methods
a. Logging (Require Summer logging)
b. Prescribed Fire
c. Mechanical
d. Chemical (Herbicides)

3. Reforestation /Re-Vegetation Methods
a. Natural Regeneration (seed, coppice, stump sprouts)
b. Natural w/partial plant
c. Full Plant
d. Seeding

FUELS TREATMENT

Treatment of hazardous levels of fuels is the most pro-active method of breaking the fire behavior triangle of fuels, weather and topography. Weather and topography cannot be modified. Methods which deny a fire's access to continuous fuels, or modify existing fuel loading in such a manner that what remains is less flammable, or burns with reduced intensity, will reduce the resistance to control of a wildfire, and reduce the ultimate costs of fire suppression. Stands can be replaced with less flammable species. Fuel treatment methods are expensive. Site specific fuels prescriptions are designed to produce maximum cost effectiveness for the results they are expected to provide. Fuels treatment where appropriate has **always** been found to be more cost effective than fire suppression, and more acceptable than living with adverse resource impacts of either a wildfire, or a wildfire suppression effort, or both.

Natural fuels are those which build up through natural processes. Activity fuels are those which accumulate as a by-product of management activity. Natural and activity fuels treatment projects have, and are taking place on the Seward Ranger District.

The array of fuels treatment options for natural fuels is identical to that of activity fuels. The level of effectiveness, cost, and number of acres treated over time can measure differences. Access and treatment type determines ultimate cost. If access is not present, another less effective form of fuels treatment may have to be substituted to keep the project cost effective.

The major difference between treatment of natural versus activity fuels on the Kenai Peninsula is that **lack of access restricts treatment of most natural fuels to only the fine fuels**. The large diameter boles, which will later come down and be available to contribute to high fire intensity levels and resistance to control, are not treated.

Under burning natural live stands, a highly viable and effective method of fuels treatment in a number of areas in the continental U.S., is not effective in Alaska where all tree species have thin bark and would be killed by the passage of fire. However, if a stand is already dead, under-burning the stand could be an option.

1. Fuels Treatment in Natural Stands

a. Fire Breaks

Firebreaks are planned fire control lines installed prior to an actual fire. They are useful in areas with flashy fuels like blue-joint reedgrass which are subject to short interval fires and are generally one or two dozer blade widths wide, cut to mineral soil and located on topographic features which assist in reducing the spread of fire. While effective, they can have a high degree of required maintenance. On steeper terrain, they can create erosion problems unless mitigation measures, like water bars are employed. Generally, fire breaks are not recommended for the eastern Kenai Peninsula, as the fire return interval in this area has been historically long-term and would not justify the initial and long-term maintenance expense. Firebreaks are a viable option to provide fire protection for any community in forested areas subject to frequent wildfires. In Cooper Landing, where human-caused fires are more frequent and blue-joint reedgrass has increased significantly since the start of the SBB epidemic. Firebreaks were installed in 1990, just prior to the Pothole Lake Fire in 1991 which was a serious threat to the community before weather conditions changed the behavior of the fire.

b. Shaded Fuel Breaks

Shaded fuel breaks are areas where fuels have been removed to slow the spread of ground fire. Trees have been removed to make the canopy discontinuous and not conducive to crown fire. Piling and burning generally accomplish fuel removal. Standing dead trees are dropped and dead and down fuels are piled. The limbs of remaining live trees are removed up to 12-14 feet in height in order to remove ladder fuels and keep fire on the ground. Dense stands of live trees are thinned to make a discontinuous canopy. Sufficient live trees need to be retained to provide shade, which maintains lower surface temperatures and higher fuel moistures. Discontinuous canopies also allow aerial retardant application to be more effective.

Low live brush is also removed. **Fuel breaks do not stop fires, they merely slow them down long enough to allow hand crews time to establish control lines within the fuel break**. Minimum standards for effective shaded fuel breaks are 300 feet wide. Fuel breaks are a viable option to provide fire protection for any community in forested areas subject to periodic wildfires. The projected beetle kill in the Moose Pass area makes utilization of shaded fuel breaks a reasonable option. Opening the canopy will also increase sunlight, which can have the negative consequence of stimulating growth and spread of Calamagrostis canadensis, a fine flashy grass fuel. Planting fuel breaks with hardwoods, or a less flammable species of native grasses which competes with blue-joint reedgrass (Calamagrostis canadensis) might be an option.

c. Isolation

Isolation consists of allowing nature to reduce hazardous levels of natural or activity fuels through the process of decomposition. Crushing by snow pack, and high rainfall and moist conditions assist the process. This is normally acceptable where the hazard rating is borderline, potentially short term, or where other fuel treatment methods are not cost effective. Breaking large blocks of continuous fuels into smaller more manageable areas with firebreaks can also assist isolation or fuel breaks. Since lightning ignition of fires on the eastern half of the Kenai Peninsula is uncommon, isolation would be a viable fuels treatment alternative in some mixed conifer stands in the on the Kenai beyond 1/4 to 1/2 mile from roads and trails. Due to the risk of ignition by humans, isolation of areas within 1/4 mile of access routes would be impractical. Isolation is the cheapest fuels treatment option in the short term, but is a gamble with associated risks, and can become an expensive mistake in the long-term if exposed to an ignition source.

d. Prescribed Burning of Natural Fuels.

Burning SBB infested and dead spruce stands will remove fine fuels in the crowns of standing timber, reduce quantities of dead and down fuels on the ground, and expose areas to mineral soil for seed beds, providing the prescribed fire is of sufficiently high intensity. Low intensity prescribed fires can remove competition and contribute to the spread of blue-joint reedgrass (Calamagrostis canadensis). There is no fire tolerant, or fire resistant tree species on the Kenai Peninsula. All species present are thin-barked, and live tree mortality can be expected to be 100% when in direct contact with fire for more than short duration. This would include all remaining small diameter spruce that have not been attacked by bark beetles.

Prescribed burning of conifer stands should result in reducing the potential for high intensity wildfires for several years, and would also be expected to induce hardwood growth on the site, providing increased big game browse. Hardwoods within the stands will also suffer 100% tree mortality, but moderate-burning conditions can stimulate new hardwood growth by basal sprouting. Decadent hardwood stands resist basal sprouting from fire.

Burning natural stands is a viable option. However, the risk of an escaped prescribed fire also has to be considered. The cost of a prescribed fire, including measures taken to maintain control, must also be worth the projected return in terms of fireproofing the stand and other benefits. When considering burning stands of live beetle infected spruce for the purpose of insect control; the risk of failure by not completing the burn prior to the spring flight must be considered. Fire season and prescribed fire season occur during the same months on the Kenai Peninsula. Some years are simply too wet to burn and achieve acceptable results. Some years rapidly become too dry to accept the risk of escaped prescribed fires. Large acres projected to be burned produce large volumes of smoke. Opportunities to burn can be reduced by smoke management constraints.

One potential disadvantage of burning standing dead trees, is that the boles will not consume except under extreme burning conditions, and will eventually make it to the ground in jackstraws. This can increase the potential resistance to control of any later wildfires within the area. Jack-strawed timber also inhibits the movement of big game animals.

2. Fuels Treatment in Activity Fuels (logging)

Activity fuels are those fuels generated by logging or management activity. Logging systems on the Kenai Peninsula are most often ground-based systems using machinery. Tree boles are removed; leaving only unmerchantable tops and branches (slash) behind, or are full tree yarded to the landing, leaving behind only breakage and pre-existing fuels. Slash is dealt with at the landing.

Pre-existing fuels and the majority of slash normally remains on the site, with some being removed to the landing. Without further treatment, the remaining slash constitutes high hazard fuels for the local site. Removal of dead spruce tree boles would reduce the potential intensity of any fire within a local area, as well as spotting potential and resistance to fire suppression efforts. Removal or reduction of the 0-3 inch size class fuels reduces the highest potential for increased fire intensity and decreases its rate of spread.

The cumulative effect of logging large discontinuous areas without doing slash treatment has consistently shown that fire starts spread rapidly in slash through aerial spotting from untreated areas, increasing fire size and suppression complexity and cost. One fire of a specific size has less perimeter to hold, requiring less people and equipment, than five fires of the same total acreage. In the long term, fuels treatment always proves cheaper and more effective than fire suppression. Fire starts in treated fuels have low rates of spread and low intensities, which are easily dealt with by initial attack fire crews.

Logging and slash treatment can mitigate some of the potential for major wildfires on the Kenai, by providing areas where fires would slow down and decrease intensity, and be stopped more readily by fire crews and equipment. Scarification through logging can provide seed beds, promoting new growth of hardwoods, and providing shade and live fuel moisture which slows rates of fire spread. Roadbeds and skid trails created by logging, whether permanent or temporary can provide fire breaks where fire suppression efforts can be anchored.

If blue-joint reedgrass (Calamagrostis canadensis) is found in every square meter in the understory prior to logging, there will be rapid spread when the stand is harvested unless clones are killed using herbicides or a deep burn. Alternatively, the shade provided by a natural canopy may inhibit the grass sufficiently to allow spruce seedlings to establish.

If grass is not abundant in the understory, we recommend (1) minimizing forest floor disturbance to reduce sites for grass colonization or (2) a slash burn with the hope of encouraging colonization by herbaceous species that have less impact on conifer seedlings." (USDA-Forest Service 2/1999)

a. Winter logging and treatment

Winter logging has the advantage of being able to remove overstory timber without damage to sensitive features or advanced regeneration, but has the disadvantage of leaving untreated pre-existing fuels below the snow, and does not allow scarification, which prepares a seedbed for natural regeneration of hardwoods and conifers. This makes the site more difficult to reforest.

b. Summer logging and treatment

On appropriate drier sites, summer logging has the advantage of being able to treat all available fuels in addition to providing site scarification (mineral soil disturbance) for seedbed preparation as part of the logging operation. Disadvantages include potential negative impacts on sensitive plants, soils, and cultural sites which would be unacceptable.

c. Chipping

Slash less than 3 inches in diameter can contribute to fire spread. Green slash < than 3 inches in diameter can provide host material for Ipps. beetle outbreaks while green slash greater than 3 inches in diameter can provide host material for spruce bark beetles and both can kill residual live spruce trees. Chipping mitigates these situations. Chipping of slash on site or whole tree yarding and chipping slash at the landings are viable options where designated units are accessible to mechanized equipment.

Chipping disadvantages include cost; chip piles can ignite (spontaneous combustion) and piles of chips, or chips spread too thick will also insulate the soil, making it a colder site and inhibiting tree growth. Slash that has been chipped must be spread and where possible, mixed with mineral soil to speed up decomposition of the chipped material.

d. Lop and Scatter
Small diameter material is cut in short pieces, laid directly on the ground and concentrations scattered. Slash is later crushed to the ground by winter snow levels and naturally decomposes over time.

From a combined fire and silvicultural standpoint, lop and scatter is a viable option under the following conditions:

- most down material is less than 3 inches in diameter,
- the material is not spruce or there are no residual spruce trees left in the stand,
- the total amount of dead and down material is discontinuous or in small enough quantities that projected fire spread would be low.

Lop and scatter is largely ineffective in dense natural stands, but can be effective in activity (logging) fuels where slash concentrations are small and discontinuous.

e. Piling and Burning
Piling and burning of activity fuels should be considered a highly practical option for fuels treatment. Whether piled by machine or hand, as long as the piles have been covered, they can be burned outside of normal fire season when risk of escape is minimal. There is also sufficient opportunity to burn them prior to a spring flight of bark beetles, with less projected constraints in terms of smoke management. Machine piling and covering should be considered as one of the most economical forms of fuel treatment in terms of cost per acre, with the least associated risk of unacceptable results. Hand piling and covering, while the most practical form of fuel treatment for some locations, is also the most expensive form of fuel treatment in terms of cost per acre, as it is the most labor intensive option. Burning piles concentrate sufficient heat to expose mineral soil and discourage the growth of blue-joint grass. They provide open sites for planting trees and natural regeneration. One major advantage of piling and burning is that residual small diameter spruce currently unaffected by bark beetle can be retained.

Leaving a limited number of piles per acre without burning has little impact on overall fuels treatment objectives, and has definite benefit for some wildlife species. However, piles retained for wildlife purposes should not contain spruce host material for Ipps. beetles or bark beetles if residual sapling and larger spruce are retained in the stand and locations should not be in close proximity to human travel routes.

f. Broadcast Burning of Activity Fuels.
Broadcast burning of activity fuels removes the 0-3 inch size class fuels. These are the fuels that contribute to rate of spread and intensity. Broadcast burning also allows more overall control. The ability to achieve acceptable results is more predictable than when burning standing timber. Techniques are more refined, research has been completed, and spotting is less likely. Fire intensities in continuous slash can be manipulated to remain high enough to discourage the growth of blue-joint grass, while still retaining a necessary lower duff layer, and quantities of large diameter fuels necessary for long term site productivity and wildlife needs. Risk of escape is more easily mitigated than with burning natural stands.

Wildlife Habitat Improvement

Prescribed Burning

The Forest Service utilizes prescribed fire for 4 major purposes:

- forest health
- site preparation for reforestation

- fuels management
- wildlife management.

Prescribed fire projects on the Forest are broken down into:

- hand or machine piled fuels ignited by hand, or
- large areas of natural fuels ignited by hand or by one of 2 aerial ignition systems.

Fuels are piled by hand, covered to keep moisture out, and allowed to dry during most of the summer months. They are burned in the later part of September through the early part of October during the fall rains, or in the early spring during wet conditions when fire escapes requiring suppression action are least likely to occur. Hand piling and burning though it may be the most effective form of fuels treatment for some areas, is the slowest most labor intensive and least cost effective form of fuels treatment that can be implemented.

Fuels, including decks and landings from timber sale operations, are piled by machine, covered to keep moisture out, allowed to dry during the summer months, and then ignited by hand during the fall. Machine piles hold a higher risk of fire escape. Machine piled fuels can be inadvertently buried under dirt during the piling operations. When burned, the piles may hold fire smoldering underground for long periods before it resurfaces, requiring suppression actions. Machine piles are only burned during the wet months in the fall or after the first snows. **Machine piling is generally the most cost-effective form of fuels treatment where soil compaction is not a problem, or when contracts permit piling on snow or frozen ground.** Machine piling is also limited to slopes up to 25%.

The burning of piled fuels still has a potential for escape during high winds, but at the time of year burned, consequences are generally minimal.

Broad scale ignition of fuels can provide the most acres burned with the least cost per acre depending upon location and requirements for protection from escape. Control lines may consist of natural barriers, hand dug firelines, hoselays, or combinations of all. The use of hand firelines and hoselays is labor intensive and expensive to install and to remove, especially considering the dollars available to the program, or the workforce available to implement it.

Hand ignition of fuels is labor intensive, and usually used on small areas or portions of areas that require greater control to prevent escapes with potential threats to life, property or higher resource values. It requires a number of people to light, to hold, and to mop up. The number of acres burned is limited by the physical capability of the people involved on the day of ignition. Small units are burned and held more cost effectively and with greater control by hand ignition than by aerial ignition.

Aerial ignition can burn large areas faster and more cost effectively than other methods. It can also rapidly generate too much fire, so has to be used with discretion. Aerial ignition can take place utilizing the helitorch, which is a machine slung under a helicopter which drops streams of burning gel, or the Primo Mk III Ping Pong Ball machine. The Primo Mk III is a machine, which sits inside a helicopter and injects glycol into a plastic sphere, which is dropped from the aircraft. The sphere undergoes an exothermic reaction and ignites 20 seconds after injected.

The Forest owns 2 helitorches, and has not used either for fuels treatment since prior to 1991. A helitorch is the most efficient tool used to burn slash in clearcuts on steep slopes without escape. It also requires short turn around times to be efficient and cost effective, and a trained and certified ground crew. The Forest does not have a trained/certified helitorch ground crew. Helitorch use has a higher potential for accidents during operation, with an increased risk of fire and potential exposure to the mixing crew by hazardous materials. Gasoline is mixed with powdered hogfat and synthesizers to make gel. Some of the powders used are potentially hazardous to the mixing crew, so personal protective equipment must be used. Helitorch use is more expensive than the Primo Mk II due to increased helicopter flight time. The aircraft must return to the helispot every 10-15 minutes for more gel. The advantage of using this machine as an ignition source is only when the fine fuels can be forced to burn under conditions, which would normally not sustain burning. When fuels are dry enough to burn on their own from any ignition source, the Primo Mk III is a safer more cost efficient tool.

The Forest owns one Primo Mk III Ping-Pong ball machine, and has 1 certified operator. Two more operators are expected to be certified by the close of the 1999 field season. Almost all aerial ignitions on the Forest will be implemented by Primo Mk III.

Smoke management is a consideration in any prescribed burning. The State Department of Environmental Conservation (DEC) is responsible for regulations and issuing permits to ensure that prescribed fires do not create a health hazard or public nuisance. Open burning of 40 acres or more in one location requires a permit. The Chugach NF provides copies of burn plans to the DEC as part of the request for a permit. We also request smoke column dispersion information from the National Weather Service prior to burning. If the generated number indicates poor smoke dispersion, the burn is cancelled. If the number indicates good smoke dispersion, the DEC is notified and the burn takes place. The responsibility for meeting air quality standards and a go/no-go decision on burning belongs to the implementing party. Test fires are mandatory, and if site specific conditions are such that smoke dispersion is inadequate at that locality, the burn will be shut down and the test fire extinguished. Burning may also be shut down when an air quality advisory is issued by the DEC. In general, most burns on the eastern half of the Kenai Peninsula pose little smoke risk to the local communities. Cooper Landing and Moose Pass have some risk from inversions occurring when burns take place in close proximity to large bodies of water. Under most situations, smoke columns are removed by transport winds from the southwest.

APPENDIX D

FIRE SUPPRESSION CAPABILITIES

FIRE SUPPRESSION CAPABILITIES

Regardless of the fire protection designation, or the appropriate suppression response chosen, protection of life and property will always be the first priority of fire suppression efforts. Should weather or fire situations change any new threat to life and property will take precedence over a wildland fire suppression effort. With a limited number of fire suppression people and equipment immediately available on the Kenai Peninsula, this could well mean that during the initial attack phase, firefighters would respond to structure protection. Wildfire suppression would have to wait. The fire would grow and spread until additional resources arrived. Once a fire has gone beyond the capabilities of the initial attack fire crews, full transition to a Class II or Class I Fire Overhead Team could take 24 hours, with full implementation of a large fire suppression strategy taking an additional 24 hours.

Current initial attack fire suppression capabilities on the Kenai Peninsula have been adequate to date. They have often been called upon to deal with more than one fire per day or several fires concurrently. Fires on the West half of the Kenai Peninsula have historically been larger, as they originated in black spruce, which is a more volatile fuel than found in the higher elevations of the eastern half. Black spruce can have fire behavior similar to California Chaparral. The West half of the Kenai Peninsula also has a history of periodic lightning fires.

1. State

During fire season, the State of Alaska Department of Forestry fields two-250 gallon engines at Soldotna staffed by 2 people each, an additional 500 gallon slip on unit at Soldotna staffed during periods of high fire danger, one-250 gallon engine at Homer staffed by 2 people, an additional 500 gallon slip on unit at Homer staffed during periods of high fire danger, and an initial attack helicopter and 2 person crew also stationed at Soldotna. Units at Homer would be unlikely to be used in the Moose pass area, but could be used to cover the State protection areas while Soldotna forces are moved.

State Initial attack resources and budgets are projected to increase on the Peninsula based on recommendations in the Spruce Bark Beetle Task Force Report. A 100 person fire cache (fire support equipment) is available at Soldotna. The Department of Forestry can also field up to 50 Emergency Firefighters on the Kenai Peninsula within 24 hours. Wildfire Dispatch for both the State Department of Forestry and the Seward Ranger District are coordinated at the Department of Forestry office in Soldotna. Air tankers with retardant are available at Palmer and Fairbanks. A retardant mixing base exists in Palmer.

2. Federal

a. Chugach National Forest

The Seward Ranger District field’s 7 initial attack firefighters dedicated specifically to fire suppression during the average 150-day annual fire season. Each works 4, ten-hour days per week due to extended Alaska daylight, and staff one-200 gallon engine with a (WEPS) Water Expansion Foam System and one-75 gallon engine with a slip on unit. A 120 person fire cache (fire support equipment) is available at Kenai Lake Work Center. Under normal fire weather conditions, 3-4 firefighters are on duty on any given day, and additional people are brought on when the fire danger climbs.

Funding for the Fire Crew is based on the National Fire Management Analysis System (NFMAS), programmed for the Seward RD. NFMAS is a National fire suppression budgeting system approved by Congress separate from other federal budgets, and is based on the District's most efficient level of initial attack. It is designed to allow congressional approval of Fire budgets 2 years in advance. It is unlikely that Seward's normal fire budget will allow increased personnel beyond its present capabilities unless the

District has significant increased numbers of fires and acres burned on Federal land. In fact, Federal staffing is projected to decrease. A fire analysis of the North Kenai assessment area in 1995 for the previous 10 years indicated that 58% of all fires within Forest Service protection were on State and private lands. This may well result in an increase in State protection in the area. Severity funding is available to hire more firefighters if the fire season becomes unusually severe. Additional trained firefighters are available from the Seward and Glacier Ranger Districts within 1-3 hours, and from the Cordova Ranger District within 3-5 hours. The Forest Service also partially funds the Alaska Dept. of Natural Resources initial attack fire helicopter at Soldotna, and the air tanker stationed at Palmer.

b. Kenai Fiords National Park

Kenai Fiords National Park has no fire suppression equipment, and no designated firefighters. A limited number of people are available for wildfire suppression by request only. Responsibility for fire suppression within the Park resides by interagency agreement with the Chugach National Forest.

c. Kenai National Wildlife Refuge

Kenai National Wildlife Refuge has some fire suppression equipment used for prescribed fire, and a limited number of people available for wildfire suppression; available by request only. Responsibility for fire suppression within the Refuge resides by interagency agreement with the State Department of Forestry.

3. Community Fire Departments

Several local communities have developed Volunteer Fire Departments for structural fire protection. All listed are currently under agreement with the Chugach National Forest, Seward Ranger District, to provide additional initial attack on wildland fires on State, Private and Federal land within their response areas. All listed are also potentially available for response upon request by the Forest Service. Due to the need to provide structural fire protection to their respective communities, not all equipment and personnel could be made available at one time. Response times vary. Many volunteers work in areas outside their local community and commute over long distances.

a. Bear Creek Volunteer Fire Department

The Bear Creek Volunteer Fire Department could potentially field on request, one-250 gallon engine, one-300 gallon engine, one-500 gallon engine, three-2,000 gallon engines, one-3,000 gallon engine, and 20 firefighters.

b. Cooper Landing Volunteer Fire Department

The Cooper Landing Volunteer Fire Department could potentially field on request, one-250 gallon engine, two-2,500 gallon engines, two support vehicles and 12 firefighters.

c. Girdwood Fire Department

The Girdwood Fire Department could potentially field on request, three-1,750 gallon engines, and 12 firefighters.

d. Moose Pass Volunteer Fire Department

The Moose Pass Volunteer Fire Department could potentially field on request, one-250 gallon engine, one-500 gallon engine, one-1,000 gallon engine, one-2,000 gallon engine and 13 firefighters.

APPENDIX E

REFERENCES

CITED

REFERENCES CITED

Alaska Interagency Fire Management Council, Managing Wild Fire In Alaska...and smoke too, brochure, no date.

Alaska Department of Natural Resources. 1997. Spruce beetle activity and potential wildland fire hazards in south-central Alaska. March 1997. Alaska Department of Natural Resources, Division of Forestry. Unpubl.

Alaska Interagency Wildland Fire Coordinating Group. October 1998. Alaska Interagency Fire Management Plan. Amended October, 1998.

Beshta, R.L. 1998. Forest hydrology in the Pacific Northwest: additional research needs. J. Amer. Water Resour. Assoc. 34:729-741.

Black, M. C. 1995. North Kenai Fire/Fuels/Air Resource Report, USDA Forest Service. Region 10. Chugach National Forest. Seward Ranger District. Unpubl.

Blanchet, D. 1993. Fire History on the Kenai Peninsula Portion of the Chugach National Forest, 1914-1986. Unpubl. Draft.

Bryden, W. 1996. Primrose/Snow River Marbled Murrelet Survey. USDA Forest Service. Chugach National Forest. Seward Ranger District. Seward, Alaska. Letter on file.

Collins, W.B. 1996. Wildlife habitat enhancement in the Matanuska and Susitna River valleys. Final Research Report Study 1.44. Alaska Dept. Fish and Game. Juneau AK. 52 p.

Daniel, T.C., B. Orland, J. Hetherington, and J.L. Paschke. 1991. Public perception and attitudes regarding spruce bark beetle damage to forest resources on the Chugach National Forest, Alaska. Final Report to the USDA Forest Service, Forest Pest Management, Region 10, Anchorage, Alaska.

Densmore, R.V. and J.C. Page. 1992. Paper birch regeneration on scarified logged areas in south-central Alaska. North. J. Appl. For. 9(2):63-66.

Holsten, E.H. 1990. Spruce beetle activity in Alaska: 1920-1989. USDA Forest Service Alaska Region, FPM. Tech. Rep.:R10-90-18. 28 p.

Holsten, E. H., R. A. Werner, and R. L. DeVelice. 1995. Effects of a spruce bark beetle (Coleoptera: Scolytidae) outbreak and fire on Lutz spruce in Alaska. Environ. Entomol. 24(6): 1539-1547.

Fox, J. 1980. Forest regeneration of upland areas following logging in interior Alaska. Agroborealis. 2: 31-34.

Kenai Peninsula Borough. 1998. An Action Plan for Rehabilitation in Response to Alaska's Spruce Bark Beetle Infestation - A Model for Alaska. Kenai Peninsula Spruce Bark Beetle Task Force, Soldotna, Alaska.

Lutz, H. J., History Of The Early Occurrence Of Moose On The KenaiPeninsula And Other Sections Of Alaska, Misc. Publ. No. 1. Alaska For. Res. Center, USDA Forest Service, 1960.

Newton, M., Cole, E.C. 1990. Vegetation Management in the Rehabilitation of the Cooper Landing Beetle Outbreak Area. USDA Forest Service Region 10. Chugach NF, SewardRD. Unpubl.

Nienstadt, H. and J.C. Zasada. 1990. *Picea glauca*. pp. 204-226. *In*: (Burns, R.M. and B.H. Honkala, tech. coords.) Silvics of North America: 1. Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.

Packee, E.C. 1990. White spruce regeneration on a blade-scarified Alaskan loess soil. North. J. Appl. For. 7:121-123.

Perala, D.A. 1990. *Populus tremuloides*. pp.555-569. *In*: (Burns, R.M. and B.H. Honkala, tech. coords.) Silvics of North America: 2, Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington D.C.

Potkin, M. 1997. Fire history disturbance study on the Kenai Peninsula mountainous portion of the Chugach National Forest. DRAFT unpublished report. USDA For. Serv., Chugach National Forest, Anchorage, Alaska.

Potts, D.F. 1984. Hydrologic impacts of a large-scale mountain pine beetle (*Dendroctonus ponderosae* Hopkins) epidemic. Water Resour. Bull. 20:373-377.

Reed, Les, Realizing the Potential of Alaska's Forest Resources, State of Alaska Dept of Natural Resources, 1993.

Reynolds, R.T., Meslow, E.C., Wight, H.M. 1982. Nesting habitat of coexisting accipiter in Oregon. Journal of Wildlife Management. 46:124-138.

Ross, Darrel W., Ph.D., A Research and Development Problem Analysis to Support the South-central Alaskan Forest Health Initiative, DRAFT, October, 1998.

Rouncaville, M. 1993. Fuels Analysis of the Seward Ranger District. USDA Forest Service. Region 10. Chugach National Forest. Seward Ranger District. Unpubl.

Safford, L.O., J.C. Bjorkbom, and J.C. Zasada. 1990. Betula papyrifera Marsh. Paper Birch. p. 158-171. *In*: (Burns, R.M. and B.H. Honkala, tech. coords.) Silvics of North America: 2, Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington D.C.

Schulz, B. 1995. Changes over time in fuel loading associated with spruce bark beetle-impacted stands of the Kenai Peninsula, Alaska. USDA For. Serv., Forest Health Management, Region 10, Technical Report R10-TP-53.

Schulz, B. 1996. Response of residual spruce in beetle-impacted stands in Resurreection Creek drainage, Kenai Peninsula, Alaska. USDA For. Serv., Forest Health Management, Region 10, Technical Report R10-TP-62.

Schulz, B. 1997. Cooper Landing regeneration surveys – preliminary results. USDA For. Serv., Forest Health Management, Region 10, Specical Report R10-TP-66.

Sedell, J.R., P.A. Bisson, F.J., and S.V. Gregory. 1988. What we know about large trees that fall into streams and rivers, pp. 47-81. In C. Maser et al. (eds.), From the forest to the sea: a story of fallen trees, USDA For. Serv. Gen. Tech. Rep. PNW-GTR-229.

See, J. 1990. Cooper Landing Spruce Beetle Fire Behavior Analysis. USDA Forest Service, Chugach NF, Seward RD, Cooper Landing Cooperative Project Environmental Assessment.

Shuster, W.C. 1980. Northern Goshawk Nest Site Requirements. USDA Forest Service. Chugach National Forest. Seward Ranger District. Unpulb. Report 11:89-96.

Spraker, T. 1999. Personal communication. Alaska Department of Fish and Game.

State of Alaska Department of Environmental Conservation. 1998. Open Burning Policy and Guidelines, September, 1998.

State of Alaska Department of Natural Resources. 1992. Burn Permit Program Need Analysis For The Cooper Landing Area, April, 1992.

State of Alaska Department of Natural Resources. 1993. Kenai Peninsula Spruce Beetle Wildland Fire Consequences.

State of Alaska Department of Natural Resources. 1998. Kenai Peninsula Spruce Beetle Epidemic Fire Danger/Behavior Status Report, January, 1998.

USDA Forest Service. 1970. Handbook 360, Fire Weather.

USDA Forest Service. 1978. Effects of Fire on Flora.

USDA Forest Service. 1984. Chugach National Forest Land and Resource Management Plan. USDA Forest Service. Region 10. Chugach National Forest.

USDA Forest Service. 1987. Timberland Resources of the Kenai Peninsula, Alaska, 1987. USDA For. Serv., Pacific Northwest Research Station, Resource Bulletin PWN-RB-180. November 1991.

USDA Forest Service. 1990. Cooper Landing Cooperative Project Environmental Assessment. USDA Forest Service. Region 10. Chugach National Forest. Seward Ranger District.

USDA Forest Service. 1993. Fire Effects Information System for: Bluejoint Reedgrass.

USDA Forest Service. 1995. Forest Service Manual 5100, Fire Management.

USDA Forest Service. 1996. Moose Pass Cooperative Project Environmental Assessment. USDA Forest Service. Region 10. Chugach National Forest. Seward Ranger District.

USDA Forest Service. 1998. Forest Health Protection Report, Forest Insect and Disease Conditions In Alaska---1998, USDA For. Serv., Forest Health Management, Region 10, Technical Report R10-TP-74.

USDA Forest Service. 1999. Briefing Paper FY2000 Budget Request, Hazardous Fuel Reduction, February, 1999. USDA Forest Service. Region 10. Chugach National Forest. Unpubl.

Wagner, R.G. and J.C. Zasada. 1991. Integrating plant autecology and silvicultural activities to prevent forest vegetation management problems. For. Chron. 67:506-513.

Werner, R.A. 1982, The Spruce Beetle in Alaska Forestry.

Lyons, J. 1997. Testimony Before the Committee on Agriculture, U.S. House of Representatives Concerning Management of the National Forest System in the Pacific Northwest. January 16, 1997.

University of Alaska Anchorage. 1991. Managing beetle-killed spruce on the Kenai Peninsula. Institute of Social and Economic Research, University of Alaska Anchorage, Research Summary No. 51.

Vanderlinden, L. 1991. Fire behavior considerations for Cooper Landing Contingency Plan. In Pot Hole Lake Fire Contingency Plan, June 3, 1991. Alaska Interagency Type 1 Incident Management Team. Unpubl.

Veireck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 278 p.

Weixelman, D. 1987. Prescribed burning for moose habitat improvement on the Chugach National Forest, Alaska. USDA Forest Service. Region 10. Technical Report R10-MB-38.

Zasada, J.C. 1972. Guidelines for obtaining natural regeneration of white spruce in Alaska. USDA For. Serv., Pacific Northwest Forest and Range Experiment Station, Portland, OR.

APPENDIX F

GIS MAPS
(GEOGRAPHIC INFORMATION SYSTEM)

Map # 1 – Shaded Relief Map of Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 2 - Forest Cover Type Map of Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 3 – Forest Vegetation Subject to Spruce Bark Beetle Infestation in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 4 – Forest Vegetation Not Subject to Spruce Bark Beetle Infestation in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 5 - Spruce Bark Beetle Infestation Spread Over Forest from Years 1976-1998, Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 6 - Fuel Models for Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 7 - Wildfire Occurrences 1989-1998 for Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 8 - Alaska Interagency Wildland Fire Protection Levels for Kenai Peninsula Watershed Associations, Chugach National Forest,

MAP # 9 – Forest Vegetation Subject to Spruce Bark Beetle Infestation within 100 foot Stream and Lake Riparian Zones in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 10 – Forest Vegetation Subject to Spruce Bark Beetle Infestation within 50 and 100 foot Utility, Trail and Road Corridors in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 11 – Forest Vegetation Subject to Spruce Bark Beetle Infestation within _ and 1 mile zones of the Seward National Scenic Byway in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 12 – Vegetation Subject to Spruce Bark Beetle Infestation within 500 feet of Forest Service Cabins and within _ mile of Forest Service Campgrounds in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 13 – Vegetation Subject to Spruce Bark Beetle Infestation within _ and 1 mile of Urban/Interface Boundaries in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 14 – Opportunities for Personal and Commercial Forest Products Use of Forest Vegetation Susceptible to Spruce Bark Beetle Infestation within zones of 100 feet, _ mile, _ mile and greater than _ mile from existing roads in Kenai Peninsula Watershed Associations, Chugach National Forest

MAP # 15 – Opportunities for Improving Moose Habitat in Forest Vegetation Located more than _ mile from the Highway System in Kenai Peninsula Watershed Associations, Chugach National Forest