Chapter 3
Environment and Effects

Introduction

This chapter describes the existing environmental conditions of the areas affected by the Proposed Action and alternatives. The information in this chapter serves as the basis for the comparison of alternatives presented in Chapter 2. Each resource potentially affected by the Proposed Action or alternatives is described by its current condition. The effects of the Proposed Action and alternatives on the environment are also described for each resource. Analyses that are specifically required by policy and law are included at the end of the chapter.

This chapter specifically addresses three significant issues identified during the scoping process. These issues are:

Helicopter use is divided into two categories: 1) flights associated with landings to access inventory plots; and 2) overflights that are associated with scouting safe routes for hiking access where no landings take place.

Wilderness-The use and noise from helicopters accessing plots and other forms of access and inventory activity could compromise the area's wilderness character and visitor experience. The units of measure are the number or amount of helicopter flights and person days.

Wildlife-The noise from helicopters accessing plots and other forms of access and inventory activity could affect wildlife. The units of measure are the number of helicopter flights and person days.

Safety-Accessing all the sites on foot would require field crews to carry additional equipment over a longer period and exposes field crews to potential injury while traveling in the steep, wet terrain with heavy packs. The units of measure are helicopter flights and person days.

The data and level of analysis used in this FEIS were commensurate with the importance of the possible impacts (40 CFR 1502.15). When assessing the level of information needed, the interdisciplinary team took one of two approaches: 1) they collected the additional information or conducted the analyses necessary to identify important relationships; or 2) they concluded that, although the additional information would have added precision to estimates or better specified a relationship, the basic data and central relationships are sufficiently well established in the respective sciences that more information would be very unlikely to reverse or nullify understood relationships. Thus, the information in

the FEIS was determined to be sufficient for a reasoned choice among the alternatives.

This chapter also addresses the environmental consequences on other relevant resources that are not associated with a significant issue (e.g., invasive species and heritage resources). Definitions of effects to all the resources can be found in Chapter 2 and in each resource discussion that occurs in this chapter.

The Planning Record is available for review at the Regional Office in Juneau, Alaska.

The discussions of current conditions and potential effects use existing information included in the Chugach and Tongass Forest Plan FEIS, project specific resource reports, agency and scientific studies, and other related information. The planning record for the FIA EIS includes all project-specific information, including resource reports, documentation of field investigations, and information from public involvement. The planning record is located at the Regional Office in Juneau, Alaska. Information from the record is available for review upon request during regular business hours.

Affected Environment and Environmental Consequences

With the help of the public and other agencies, we identified three significant issues to be examined in detail for the proposed project (wilderness, wildlife, and safety). In the following sections, we describe the environmental effects of each of our alternatives as they relate to these three issues. Other resources for which significant effects may occur are also discussed in this chapter.

NEPA and its implementing regulations (40 CFR 1500-1508) require the Forest Service to consider the effects of their actions on the environment. This analysis describes current environmental conditions and describes how the Proposed Action and alternatives will change or affect these conditions.

Wilderness

The action alternatives analyze access to the FIA plots within the wilderness areas of the Alaska Region through a variety of means, including boats, day hiking, overnight camping, base camps, helicopters, and floatplanes. This analysis examines the effects of the Proposed Action and alternatives on visitor experience and the four wilderness character qualities.

These alternatives can affect the wilderness character and visitor experience in the following ways:

- The disturbance from inventory crews hiking to plots and camping
- The noise and visual disturbance from helicopter and fixed-wing use
- The disturbance from using boats and skiffs

Wilderness Affected Environment

The 5.8 million acres of wilderness within Alaska's Tongass National Forest and the 2.0 million acres of the wilderness study area on the Chugach National Forest offer superb opportunities to enjoy extensive undeveloped natural environments. For many people, these areas are places to pursue wildland recreation, subsistence, and other wildland-dependent activities.

The Wilderness Act of 1964 mandates that "each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area (Section 4(b))." Section 2(c) defines wilderness:

> A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Wilderness access is restricted by regulations, policy, and manual direction. In the Alaska Region, there are exceptions to motorized access in wilderness that are authorized under the Alaska National Interest Lands Conservation Act (ANILCA) of 1980. In ANILCA, Congress reaffirmed and expanded upon the purposes of wilderness as stated in the 1964 Wilderness Act, specifically for

wilderness established in Alaska. With the passage of ANILCA, however, Congress did not modify the basic provisions of the 1964 Wilderness Act (Hendee and Dawson 2002), the definition of wilderness, or the mandate to preserve wilderness character.

Section 1110(a) in ANILCA requires that:

> … the Secretary "shall permit" on conservation system units,…and those public lands designated as wilderness study, the use of snowmachines (during periods of adequate snow cover or frozen river conditions in the case of Wild or Scenic rivers), motorboats, airplanes, and nonmotorized surface transportation methods for traditional activities (where such activities are permitted by this Act or other law) and travel to and from villages and homesites.

Helicopters are not allowed in wilderness for general public access. Under the National Environmental Policy Act and the Wilderness Act, Section 4(d)(1), the Regional Forester prepared an environmental impact statement that analyzed the public use of helicopters in wilderness areas. The Regional Forester issued a Record of Decision for the *Helicopter Landings in Wilderness FEIS* (1997) that does not allow public or commercially guided helicopter access in wilderness.

Administrative use of helicopters by government agencies may be authorized under a separate process and in accordance with provisions in the Wilderness Act and ANILCA.

Helicopters may also be authorized by the Forest Supervisor in emergencies such as an agency-initiated search and rescue or evacuation, where the situation involves the health and safety of people within the area, and an inescapable urgency and temporary need exists for speed.

Typically, access to most of the wilderness areas on the Tongass National Forest and to the wilderness study area on the Chugach National Forest is by airplane or boat since they are remotely located away from road systems. There are only two wilderness areas in the Alaska Region where one can drive and walk in from a trailhead that is off the road system.

The general public does not need a permit to use fixed-wing airplanes, motorboats, snowmachines, or other forms of nonmotorized surface transportation as long as they are being used for traditional activities that are otherwise legal, unless an area is specifically closed to public uses by an emergency closure order (e.g. to protect public safety or wildlife values), or prohibited following a public process with notice and hearings in the vicinity of the affected unit or area.

Fixed-wing airplanes are allowed to land in wilderness areas on all suitable lakes, beaches, rivers, gravel bars, open ground, and ice fields without a permit unless the area is closed or otherwise restricted. If this transportation is

associated with a recreation commercial service such as outfitting and guiding, a permit is required for the guiding activity and specifies authorized methods of access.

Forest Service Manual provides policy direction for general use and research projects in wilderness:

- Where a choice must be made between wilderness values, and visitor or any other activity, preserving the wilderness resource is the overriding value. Economy, convenience, commercial value, and comfort are not standards of management or use of wilderness (FSM 2320.6).
- Review research proposals to conduct research in wilderness to ensure that research methods are compatible with wilderness values. Do not allow the use of motorized equipment or mechanical transport unless the research is essential to meet minimum requirements for administration of the area as wilderness and cannot be done another way (sec. 4(c) the Wilderness Act). Include specific stipulations in the approval document (FSM 2324.42).

The manual also provides direction for conditions under which motorized equipment or mechanical transport may be approved:

- To meet minimum needs for protection and administration of the area as wilderness, only as follows:
- A delivery or application problem necessary to meet wilderness objectives cannot be resolved within reason through the use of nonmotorized methods.
- An essential activity is impossible to accomplish by nonmotorized means because of such factors as time or season limitations, safety, or other material restrictions.
- A necessary and continuing program was established around the use of motorized equipment before the unit became a part of the National Wilderness Preservation System, and the continued use of motorized equipment is essential to continuation of the program. (FSM 2326.1)

Tongass National Forest

The Forest Service is committed to managing designated wilderness so that it will endure, while providing public access and uses consistent with the Wilderness Act of 1964 and ANILCA.

The Wilderness Act of 1964 mandates that designated "wilderness areas … shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness."

Congress has the sole authority for designating additions to the National Wilderness Preservation System. Congressionally designated wilderness in the

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Tongass National Forest comes from two pieces of legislation. ANILCA established 14 wildernesses totaling 5.5 million acres within the Tongass. Two of the areas, Admiralty Island and Misty Fiords, were designated as national monuments. The majority of acreage in both monuments is also designated wilderness, so the special provisions for public activities in wilderness largely apply in those monuments. ANILCA directs the Secretary of Agriculture to manage the monuments as units of the National Forest System to protect objects of ecological, cultural, geological, historical, prehistorical, and scientific interest. In 1980, ANILCA established the wildernesses in Alaska.

In 1990, the Tongass Timber Reform Act (TTRA) amended ANILCA and designated five new wilderness areas and added acreage to one existing wilderness totaling 296,080 acres. This brings the total to 5.8 million acres in 19 wilderness areas on the Tongass National Forest.

The wilderness acreages in the 2003 Final Supplemental Environment Effect Statement (SEIS) reflect the legal descriptions as reported to Congress and are shown in Table 3-1.

Table 3-1. Tongass National Forest wilderness areas

Wilderness/Ranger District	Net Acreage	Created in
Chuck River Wilderness, Juneau Ranger District	74,298	TTRA*
Coronation Island Wilderness, Thorne Bay Ranger District	19,232	ANILCA**
Endicott River Wilderness, Juneau Ranger District	98,729	ANILCA
Karta River Wilderness, Thorne Bay Ranger District	39,889	TTRA
Kootznoowoo Wilderness, Admiralty Island National Monument	955,858	ANILCA
Kuiu Wilderness, Petersburg Ranger District	60,581	TTRA
Maurelle Islands Wilderness, Thorne Bay Ranger District	4,937	ANILCA
Misty Fiords National Monument Wilderness, Ketchikan-Misty Ranger District	2,142,307	ANILCA
Petersburg Creek-Duncan Salt Chuck Wilderness, Petersburg Ranger District	46,849	ANILCA
Pleasant-Lemesurier-Inian Islands Wilderness, Hoonah Ranger District	23,096	TTRA
Russell Fiord Wilderness, Yakutat Ranger District	348,701	ANILCA
South Baranof Wilderness, Sitka Ranger District	319,568	ANILCA
South Etolin Wilderness, Wrangell Ranger District	82,619	TTRA
South Prince of Wales Wilderness, Craig Ranger District	90,968	ANILCA
Stikine-LeConte Wilderness, Wrangell Ranger District	448,926	ANILCA
Tebenkof Bay Wilderness, Petersburg Ranger District	66,812	ANILCA
Tracy Arm-Fords Terror Wilderness, Juneau Ranger District	653,179	ANILCA
Warren Island Wilderness, Thorne Bay Ranger District	11,181	ANILCA
West Chichagof-Yakobi Wilderness, Sitka and Hoonah Districts	264,491	ANILCA
Total Acreage	**5,752,221**	

*TTRA=Tongass Timber Reform Act,
**ANILCA=Alaska National Interest Lands Conservation Act

Chugach National Forest

On the Chugach National Forest, Section 704 of ANILCA identified the Nellie Juan-College Fiord Area for review as a wilderness study area in order to determine the suitability or nonsuitability of the area as wilderness. Recommendations were developed through the Chugach Forest Land and Resource Management Plan processes in 1984 and 2002, and were forwarded to the Chief of the Forest Service in Washington, D.C. To date, no action has been taken by Congress.

> "In 1973 the first Roadless Area Review and Evaluation (RARE I) recommended a 704,000 acre Nellie Juan New Study Area to be evaluated for wilderness....During deliberation on H.R. 39 by the House Committee on Interior and Insular Affairs in 1979, the Carter Administration favored Wilderness designation for 696,000 acres in the Nellie Juan and 847,000 acres in the College Fiord area. Subsequently, in 1978 these two areas were not inventoried and further evaluated in the second Roadless Area Review and Evaluation (RARE II).
>
> The 1980 Alaska Lands Act (section 704) identified the Nellie Juan-College Fiord Wilderness Study Area ... to be reviewed by the Secretary of Agriculture to determine the suitability or non-suitability for preservation of wilderness" (1984 Chugach Final EIS, p. A-5).

Forest Service national policy and the Chugach Forest Plan maintains the principle of nondegradation of conditions (preserving the wilderness character) existing on the date the area was established to guide the management of both designated wildernesses and the wilderness study area (1980), to the extent consistent with ANILCA. Therefore, all references and responses throughout this document regarding wilderness also apply to the Nellie Juan-College Fiord Wilderness Study Area.

The 2002 Revised Land and Resource Management Plan Record of Decision for the Chugach National Forest recommends 1,412,230 acres for wilderness designation in the Nellie Juan-College Fiord Wilderness Study Area (WSA). The decision also states that the entire Nellie Juan-College Fiord WSA (2.0 million acres) will be managed under the Wilderness Study Area prescription until Congress acts on the recommendation.

Recreation Opportunity Spectrum

The Forest Service uses a system called the Recreation Opportunity Spectrum (ROS) to describe different settings across the forest. The ROS classes range from highly modified and developed places to primitive, undeveloped settings. Attributes typically considered in describing the settings are scenic quality; type and degree of access; remoteness; level of development; social encounters; and the amount of on-site management.

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The Tongass Forest Plan objective for wilderness includes "manage recreation activities to meet the appropriate levels of social encounters, on-site developments, methods of access, and visitor effects indicated for the adopted or existing ROS." (Tongass Forest Plan, p. 3-7)

The seven ROS classes from least to most developed are:

Primitive (P)
Semi-primitive nonmotorized (SPNM)
Semi-primitive motorized (SPM)
Roaded Natural (RN)
Roaded Modified (RM)
Rural and Urban (R+ U)

Existing wilderness on the Tongass is mostly allocated to the Primitive ROS setting (79 percent) with the remaining 21 percent comprised of SPNM (10 percent), and SPM (11 percent). The Nellie Juan-College Fiord WSA has 55 percent allocated to the Primitive setting and 45 percent allocated to SPNM. Much of the SPM area on the Tongass is accessed via motorized watercraft.

The Tongass Forest Plan describes the ROS class setting indicators. In a primitive ROS class setting, the user meets less than three parties per day during a trip. No other parties are within sight or sound of dispersed campsites or cabins. Maximum party size is generally 12 people. Cross-country travel and travel on nonmotorized trails and on waterways is typical. Use of airplanes, helicopters, motorboats and snowmachines for traditional activities, subsistence, emergency search and rescue, and other authorized resource management activities may occur but is rare.

In a semi-primitive nonmotorized ROS class, the user meets less than six parties per day in wilderness on trails and waterways during 80 percent of the primary use season. No other parties are within sight or sound of dispersed campsites during 80 percent of the primary use season. Maximum party size is generally 12 people. Cross-country travel and travel on nonmotorized trails and on waterways is typical. Use of airplanes, helicopters, motorboats and snowmachines for traditional activities, subsistence, emergency search and rescue, and other authorized resource management activities may occur unless specifically restricted for safety and/or resource protection purposes.

Environmental Consequences

Effects on Wilderness Character

Factors associated with the FIA access for day hiking, backpacking, and camping include displacement of visitors from destinations and disruption of solitude due to encounters with the crew. Hiking and camping can create temporary trail impacts due to the wet, boggy, muskeg areas present in the wilderness areas on the Tongass and the Chugach.

Generally, the factors associated with helicopter landings (and the resulting flights to and from the access areas) include the sights and sounds of the

helicopter and the presence of an activity that is generally not associated with activities in a wilderness area.

Currently there are helicopters being used in Tongass wildernesses and the Nellie Juan-College Fiord WSA on the Chugach National Forest by the Forest Service and other agencies for research, maintenance of communication and other management purposes. Helicopters are used infrequently and only when determined to be the minimum tool necessary to accomplish the work.

During 2004, there were 10 helicopter authorizations on Tongass National Forest wilderness areas that authorized 32 landings and two helicopter authorizations on the Nellie Juan-College Fiord WSA for 14 landings. The total number of landings authorized in 2004 in the wilderness areas and wilderness study area was 46 (USDA Forest Service INFRA report 2005c and 2005d). There was no wilderness FIA helicopter activity in 2004.

Studies conducted in a sampling of lower-48 Forest Service wildernesses summarized in a report to Congress in 1992 revealed that only a small percentage (16 percent) of wilderness visitors reported being annoyed by overflights. Those visitors that were bothered identified low-altitude and high-speed aircraft as the most annoying type of aircraft to hear or see. Specifically, visitors judged low-flying jets and helicopters more annoying to hear than high altitude jets and small private aircraft (USDA 1992).

Direct and Indirect Effects

Each of the action alternatives is analyzed below with regard to the following four qualities that provide for preservation of wilderness character as required in the Wilderness Act.

Untrammeled–The Wilderness Act states that wilderness is "an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature." This quality refers to wilderness being essentially unhindered and free from modern human control or manipulation.

Natural–The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." The quality refers to both intended and unintended effect of modern people on ecological systems inside wilderness since the time of designation.

Undeveloped–The Wilderness Act states that wilderness is "an area of undeveloped Federal land retaining its primeval character and influence or human habitation." The undeveloped quality refers to the presence of structures, construction, habitations, and other evidence of modern human presence or occupation including the development level of trails and campsites.

The undeveloped quality also refers to the absence of mechanical transport and motorized equipment. Wilderness was partly established "in order to assure that…growing mechanization does not occupy and modify all areas within the United States…" (Wilderness Act, Section 2a). Helicopters embody modern

technology and degrade the undeveloped character. Included in the undeveloped quality is the number of helicopter flights.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation–The Wilderness Act states that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality includes the values of inspiration and physical and mental challenge. Primitive recreation in wilderness has largely been interpreted as travel by nonmotorized and nonmechanical means. It also encompasses reliance on personal skills to travel and camp in an area. Unconfined encompasses attributes such as self-discovery, exploration, and freedom from societal and managerial controls.

Definitions of effects on the qualities of wilderness character are shown in Table 3-2.

Table 3-2. Definition of potential effects for wilderness character qualities

Negligible: only slight changes in one or more of the wilderness qualities occur as a result of helicopter landings and/or overflights and inventory activity.
Minor: ephemeral impacts to one or more wilderness qualities could occur as a result of increased helicopter use and/or inventory activity. Over the course of a visitor season, a few individuals or groups could encounter helicopters engaged in FIA work.
Moderate: short-term (lasting less than one season) impacts to one or more wilderness qualities could occur as a result of increased helicopter use and/or inventory activity. The proportion of summer days in the wilderness areas without helicopter landings could be reduced by up to 25 percent. Over the course of a visitor season, a few individuals or visitor groups could encounter helicopters engaged in FIA work, or other evidence of access to inventory plots.
Major: long-term impacts (lasting more than one season) to one or more wilderness qualities could occur as a result of increased helicopter use and/or inventory activity. The proportion of summer days in the wilderness areas without helicopter landings could be reduced by more than 25 percent. Over the course of their wilderness trips, several individuals or groups could encounter helicopters engaged in FIA work, or other evidence of access to inventory plots.

Effects Common to all Action Alternatives

Under all alternatives, the sights and sounds of helicopters would detract from the enjoyment of some visitors because backcountry visitors are likely to be seeking natural quiet and solitude.

None of the alternatives would change any of the ROS settings or have any long-term effects on the recreation opportunity spectrum class. However, most of the 7.8 million acres of wilderness/wilderness study area on the Tongass and Chugach are in primitive and semi-primitive nonmotorized settings, so in Alternatives 2, 3, 4, and 5 the social setting and other indicators of meeting ROS would be negatively affected during the inventory.

The effects from monumentation have been separated from the helicopter effects on the undeveloped quality of wilderness character to better display the impacts from each activity. The 3,652 reference point stakes (four stakes per plot and 913 plots) used for marking plots diminish the undeveloped quality of wilderness character and have a major overall effect. Visually, the stakes are unobtrusive to the visitor and in most cases would be located in areas a long distance from where visitor use occurs; however, the markers represent permanent installations in wilderness areas. There is a 2005 intra-agency agreement that states, "Subplot centers are witnesses with a metal wire/rod in the ground as a marker which may not protrude from the ground more than one inch. Flagging may not be attached to the marker."

Alternative 0 (No Action)

No FIA crews will be allowed to access the wilderness for inventories in this alternative.

This alternative provides the most protection to wilderness values with no motorized access. Since helicopter landings would not occur, there would be no increase above the current level of motorized/mechanized use already occurring in the Tongass wilderness areas and the Nellie Juan-College Fiord WSA from this project. Current outstanding opportunities for solitude or a primitive and unconfined type of recreation would continue without displacement of visitors due to crew campsites, crew transport by floatplane or skiff, and crew presence in the wilderness. No effects to the wilderness character qualities from helicopter landings or temporary trails from hiking to plots would occur.

The No Action Alternative would not provide an opportunity to obtain a statistically valid baseline inventory of vegetation across each wilderness and FIA information for monitoring the ecological conditions related to the natural environment. Both the Tongass and Chugach National Forests would also have missing data from one-third of their land bases and this would create a large gap in knowledge about the region's ecology. The Forest Service would lose the chance for the immediate future (estimated to be at least 15 years or longer barring significant changes in the political or natural environment) to obtain data from these unmodified areas and to determine if the wilderness environment is changing and the rate of change.

Alternative 1 (Preferred Alternative)

In Alternative 1, access to all plots would be through a combination of hiking and backpacking, and base camps. A total of 33 plots would be reached yearly via a three-day (or longer) backpack, 21 plots would be accessed yearly using a base camp, and 37 plots would be accessed yearly through day hiking. There would be no helicopter landings but 49 helicopter overflights per year would be made to scout hiking routes for safety hazards.

Untrammeled: In Alternative 1, there will be no manipulation of the wilderness, so there are no expected effects to the untrammeled quality of wilderness character.

Natural: There would be no effect to the natural quality from helicopter landings, since helicopter access would not occur.

Undeveloped: There would be no landings, additional structures or other improvements; however, there are 49 overflights that will take place each year that will have a negligible effect on the undeveloped quality of wilderness.

Effects to the undeveloped quality from hiking to plots would be limited to flattened vegetation and temporary trails from accessing plots. Due to mitigation measures for wilderness camps, no permanent effects are anticipated to occur. Occasionally, the crews may have to spend extra time hunting for durable campsites, and this could create additional temporary trails. Effects from backpacking are anticipated to be negligible from the campsites because the effects would be localized and of typically short duration.

Effects from day hiking to plots would be limited to temporary trails to and from the plot. These effects would consist of flattened vegetation and footprints. Since only a few passes would be made over each route, effects would be negligible. The effects from hiking and camping are negligible.

The overall effects from Alternative 1 to the motorized use component of the undeveloped quality are negligible since no helicopters landings would occur.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: There are no helicopter landings in this alternative, however there are 49 overflights per year. Helicopters overflights could affect visitors to the wilderness as crews do aerial reconnaissance. Forest Service safety requirements do not allow overflights within 500 feet above ground level. The effects of Alternative 1 to opportunities for solitude are expected to be negligible.

Effects from the sights and sounds of people (social encounters) is greatest of all the five action alternatives because this alternative proposes the most physical amount of time that crews would spend in the wilderness. On a yearly basis, crews would be in the wilderness an average of 817 person days. Effects would occur when visitors encounter a base camp or backpack camp, and are expected to be localized and of short duration due to the random distribution of plots and resulting locations of backpack camps and small number of base camps. Effects are expected to be negligible since most base and backpack camps would be located in remote locations. Chances of encounters would be more likely when camps were located near popular shoreline recreation areas.

Effects from day hiking would mainly be limited to encounters near the beginning of the route the crew chooses to take to the plot. In some cases, the best access to plots occurs along a portion of trail corridor or up streams where fishing occasionally occurs. However, this will likely be uncommon because

plots are in random locations and rarely are adjacent to a popular use area that would serve as a beginning access point. Since only 37 plots would be accessed per year by day hiking, effects to solitude from this method of access are anticipated to be negligible.

Though most backpack campsites would be located in areas where the normal visitor does not go, in infrequent situations, hikers, backpackers, or hunters could be displaced in the short-term while the crew was camped in the area.

Several methods of access will be used in this alternative, including skiffs and floatplanes, because local tides, weather, and terrain dictate access to the base camps. Floatplanes may drop crews off at lakes within a two or three-hour hike of the plots and camps may be established there. The sights and sounds of floatplanes and skiffs taking crews in and out of the base camps may negatively affect the outstanding opportunity for solitude. This alternative proposes the greatest amount of skiff and floatplane use when combined with crew transport to access points for backpacking routes. Visitors recreating on nearby shorelines or at inland lakes may be displaced by the presence of a three-day camp, or choose to move because of traffic noise. The degree of displacement may be higher if the camp is located on a lake, which requires more planning and expense on the part of the visitor to access.

Since only 21 base camps per year are proposed under this alternative, yearly effects from base camps are expected to be localized to the campsite area and typically short duration (up to three days).

The overall effects from Alternative 1 to this wilderness character quality are considered to be negligible because the effects will be localized and of short duration. In addition, the random nature of the plots causes many of the plots to be away from the shoreline where encounters with visitors would typically occur.

Alternative 2

In Alternative 2, 40 helicopter landings (access to 20 plots) and 29 overflights would occur each year, 13 plots would be reached yearly via a three-day backpack, 21 plots would be accessed yearly using a base camp, and 37 plots would be accessed yearly through day hiking.

Untrammeled: In Alternative 2, there will be no manipulation of the wilderness, so there are no expected effects to the untrammeled quality of wilderness character.

Natural: In Alternative 2, the helicopter landings are not expected to permanently damage or alter plant habitat. There would be temporary flattening of vegetation from the skids during helicopter landings. Minor vegetation modification (i.e., moving branches) may occur at landing sites. A low risk of introduction of non-native species via the skids could occur if multiple non-wilderness and wilderness flights occurred consecutively. The overall effects

from Alternative 2 to this wilderness character quality are considered to be negligible.

Undeveloped: Although there would be no physical improvements, an additional 40 authorized landings and 29 overflights each year for helicopters are proposed which would affect the undeveloped quality of the wilderness character. This would increase the number of authorized landings from 46 in 2004 to 86 in this alternative. Even though the increased landings are over a large landscape, the proposed use is an 87 percent increase over current authorized helicopter landings. Even if there are no visitors present to see, hear, or object to a helicopter in wilderness, the spirit of wilderness would be diminished.

In Alternative 2, there are 34 crew campsites that would be used. Effects to the undeveloped quality would be limited to flattened vegetation and temporary social trails to and from the plots. Due to mitigation measures for wilderness camps, no permanent effects are anticipated to occur. Occasionally, the crews may have to spend extra time hunting for durable campsites, and this could create additional temporary trails. Since only 34 total camps (backpacking and base) would be used per year, effects to the undeveloped quality from backpacking are anticipated to be negligible. Effects to the undeveloped quality from day hiking would be the same as Alternative 1.

The effects to the motorized use component of the undeveloped quality are minor due to the level of helicopter use.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Helicopter flights and landings would diminish outstanding opportunities for solitude, sense of isolation and remoteness from sights and sounds of human activities. Visitors may choose to move to a different location due to the presence and noise of the helicopter. Since most plot locations accessed by helicopter in this alternative are very remote and difficult to access on foot, effects are expected to be minor.

Low flying reconnaissance or flightpaths that occur near recreation sites could displace or negatively affect visitors. If a group does encounter a low flying helicopter in such a remote area, the resulting effect to their perceived wilderness experience is likely to be pronounced because they most likely will have sought out this area due to its outstanding opportunity for solitude. Low flying helicopter noise is distinctly different from floatplanes.

Near the shorelines, a remote wilderness experience in some of the wilderness areas can be frequently interrupted by the sounds of floatplanes or motorboats. Frequent travel routes bound some wilderness areas. At those locations, the sound of boats and planes can be relatively continuous. Visitors in these locations may have different expectations of experiencing outstanding opportunities for solitude than those in more remote locations.

Effects from backpacking would be less (20 less plots per year) than Alternative 1. The amount of time that crews would be in the wilderness would be 42 percent less than Alternative 1 since 20 plots would be accessed by helicopter and not on foot. On a yearly basis, crews would be in the wilderness an average of 477 person days. Though most backpack campsites would be located in areas where the normal visitor does not go, in infrequent situations hikers, backpackers, or hunters could be displaced in the short-term while the crew was camped in the area. Effects from base camps would be the same as Alternative 1 (negligible).

In Alternative 2, effects would be typically short duration and directly related to the amount of interference that a particular visitor perceives with the enjoyment of natural quiet. It is generally assumed that visitors to wilderness areas expect these areas to be quieter than populated ones. In those wildernesses where the sounds of human activities are limited to the occasional passing motorboat, effects from helicopter landings may be perceived as being more intrusive because of the natural quiet that already exists.

In Alternative 2, nine out of the 20 wilderness/wilderness study areas would have helicopter landings. At the level of landings proposed in this alternative, effects to solitude from the sights and sounds of helicopters are expected to be minor.

Alternative 3

This alternative proposes 26 more helicopter landings than in Alternative 2 (66 total landings), 17 overflights each year, and the same day hiking to 37 plots and 21 base camps as Alternative 2. The major difference between Alternative 2 and 3 is the elimination of backpacking access to plots in Alternative 3, resulting in an increase in helicopter landings.

Untrammeled: In Alternative 3, there will be no manipulation of the wilderness, so there are no expected effects to the untrammeled quality of wilderness character.

Natural: Effects to the natural quality from helicopter landings would be similar to Alternative 2 (negligible).

Undeveloped: There are 66 proposed helicopter landings per year. Even though the additions are over a large landscape, the proposed use is a 143 percent increase over current authorized helicopter landings (46 landings) which would affect the undeveloped quality of the wilderness character. Even if there are no visitors present to see, hear, or object to a helicopter in wilderness, the spirit of wilderness would be diminished.

Effects from camping would be similar to Alternative 2, but there would be less temporary effects from flattened vegetation and social trails since there would be no backpack camps. Effects from day hiking would be similar to Alternative 2. Hiking and camping have negligible effects in Alternative 3.

The overall effects from Alternative 3 to the motorized use component of the undeveloped quality are minor due to the level of helicopter use.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: The amount of time crews would be in the wilderness would be slightly less than in Alternative 2 since crews would not be hiking two full days to reach a plot. In most cases under this alternative, crews would spend an average of three days in the wilderness per base camp plot. On a yearly basis, there are 399 person days spent in the wilderness.

Effects from camping would be less than in Alternative 2, since no backpacking would occur. Effects from base camps would be similar to Alternative 2. Since there would be no backpack camps under this alternative, crews would be spending fewer person days in the wilderness and the potential for visitors to encounter crews would be decreased. Effects from day hiking would be the same as in Alternative 2.

In Alternative 3, 13 of the 20 wilderness areas would have helicopter landings. At the level of landings proposed in this alternative, overall, the effects to the outstanding opportunities for solitude from the sights and sounds of helicopters are expected to be minor. This is because the level of landings would be below 25 percent of the visitor use season days. However, there are individuals whose sense of solitude would be significantly affected from any helicopter noise.

Alternative 4 (Proposed Action)

Alternative 4 proposes the second highest level of helicopter access of the alternatives with 108 landings and four overflights per year, and the same amount of day hike plots as Alternatives 2 and 3. The main difference between this alternative and the other action alternatives is the increased number of helicopter landings, the elimination of the base camps, and the backpacking option.

Untrammeled: In Alternative 4, there will be no manipulation of the wilderness, so there are no expected effects to the untrammeled quality of wilderness character.

Natural: Effects from helicopter landings would be similar to Alternative 3. More helicopter landings would only incrementally increase the low risk of introduction of non-native plant species and the effect to this wilderness character quality would be negligible.

Undeveloped: There are 108 proposed helicopter landings per year. Even though the additional landings are over a large landscape, the proposed use is a 235 percent increase over current authorized landings (46 landings) which would affect the undeveloped quality of the wilderness character. Even if there are no visitors present to see, hear, or object to a helicopter in wilderness, the spirit of wilderness would be diminished.

Effects from day hiking would be similar to Alternative 2 and the effects from hiking and camping would be negligible.

The overall effects from Alternative 4 to the motorized use component of the undeveloped quality are moderate due to the level of helicopter use.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Effects from helicopter landings increase in Alternative 4. Eighteen out of 20 wilderness areas would have helicopter landings as part of the FIA inventory. At the level of landings proposed in this alternative the effects to the outstanding opportunities for solitude from the sights and sounds of helicopters are expected to be moderate on a yearly basis. There are individuals whose sense of solitude would be significantly affected from any helicopter noise.

Alternative 4 would have no base camps or backpacking and 273 person days per year. As a result, the potential for visitors to encounter crews will be decreased. The effects from day hiking would be the same as Alternative 3.

Alternative 5

All plots in Alternative 5 would be accessed by helicopter.

Untrammeled: In Alternative 5, there will be no manipulation of the wilderness, so there are no expected effects to the untrammeled quality of wilderness character.

Natural: Effects to the natural quality from helicopter landings would be negligible. The potential risk from non-native plant introduction would remain low.

Undeveloped: There are 182 proposed helicopter landings per year. Even though the additional use occurs over a large landscape, the proposed use is a 396 percent increase over existing use (46 landings) and would affect the undeveloped quality of wilderness character. Even if there are no visitors present to see, hear, or object to a helicopter in wilderness, the spirit of wilderness would be diminished.

Since no day hiking would occur, the only temporary effects would be temporary trails created from the helicopter landing sites to the plots. These effects are expected to be negligible.

The overall effects from Alternative 5 to the motorized use component of the undeveloped quality are major due to the level of helicopter use.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: All 20 wilderness areas would have helicopter landings. At the level of landings proposed in this alternative, overall, the effects to the outstanding opportunities for solitude from the sights and sounds of helicopters are expected to be moderate. The chances of hearing a helicopter are greatly increased in Alternative 5 with 182 landings per year. There are individuals

whose sense of solitude would be significantly affected from any helicopter noise. On a yearly basis, the effects to the opportunity for solitude wilderness character quality are major because the number of helicopter landings proposed would exceed 25 percent of the days during the summer without helicopter landings.

In Alternative 5, effects from helicopter landings would have more potential for conflicts with visitors due to the increased number of plots located near shorelines that would be accessed by helicopter. These effects would occur during the drop-off and retrieval of crews.

On a yearly basis, there are 273 person days in the wilderness. The potential for visitors to encounter crews will be less than Alternatives 1, 2, 3, and 4. In Alternative 5, there are no base camps or backpacking and the crew will be flying from the boat to the vicinity of the plot.

Summary of Direct and Indirect Effects to Wilderness Character

Table 3-3 is a summary of the effects by alternative on the untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation wilderness character qualities.

Table 3-3. Potential direct and indirect effects to wilderness character qualities by action alternative

	Alternatives				
Wilderness Character Quality	**1 Preferred Alternative**	**2**	**3**	**4 Proposed Action**	**5**
1. Untrammeled-unhindered and free from modern human control or manipulation	None	None	None	None	None
2. Natural-ecological systems are substantially free from effects of modern civilization	None	Negligible	Negligible	Negligible	Negligible
3a. Undeveloped*-motorized use	Negligible	Minor	Minor	Moderate	Major
3b. Undeveloped-monumentation	Major	Major	Major	Major	Major
4. Outstanding opportunities for solitude or primitive, unconfined recreation	Negligible	Minor	Minor	Moderate	Major

*The undeveloped quality of wilderness character refers to the presence of structures, construction, habitations, and other evidence of modern human presence or occupation including the development of trails and campsites. It also refers to the absence of mechanical transport and motorized equipment.

Cumulative Effects

Wilderness areas on the Tongass National Forest and the wilderness study area on the Chugach National Forest have become noisier places since designation by ANILCA in 1980 and TTRA in 1990. Fixed-wing aircraft are primarily responsible for the increased sound levels.

The analysis of cumulative effects for wilderness considered the effects from uses that contribute to the overall noise and visual effects from fixed-wing

aircraft and helicopters during the inventory period from approximately June 1 to September 15. There is no information that is available to quantitatively (i.e., decibels) determine the soundscape for each wilderness so estimated use levels from 2004 were selected as the reference year to assess the incremental changes associated with this project. The list of noise and visual effects and additional discussion of the effects is included in the project planning record.

In addition, managers for each wilderness area were asked to estimate the number of aircraft and helicopter landings that took place in the areas they managed. These estimates included use from administrative work, landings at Forest Service public recreation cabins, helicopter landings, special use permit cabins, outfitter/guides, and point-to-point use to other locations within the wilderness. Landings on freshwater and saltwater (not within Forest Service jurisdiction) were included because saltwater use adjacent to wilderness is an important method of access to the wilderness.

Each wilderness area was placed into one of three wilderness use rating categories depending on the number of landings. Results of these ratings are displayed in Table 3-4. This information, in conjunction with data from other sources, has been used in this analysis to give an overall picture of the cumulative effects from aircraft and helicopters.

Category 1: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use of either floatplanes or helicopters is between 1 to 99 landings in this wilderness per year.

Category 2: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use of either floatplanes or helicopters is between 100 to 299 landings in this wilderness per year

Category 3: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use is greater than 299 landings in this wilderness per year

Overall, types of uses considered in this analysis consisted of:

- Private fixed-wing aircraft overflights and landings,
- Commercial fixed-wing aircraft (point to point, overflights) that are not under Forest Service permit,
- Commercial fixed-wing aircraft operating in non-wilderness under Forest Service permit,
- Commercial fixed-wing aircraft operating in wilderness areas under Forest Service permit,
- Commercial helicopter tours,
- Private helicopters,
- Forest Service and private landowner helicopter logging adjacent to

wilderness areas,

- Coast Guard helicopter for search and rescue,
- Forest Service authorized helicopter use allowed under ANILCA,
- FIA helicopter use adjacent to wilderness areas, and
- Forest Service fixed-wing and helicopter administrative use.

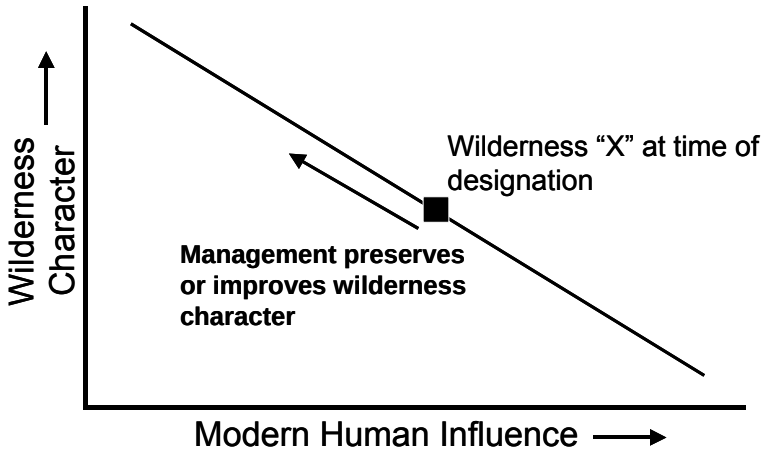
Table 3-4. Wilderness use ratings for current fixed-wing and helicopter use by wilderness

Wilderness	Category		
	1 (1 to 99 landings)	2 (100 to 299 landings)	3 (>299 landings)
Chuck River	X		
Coronation Island	X		
Endicott River	X		
Karta River		X	
Kootznoowoo			X
Kuiu	X		
Maurelle Islands	X		
Misty Fiords			X
Nellie Juan-College Fiord			X
Petersburg Creek-Duncan Salt Chuck	X		
Pleasant-Lemesurier-Inian Islands	X		
Russell Fiord	X		
South Baranof		X	
South Etolin	X		
South Prince of Wales	X		
Stikine LeConte	X		
Tebenkof Bay	X		
Tracy Arm-Fords Terror	X		
Warren Island	X		
West Chichagof-Yakobi	X		

Table 3-4 shows that 15 out of the 20 wilderness areas are in Category 1 where estimated combined floatplane and helicopter use is less than 100 landings per year; two areas have combined use of 100 to 299 landings per year; and three have estimated use at over 299 landings per year.

Figure 3-1 is referred to in the Wilderness Character Framework (Landres et.al 2005) as the Wilderness Management Model. The vertical axis represents wilderness character, improving upwards. The horizontal axis represents the amount of modern human influence on wilderness character, with increasing influence to the right. A goal of wilderness management is to maintain or improve wilderness character from its state at the time of designation.

Figure 3-1. Wilderness management model



Overall, the cumulative effects of the FIA and other authorized administrative helicopter landings will increase the amount of human influence and will add to the degradation of the wilderness character during the years of the inventory. Requests for the current types of administrative activities using helicopters are expected to continue over the next 10 years, and when considered with the levels of use proposed, would represent a change over time in the current soundscape and wilderness experience. The increasing levels of mechanization in the alternatives, even over a large landscape, has the potential for permanently altering the perception of these wildernesses as places generally free from the growing mechanization that characterizes the majority of the American landscape.

ANILCA allows the use of some motorized uses in wilderness, including the use of floatplanes and motorboats. This use is low in many wildernesses but is high in others, particularly portions of Misty Fiords. In addition, daily flight-seeing tours, mail and passenger flights, and private flights of commercial jets, and floatplanes occur regularly over some wildernesses. While activities occurring outside a wilderness boundary cannot be regulated by the Forest Service, many visitors may believe that the sights and sounds of boats and planes detract from a remote wilderness experience. Frequency of overflights and the altitude of the aircraft will play a major role in how the encounter with the aircraft is perceived by the wilderness visitor. These types of uses are well established and are expected to continue into the foreseeable future.

Though no physical cumulative effects are expected from helicopter access, the level of use will contribute to an overall increased mechanization in wilderness. Combined with uses authorized by ANILCA and the other permitted administrative uses over the next 10 years, in some localized wilderness areas there is expected to be a minor reduction in the number of places where people

may experience freedom from visual and noise intrusion from motorized equipment. In other, more remote wildernesses where little motorized use presently occurs, helicopter landings from this project would represent a large increase in mechanization, depending on the number of plots accessed by helicopter per year. When considered with other uses already occurring, and those expected to occur over the next 10 years, there would be a minor overall diminishment of the sense of remoteness and isolation from human sounds and activities in some wildernesses.

Over the next 10 years, the Proposed Action would authorize an additional 1,080 landings. When considered over a 10-year span, this level of helicopter access exceeds the current permitted use of 46 landings per year or 460 landings over 10 years. In Alternative 4, the cumulative effects to the undeveloped quality are moderate for motorized use and major for monumentation. The effects in Alternative 5 are major for both components of the undeveloped quality over the 10-year timeframe.

In Alternatives 4 and 5, the cumulative effects to the outstanding opportunities for solitude or primitive and unconfined recreation are expected to be major due to the high number of additional helicopter landings and overflights.

Flightpaths will cover an expanded area as the number of landings is increased. The potential for a helicopter to displace visitors at plot locations will not increase in most of the alternatives due to the remote nature of the plot locations, and unlikely possibility of a group recreating close enough to the plot to be negatively affected by the helicopter landing. However, as plots accessed by helicopter increase by alternative, the potential for visitors to be affected increases, especially in those locations where plots are located on or very near to the beach fringe. As more helicopter flights are added by alternative, the potential effects of overflights on wilderness visitors will become more pronounced.

Though individual visitors may not be affected on a personal level, simply knowing that this level of mechanization, combined with the uses already occurring and those expected to occur, exists in a designated wilderness would not be acceptable for some.

Over the next 10 years, the current trends of increasing day use are expected to continue. Most of the guided and unguided recreation use of the wilderness areas is largely confined to shorelines, rivers, and inland lakes. Hunters and hikers, as well as agency personnel conducting inventories, venture beyond the shorelines on an occasional basis. No cumulative effects are expected from day hiking access over a 10-year period. Any effects from crews passing over the landscape to access plots on foot would be temporary and consist of flattened vegetation and footprints.

Visitor use of the wilderness shoreline areas, particularly by outfitter/guides, has grown over the past 10 years and this trend is expected to continue. Outstanding opportunities for solitude are increasingly hard to find in some popular

wilderness locations like Rudyerd Bay in Misty Fiords, although many locations will continue to offer the expected Alaska wilderness experience. Increasing numbers of conflicts in wilderness areas are reported at some areas between guided and unguided groups. Temporary displacement is expected to occur because some of the base camps would be located in the same locations as those that visitors and guides like to use and flat terrain is at a premium. With 210 base camps occupied for an average of three days each over the 10 years, in combination with the guided and unguided use already occurring, there is the possibility for minor displacement and disruption of outstanding opportunities for solitude in site-specific areas over time.

Backpacking is still a relatively rare form of recreation on the Tongass wilderness areas and in the Nellie Juan-College Fiord Wilderness Study Area and this trend is expected to continue over the next 10 years. Weather, bear presence, steep slopes, and extremely rugged terrain are the main reasons why this activity is not pursued more often. Most visitors are satisfied to experience the wilderness while on the adjacent waterways or pursuing activities within the coastal areas. There are no expected cumulative effects from backpacking access or base camps for these reasons.

When combined with the expected continuance and expected growth of overflights, floatplane tours, boat-based tourism, and air taxi landings, there would be an overall diminishment of solitude in many of the 20 wilderness areas, some of which, such as Misty Fiords, already experience a large volume of air and boat traffic. This diminishment may not be measurable on a yearly scale, but over time there would be locations in some wildernesses where visitors could not experience a cessation of noise or avoid seeing some form of motorized activity during the summer daylight hours. The distinction between designated wilderness and other forest areas would diminish over the next 10 years when this level of helicopter access is added to the existing and expected condition.

Untrammeled quality: There are no cumulative effects on the untrammeled quality of wilderness character in any of the alternatives because there would be no direct human manipulation of the wilderness environment.

Natural quality: In the natural quality, the cumulative effects are negligible because there are no long-term changes to the ecological systems inside wilderness.

Undeveloped quality: In the motorized use component of the undeveloped quality, there are negligible cumulative effects in Alternative 1, minor cumulative effects in Alternatives 2 and 3, moderate cumulative effects in Alternative 4 and major cumulative effects in Alternative 5 because the number of authorized helicopter landings is one of the indicators that measure changes in this quality.

Outstanding opportunities for solitude or primitive and unconfined recreation: As the number of helicopter landings increase, the effects for

outstanding opportunities for solitude or primitive and unconfined recreation increase. Cumulative effects range from negligible to major depending on the number of landings that would occur. In Alternative 1, negligible cumulative effects are expected, in Alternative 2 minor cumulative effects; in Alternative 3 moderate cumulative effects, in Alternatives 4 and 5 major cumulative effects because the effects will continue for over the 10-year timeframe.

Table 3-5. Potential cumulative effects to wilderness character quality by action alternative

	Alternatives				
Wilderness Character Quality	**1 Preferred Alternative**	**2**	**3**	**4 Proposed Action**	**5**
1. Untrammeled-unhindered and free from modern human control or manipulation	None	None	None	None	None
2. Natural-ecological systems are substantially free from effects of modern civilization	None	Negligible	Negligible	Negligible	Negligible
3a. Undeveloped-motorized use	Negligible	Minor	Minor	Moderate	Major
3b. Undeveloped-monumentation	Major	Major	Major	Major	Major
4. Effect to outstanding opportunities for solitude or primitive, unconfined recreation	Negligible	Minor	Moderate	Major	Major
Alternative Components					
Person days (10-years)	8,170	4,770	3,990	2,730	2,730
Helicopter Landings (10-years)	0	400	660	1,080	1,826
Helicopter Overflights (10-years)	490	290	170	40	0

Wildlife

The wilderness areas of the Alaska Region contains habitat for a variety of marine and land based wildlife species. A description of the affected environment for wildlife can be found in the section discussing each species. The Proposed Action and alternatives consider accessing FIA plots in these wilderness areas through a variety of means including: boats, hiking, overnight camping, base camps, helicopters, and floatplanes. This analysis examines the effects of the Proposed Action and alternatives on wildlife species, populations, and habitat.

The Proposed Action and action alternatives can affect wildlife in the following ways:

- The disturbance from inventory crews hiking to plots and camping
- The noise and visual disturbance from helicopter and fixed-wing use
- The disturbance from using boats and skiffs

The wildlife species discussed in this analysis were chosen for two reasons. First, statute, regulation, and Forest Plan direction require an analysis of the effects of the Proposed Action and alternatives on Federally Threatened, Endangered, and Candidate Species (TES) and Forest Service Sensitive Species (SS). The second reason a particular species is included is because of its potential sensitivity to the effects of the Proposed Action and alternatives. While other species of interest (i.e., wolf, black bear) could have been included in this analysis, their temporal and spatial habitat requirements, and response to disturbance are similar to the species that are included in the analysis. Table 3-6 lists the species that are considered in this analysis.

Table 3-6. List of species considered in this analysis*

Species	Reason for Considering
Humpback whale	Federally Endangered under ESA
Steller's sea lion	Federally Endangered under ESA
Steller's eider	Federally Threatened under ESA
Kittlitz's murrelet	USF&WS Candidate under ESA
Cook Inlet beluga whale	USF&WS Candidate under ESA
Montague Island tundra vole	Forest Service SS
Trumpeter swan	Forest Service SS
Dusky Canada goose	Forest Service SS
American osprey	Forest Service SS
Queen Charlotte goshawk	Forest Service SS
Peale's peregrine falcon	Forest Service SS
Bald eagle	Potentially affected by the Proposed Action or alternatives
Mountain goat	Potentially affected by the Proposed Action or alternatives
Wolverine	Potentially affected by the Proposed Action or alternatives
Brown bear	Potentially affected by the Proposed Action or alternatives

*The Cook Inlet beluga whale, Montague Island tundra vole, and the Dusky Canada goose are not included in this analysis because they are not present in the project area or are not present during the period of project activity.

General Effects of FIA Inventory Activities to Wildlife

General Effects to Wildlife

The Proposed Action and alternatives propose a variety of methods of access to accomplish the project, and wildlife species have the potential to be affected by these types of activities. For example, marine vessels can collide with whales or hiking and helicopter use can disturb land mammals.

The predominate factors in evaluating the effects to wildlife species is the duration and frequency of the activity. An increase in one or both of these factors increases the overall intensity of the effect. For example, some animals tend to abandon habitat or nests when the disturbance occurs frequently or occurs for a long duration or they become habituated (have a lower response because they are accustomed to the disturbance). If the disturbance occurs infrequently or for short durations, animals tend to only leave the habitat or nest temporarily. The duration or frequency of the disturbance, therefore, determines whether proposed activity results in only short-term energetic costs or long-term habitat abandonment.

For this reason, it was important to this analysis to determine the number of person days in the field associated with each alternative because they are indicators of the duration or frequency of disturbance to wildlife. Generally, the greater the number of person days in the field, regardless of method of access, the greater the possibility of a more severe or frequent response from wildlife or increased likelihood of habituation.

Generally, helicopter, hiking, and camping do not affect marine animals because there is little geographic or temporal overlap or because regulations provide for separation distances. However, helicopters and hiking do have the potential to disturb land-based animals, such as shorebirds or brown bears. In choosing among the alternatives, it is important to understand the differences and similarities in the effects from helicopter access and hiking access.

The noise and visual disturbance from helicopters generally affects a larger area for a shorter period of time (48 minutes of helicopter time per plot); whereas the noise and visual disturbance from hiking and camping activities affects a smaller area for a longer period of time (up to five days). However, the effects of both activities are similar in that they generally result in short-term disturbances and energetic costs and do not result in long-term habitat abandonment. In addition, because the use is limited in duration and frequency, the possibility of habituation occurring is negligible.

Effects of Overflights on Wildlife

In general, wildlife does respond to low-altitude (300-800 feet) aircraft overflights. Aircraft overflights can affect the physiology and behavior of wildlife, and if the stress becomes frequent, can negatively affect an animal's fitness and long-term survival (USDI 1994).

Both sound and visual stimuli can cause stress. The manner and degree in which overflights influence wildlife depends on life history of the species, characteristics of the aircraft and flight activities, and other factors including habitat, season, activity at time of exposure, sex, age, health, and previous experience with aircraft (USDI 1994). Forested habitat generally reduces noise and visual stimuli because trees provide cover and muffle sound.

The relationship between overflights and effects to wildlife is complex, but it is clear that the closer the aircraft, the more likely an animal will be stressed, and that helicopter overflights are more stressful than fixed-wing overflights (USDI 1994). Review of the literature shows that aircraft overflights may cause flushing of birds from feeding or nesting areas, alteration of movement or activity patterns, decreased foraging efficiency, panic running of big game animals, decreased young survival, and increased heart rates in big game animals (USDA 1999).

It is not possible to specifically evaluate the effects of overflights because, in most cases, animal responses fall across a spectrum so that the question of whether or not a disturbance occurs cannot be answered with a yes or no. For example, an overflight generally causes some animals to panic, some to be mildly disturbed, and some animals to ignore the aircraft. At a lower altitude, the overflight causes more to panic and fewer to be mildly disturbed. "At what degree of disturbance in what percentage of animals should overflights be considered detrimental or otherwise unacceptable? At present, these questions

have only largely subjective answers." There is no consensus in public or scientific communities regarding effect definition. (USDI 1994).

The list below summarizes the specific actions that may cause adverse effects to wildlife from helicopter operations (USDA 1999).

- Helicopter fly by or over
- Helicopter landings and take-offs (including the take-off sequence)
- Approach and take-off patterns (to and from landings)
- Hovering
- Sitting with engine operating on the ground
- Varying levels and types of sounds created by blade pitch
- Different noise levels associated with cruising, landing, and flying in head and tail winds
- Elevation and distance of helicopters from the animal reacting to it.

Effects of Boats and Skiff on Wildlife

Boats and skiffs have the potential to strike marine animals, create acoustic disturbance, or encroach on habitat. The sight and sounds of motorized vessels are known to disturb both humpback whales and Steller sea lions (Bauer 1995; Matthews 1996). The specific reaction of an individual on any particular encounter cannot be predicted, since the reaction depends on many factors, including the prior activity and previous experience of the individual animal, the speed and course of the vessel, the vessel type, and a number of other factors. Still, it can be assumed that the presence of vessels can startle, frighten, and/or annoy individual animals and, in some cases, causes them to increase activity, flee, change activities, dive, make sounds (or stop making sounds), or, for Steller sea lions, occasionally causes them to reenter the water from a haul-out (USDI NPS Vessel Quotas and Operating Requirements FEIS 2003). The predominate factor in determining the severity of the effect is the size and speed of the boat and the distance of the vessel from critical habitat.

The effect of changes in behavior is a reduced benefit from whatever activity the animal was undertaking at the time of the encounter, as well as the energy expended due to the reaction. If an animal is feeding, then the effect is a loss of energy acquired. If the animal is resting, then the effect is a loss of rest and, potentially, the need to rest later rather than feeding.

Long-term exposure can potentially increase stress, which could contribute to health problems. Long-term exposure may also cause individuals to become accustomed to the sight and sounds of vessels (habituate) and consider them as just another element of their environment. Habituation has the potential to be detrimental if it increases the animal's risk of vessel collision (Laist et al. 2001; Terhune and Verboom 1999). In order to reduce the likelihood of these effects

the National Oceanic and Atmospheric Administration's (NOAA) and National Marine Fisheries Service (NMFS) has developed guidelines for approaching marine animals and separation distances between marine vessels and sea lion rookeries.

Estimating Effects of the Proposed Action and Alternatives

Affected Environment and Environmental Consequences by Wildlife Species

For this analysis, a finding is made on whether the alternatives will affect TES species in accordance with the Endangered Species Act and Forest Service policy. A summary of the effects of each alternative on all wildlife resources is located at the end of the wildlife section.

Definitions of the effects to other species of concern can be found in Table 3-7.

Table 3-7. Definition of potential direct and indirect effects to other species of concern

Negligible: effects may or may not cause observable changes to natural conditions; regardless, they do not reduce the integrity of a resource.
Minor: effects cause observable and short-term changes to natural conditions, but they do not reduce the integrity of a resource.
Moderate: effects cause observable and short-term changes to natural conditions, and/or they reduce the integrity of a resource.
Major: effects cause observable and long-term changes to natural conditions, and they reduce the integrity of a resource.

Habitat in the wilderness areas of the Alaska Region consists of forested, alpine, riparian, marine, and coastal areas. These habitats provide for a wide variety of wildlife species. The effects of the Proposed Action and alternatives on each affected species are discussed below. A Biological Evaluation has been completed for TES species and can be found in the project planning record.

Humpback Whale

Affected Environment

The humpback whale is a federally listed endangered species that occurs in all oceans of the world. Commercial whaling during the middle of the 20th Century is responsible for its listing under the ESA. In summer, most humpback whales are in waters of high biological productivity, usually in higher latitudes. Humpback whales are common in the inside passage, in coastal waters of the Tongass National Forest from Yakutat Bay south to Queen Charlotte Sound, and in coastal waters of the Chugach National Forest in Prince William Sound.

Humpback whales feed in Alaskan waters from about May through December, although some have been seen every month of the year. Peak numbers of whales are usually found in near shore waters during late August and

September, but substantial numbers generally remain until early winter. The local distribution of humpbacks in Southeast Alaska and Prince William Sound appears to be correlated with the density and seasonal availability of prey, particularly herring and other species.

Environmental Consequences

The use of helicopters or floatplanes does not affect humpback whales. However, the FIA marine vessel has the potential to strike humpback whales, cause acoustic disturbance, or encroach on habitat.

Effects of Vessel Collisions

Between 1996 and 2003, five whales (humpbacks, gray whales, and unidentified whales) have been reported killed by vessel collisions in Southeast Alaska, while more have been struck, but have not been confirmed as killed (National Marine Fisheries Service 2006). The vessel size and speed are important factors in the frequency and severity of whale/vessel collisions.

It has been suggested that when vessel speeds exceed about 13 knots, the ability of right whales to avoid collisions is reduced. In addition, collisions between a whale and a ship greater than 262 feet (80 meters) in length are likely to result in the death of the whale (Laist et al. 2001).

Effects of Acoustic Disturbance

Humpback whales have the potential to be affected by the acoustic disturbance of marine vessels. The specific reactions of an individual whale on any particular encounter with a marine vessel cannot be predicted, since the reaction depends on many factors, including the prior activity and previous experience of the individual animal, the speed and course of the vessel, the vessel type, and a number of other factors. The presence of vessels can startle, frighten, and/or annoy individual whales and, in some cases, cause them to increase activity, flee, change activities, dive, and make sounds (or stop making sounds).

Acoustic disturbances have the greatest potential to affect humpback whales when many large marine vessels are operating at high speeds in narrow bays or channels.

Effects of Encroachment on Habitat

Marine vessels have the potential to encroach on habitat used by humpback whales. The effects of encroachment on habitat are similar to those of acoustic disturbance. Although humpback whales are common in the inside passage, in the coastal waters from Yakutat Bay south to Queen Charlotte Sound, and in the coastal waters of Prince William Sound, the NMFS has not designated critical habitat for humpback whales. However, regulations (50 CFR 224.103) govern the approach of marine vessels to humpback whales to no closer than 300 feet.

Direct and Indirect Effects

The Proposed Action and alternatives entail the use of an 86-foot marine vessel to transport crew to plots throughout the wilderness areas in the Alaska Region.

The 86-foot marine vessel is used as the base of operations for the inventory crew; and skiffs and helicopters are used to transport inventory crews from the vessel to the plot or within walking distance of the plot. This vessel generally travels at less than 10 knots.

Under the No Action Alternative the FIA will not take place, and any potential effects to humpback whales from FIA activities would not occur.

Alternatives 1 through 5 propose varying levels of helicopter access to plots: Alternative 1 proposes no helicopter use; Alternative 5 proposes only helicopter access; and Alternatives 2 through 4 proposing increasing levels of helicopter use. The more frequently the helicopter is used to access plots, the less frequently the marine vessel and the skiff is used. In terms of alternatives, Alternative 1 would require the most use of marine vessels, while Alternative 5 would propose the least.

The likelihood of a fatal collision is only associated with the use of the 86-foot research vessel. The skiff is not large enough to cause a fatality. Regardless of the alternative, collisions with vessels are expected to be rare due to whale distribution, vessel traffic patterns, and NMFS regulations. A determination of no effect to humpback whale populations has been made.

Steller Sea Lions

Affected Environment

Steller sea lions range from Hokkaido, Japan, through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, Gulf of Alaska, Southeast Alaska, and south to central California. The centers of abundance and distribution are the Gulf of Alaska and Aleutian Islands. The National Marine Fisheries Service (NMFS) designated the Steller sea lion as a threatened species under the Endangered Species Act in 1990 (55 Fed Reg 12645, April 5 & 55 FR 49204, November 26). In 1997, two separate populations separated at 144° W longitude were recognized. The western population (Aleutian Islands and Gulf of Alaska), which had suffered a greater decline than the eastern population (Southeast Alaska, Washington, Oregon, California), was reclassified as endangered (62 FR 24345, May 5).

Steller sea lion habitat includes marine and terrestrial areas that they use for a variety of physical and biological purposes. Steller sea lions are highly gregarious and they use traditional haul out sites (an area used for resting) and rookeries (an area used for breeding and rearing young) on remote and exposed islands. These sites can be rock shelves, ledges, boulders, and gravel or sand beaches, and are often in exposed areas that are not easily accessed by humans or mammalian predictors.

NMFS (2003) designated Steller sea lion critical habitat as all “major” Steller sea lion rookeries and haul outs in Alaska, as well as terrestrial, air, and aquatic zones surrounding these sites. The terrestrial zone extends 3,000 feet (0.9 km)

landward, the air zone extends 3,000 feet (0.9 km) above the terrestrial zone and the aquatic zone extends 20 nautical miles (37 km) seaward in State and Federally managed waters west of 144° W longitude (50 CFR 226.202). "Major" rookeries and haul outs were defined as those with two hundred or more animals. In designating critical habitat, NMFS regarded conservation and management of prey resources and foraging areas as essential to the recovery of the Steller sea lion populations (58 Federal Register 45269, August 27, 1993).

In proposing the 20-nautical mile aquatic zone, NMFS noted that aquatic areas surrounding major rookeries and haulouts provided foraging habitats, prey resources and refuges that are not only essential to lactating females and juveniles, but also encompass areas for nonbreeding animals year-round and for reproductively active animals during the nonbreeding season.

Environmental Consequences

Direct and Indirect Effects

The primary effect to Steller sea lions would result from FIA vessels or helicopters from encroaching on designated rookeries and haulouts because these areas hold prey resources and are used for breeding and rearing young. None of the alternatives propose marine vessel use near or helicopter use over designated habitat and regulations require separation distances between marine vessels and aircraft over designated habitat. Therefore, all alternatives have a determination of no effect on Steller sea lions populations.

Kittlitz's Murrelet

Affected Environment

Kittlitz's murrelets are small diving seabirds whose entire North American population, and most of the world's inventoried population, inhabits Alaskan coastal waters discontinuously from Point Lay south to the northern portions of southeast Alaska. Available information indicates this species nests in nonvegetated scree fields, coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains; generally in the vicinity of glaciers, cirques near glaciers, or recently glaciated areas. The U.S. Fish and Wildlife Service have designated it as a candidate species under the Endangered Species Act (Federal Register, 59 FR 58982) because of population declines.

The primary factor contributing to population decline of this species is glacial retreat and the resulting changes in the distribution and extent of glacial areas and the prey that may occupy those waters. Most glaciers in Alaska, including those surrounding Prince William Sound have been receding since the turn of the century (Lethcoe 1987, Molina 2001). This reduction in glacially influenced habitat is most likely responsible for the decline in Kittlitz's murrelets.

Other factors that may affect Kittlitz's murrelets include increased boat traffic in waters used to feed or aerial traffic such as helicopters flying over or near nest sites. Conclusive studies have not been completed that determine the effects of boat traffic or helicopter disturbance on Kittlitz's murrelets; however, generally

when a human induced or other type of disturbance occurs for a short period and infrequently, birds tend to fly away for a short time and then return to their nest. Permanent nest abandonment is generally the result of long-term and repetitive or frequent disturbances.

Environmental Consequences

Direct and Indirect Effects

The primary effect to Kittlitz's murrelets from the Proposed Action and alternatives would result from FIA inventory crews hiking and camping to access plots and the use of helicopters to access plots which cross Kittlitz's murrelet habitat. FIA marine vessel or skiff use is not expected to occur with enough frequency under any alternative to measurably disturb waters used for feeding and marine vessel operators must conform to Forest Plan guidelines for approach of seabirds (750-foot buffer from human disturbance and 1,500-foot buffer from aircraft).

Under the No Action Alternative, the proposed FIA inventory would not take place, and Kittlitz's murrelets would not be exposed to any potential disturbance (short-term flushing of birds) from FIA inventory crews or helicopters.

Under the Action Alternatives, helicopters and hiking access have the potential to cause birds to flush or to fly away from their nests for a short time and return, resulting in energetic costs. Kittlitz's murrelets only inhabit coastal areas; therefore FIA activities at or near coastal areas are likely to affect this species. These effects would occur mainly from helicopter overflights or hiking through and camping in coastal areas near Kittlitz's murrelet habitat.

Irrespective of alternative, effects from FIA helicopter or hiking access are negligible and are not expected to cause habitat or nest abandonment because of the short-term and nonrepetitive nature of helicopter flights and hiking activities. For example, there would be an average of one plot accessed by helicopter per 144,444 acres (226 square miles) at a frequency of about every two days under the Proposed Action. A determination of no effect to Kittlitz's murrelet populations are expected under any alternative.

Steller's Eider

Affected Environment

The Steller's eider breeding population in Alaska is listed as Federally Threatened (Federal Register, June 11, 1997). The decline in world population is not known, but current threats include predation by ravens, large gulls, and foxes on the breeding grounds where populations of these predators are enhanced by the year-round food and shelter provided by human activities and garbage dumps.

Breeding distribution is restricted to the North Slope and western Alaska. The current primary nesting range in Alaska consists of a portion of the central arctic coastal plain between Wainwright and Prudhoe Bay, primarily near Barrow.

Critical habitat for the Steller's eiders has been designated along the central arctic coastal plain between Wainwright and Prudhoe Bay, primarily near Barrow, Alaska. The majority of the world population winter in Alaska from the eastern Aleutian Islands to Lower Cook Inlet. This species does not generally occur near Alaska wilderness areas during summer months, but is included in this analysis because of occasional sightings in Prince William Sound during the summer.

Environmental Consequences

Direct and Indirect Effects

All alternatives are not expected to have adverse effects to Steller's eiders populations because it is unlikely that Steller's eiders would be present during FIA inventory activities regardless of alternative. Determinations of no effect to Steller's eider populations are expected under any alternative.

Queen Charlotte Goshawk

Affected Environment

The Queen Charlotte goshawk (goshawk) is a wide-ranging forest raptor that feeds on small and medium sized mammals and birds and occupies mature forest habitat in Southeast Alaska. Suitable nest site habitat consists of large trees with a dense canopy and generally an open understory averaging 12 to 37 acres in size. Goshawk nest sites generally occur far from openings, in stands more than 600 feet wide, on slopes of less than 60 percent, and near the toe of a slope or on bench. On average, nest trees occur at 423 feet elevation and generally occur below 1,000 feet. Breeding season home range size is strongly dependent upon the quality of foraging habitat and prey availability. In Southeast Alaska, prey remains identified in goshawk breeding areas included Steller's jays (*Cyanocetti stelleri*), grouse (*Dendragapus* spp.), varied thrush (*Izoreus naevius*), red squirrel (*Tamiasciurus hudsonicus*) and woodpeckers (*Picidae*).

Environmental Consequences

Direct and Indirect Effects

The primary effect to goshawks from the Proposed Action and alternatives would result from FIA inventory crews hiking to plots and the use of helicopters to access plots that are in goshawk habitat.

Under the No Action Alternative, the proposed FIA inventory would not take place, and goshawks would not be exposed to any potential disturbance (short-term flushing of birds) from FIA inventory crews or helicopters.

Under the Action Alternatives, helicopters have the potential to cause birds to flush or to fly away from their nests for a short time and return, resulting in energetic costs. Irrespective of alternative, FIA helicopter use is not expected to cause habitat or nest abandonment because of the short-term and nonrepetitive nature of helicopter flights (24 minutes in the morning and 24 minutes in the evening for each plot). However, the more frequently a helicopter is used to

access FIA plots, the more likely it is that goshawks will be subject to these short-term effects.

A FIA crew hiking to plots has the potential to cause short-term disturbances to goshawks similar to helicopters (flushing of birds for a short time). However, the disturbance from hiking activities is of a longer duration and results in more energetic costs than helicopters because the amount of time disturbing the individuals is greater as hiking access requires more person days than helicopter access.

Of the action alternatives, Alternative 1 would have the greatest potential to result in short-term disturbance with 817 person days per season. Alternatives 4 and 5 would result in the least potential for short-term disturbance with 273 person days per season. Regardless of alternative, the Proposed Action and alternatives would not likely result in abandonment of habitat or nests and there would be no adverse effect to goshawk populations. In addition, no habituation would occur. A determination of no impact for the Queen Charlotte goshawk has been made.

Trumpeter Swan

Affected Environment

The trumpeter swan is the largest waterfowl species in the world. Its present range is only a vestige of the once vast region of North America that is frequented in both summer and winter. Trumpeter swans breeding in Alaska spend the winter along the Pacific Coast from the Alaska Peninsula to the mouth of the Columbia River, where they take advantage of open waters of saltwater estuaries and freshwater lakes and rivers. Trumpeter swans will likely be present in the project area during the migration period in March and April and later starting in September. They have been observed during the summer but nesting in the project area is believed to be rare.

Environmental Consequences

Direct and Indirect Effects

Effects to trumpeter swans by any Action Alternative are negligible, primarily because of their rarity in the project area when FIA activity would be taking place. However, if FIA inventory crews do encounter trumpeter swans, it is unlikely that it will result in long-term habitat abandonment because of the short-term and nonrepetitive nature of helicopter flights and hiking activities. No impact to trumpeter swan populations is expected.

American Osprey

Affected Environment

Ospreys are migratory and spend their winters in Mexico and Central and South America. Ospreys return to Alaska in late April. A breeding pair returns to the same nest area each year. The nest is situated near water, atop trees, posts, rock

pinnacles, or even the ground. In mid-May the female lays eggs which are incubated by both parents for five weeks. Females closely guard their nestlings from the weather and predators while the male provides food. The osprey's diet is mainly fish. The nestlings are ready to fly at 7 to 8 weeks of age (mid-August). Most ospreys have departed Alaska by October. Little is known about the status of osprey populations in Alaska. They frequently adapt to human activities, but any disturbances which keep adults from their nests in May or June may cause the eggs or young nestlings to become chilled and die (VanDaele 1994).

Environmental Consequences

Direct and Indirect Effects

Effects to ospreys by any action alternative are negligible, primarily because they are not common in the project area. Encounters with nesting osprey would most likely occur at lakes and the majority of FIA crew access does not occur from lakes. Lake access will usually be by floatplane and not a helicopter. In addition, if FIA inventory crews do encounter ospreys, the mitigation in the Tongass Forest Plan will minimize any effects. It is unlikely FIA activity will result in long-term habitat abandonment because of the short-term and nonrepetitive nature of floatplanes and hiking activities. No impact to osprey populations is expected.

Peale's Peregrine Falcon

Affected Environment

The Peale's peregrine falcon nests in Alaska along the Pacific Coast from Southeastern Alaska through the Gulf of Alaska and west to the end of the Aleutian Islands. Nesting habitat in Alaska includes ledges of vertical rocky cliffs in the vicinity of seabird colonies (Ambrose et al 2000). Peale's peregrine falcons can be found within the project area during the proposed dates of work, but are considered rare throughout the project area.

Environmental Consequences

Direct and Indirect Effects

Effects to Peale's peregrine falcon by any Action Alternative are negligible, primarily because of their rarity in the project area. In addition, if FIA inventory crews do encounter Peale's peregrine falcons, the mitigation in the Tongass Forest Plan will minimize any effects. It is unlikely that FIA activity will result in long-term habitat abandonment because of the short-term and nonrepetitive nature of helicopter flights and hiking activities. No impact to Peale's peregrine falcon populations is expected.

Bald Eagle

Affected Environment

Bald eagles generally nest in Alaska from March 1 to August 31. Eagles nest in South-central and Southeast Alaska in large old trees they can reuse in

successive years, near saltwater shorelines, mainland rivers, and other water bodies (Daum 1994). Bald eagle nest protection standards are outlined in a Memorandum of Understanding (MOU) between the USFS and the USFWS. Among the stipulations in the MOU, the USFS is required to minimize human disturbance within a 330-foot radius around active bald eagle nests and avoid repeated helicopter flights within one-quarter mile of active nests (USFWS 2002).

Previous inventories of Southeast Alaska and Prince William Sound provided many nest locations; however, because recent inventories have not been completed, inventory data are not adequate to know the status of all nests. In areas with inventory data, these data are used to avoid known nest locations.

Environmental Consequences

Southeast Alaska has the largest population and highest density of bald eagles in the world. Most Tongass wilderness areas have not been inventoried. The proposed activity has the potential to overlap many shoreline bald eagle nests and there is the potential that such interactions could result in disturbance of these birds, particularly while nesting. All known nest sites from the Tongass and Chugach GIS databases are avoided following the guidelines in the MOU. When FIA crews spot eagles in areas with limited or no useful inventory data, they should attempt to locate the nest. When the nest is located, they shall avoid the 330-foot buffered nest area, and when feasible, keep helicopter flightpaths one-quarter mile away from identified nests.

Direct and Indirect Effects

The primary effect to bald eagles from the Proposed Action and alternatives would result from FIA inventory crews hiking to plots and the use of helicopters to access plots that cross bald eagle habitat.

Under the No Action Alternative, the proposed FIA inventory would not take place, and bald eagles would not be exposed to any potential disturbance (short-term flushing of birds) from FIA inventory crews or helicopters.

Under the Action Alternatives, helicopters have the potential to cause birds to flush or to fly away from their nests for a short time and return, resulting in energetic costs. Irrespective of alternative, FIA helicopter use is not expected to cause habitat or nest abandonment because of the short-term and nonrepetitive nature of helicopter flights. However, the more frequently a helicopter is used to access FIA plots, the more likely it is that bald eagles will be subject to these short-term effects and that these effects will occur more frequently.

An FIA crew hiking to plots has the potential to cause short-term disturbances to bald eagles similar to helicopters (flushing of birds for a short time). However, the disturbance from hiking activities is of a longer duration and results in more energetic costs than helicopters because the amount of time disturbing the individuals is greater as hiking access requires more person days than helicopter access.

Of the action alternatives, Alternative 1 would have the greatest potential to result in short-term disturbance with 817 person days per season. Alternatives 4 and 5 would result in the least potential for short-term disturbance with 273 person days per season. Regardless of alternative, the Proposed Action and alternatives would not likely result in abandonment of habitat or nests because a 330-foot buffer is established around active nests for ground activities with additional clearances placed on fixed-wing aircraft and helicopters. There would be negligible effects to bald eagle populations. This is because the mitigation identified in Chapter 2 will reduce the effects from the alternatives and the incremental differences between alternatives do not increase the effects to a higher level.

Mountain Goats

Affected Environment

Mountain goats are a Management Indicator Species that inhabit alpine areas on both the Chugach and Tongass National Forests. Mountain goats respond to helicopter and aircraft overflights based on type of aircraft, aircraft distance from goats, angle of aircraft approach, topography, and habitat (Côté 1996; Foster and Rahs 1983; Joslin 1986; Goldstein et al 2005). Behavioral responses include alert, interruptions from rest, increased foraging, and escape behavior (fleeing or hiding). Closer and more direct flightpaths elicited the strongest responses (Côté 1996; Foster and Rahs 1983; Joslin 1986; Goldstein et al. 2005).

Contradictory evidence exists as to whether or not goats habituate to aircraft overflights. Goats in Canada exposed to helicopters with sling loads did not habituate (Côté 1996; Foster and Rahs 1983). Goats in Alaska appeared to habituate, although the helicopters were smaller, less noisy, and did not carry sling loads (Goldstein et al 2005). Approach distances resulting in greater than 90 percent probability of maintaining existing behavior (i.e., eating, nursing, lying down) were significantly larger where mountain goats had received less prior exposure to helicopters (Goldstein et al 2005). For example, a helicopter overflight at 1,500 feet in areas with less previous exposure had a higher probability to react in a disturbance category (e.g., running) than in an area with more prior exposure. The reactions, however, were of low intensity and short duration.

Contradictory evidence and conjecture exists as to what happens to mountain goats following helicopter disturbance. In Alaska, responses occurred in 33 percent of the overflights and changes in maintenance behaviors lasted greater than two minutes (90 percent lasted <60 seconds and 55 percent lasted <20 seconds). Independent of study area (correlated to amount of prior exposure), reproductive class, angle, or distance, the length of time that a goat remained in a disturbed state following an overflight for an average of 30.7 seconds.

Environmental Consequences

Direct and Indirect Effects

Mountain goats are affected by hiking and helicopters and both can cause temporary displacement. Hiking may cause the goats to move out of the area while the crew is passing nearby and since there is no continuous human use of the area, the goats will likely return shortly afterwards. The helicopter will cause a disturbance as it approaches the area and then passes by with the goats returning shortly afterward. The actual displacement from both types of access will be a function of the individual(s) affected by the disturbance.

All of the action alternatives have some potential to affect mountain goats. Due to the nature of the inventory, FIA helicopter use is not expected to cause long-term habitat abandonment or population decline because of the short-term (two 24-minutes flights per plot) and nonrepetitive nature of helicopter flights and hiking in the area. For example, there would be an average of one plot accessed by helicopter per 144,444 acres (226 square miles) at a frequency of about every two days under the Proposed Action. There would be a negligible effect from all action alternatives to mountain goat populations. This is because the mitigation identified in Chapter 2 will reduce the effects from the alternatives and the incremental differences between alternatives do not increase the effects to a higher level.

Wolverine

Affected Environment

Wolverines live in forest, tundra, and taiga (Carroll et al. 2001). Wolverines are normally active year-round, although because they rear kits in dens during winter, and naturally move between multiple den sites, winter disturbance may cause the greatest displacement in annual productivity. Several factors appear to influence wolverine habitat selection at the landscape and stand levels, such as the distribution and density of large mammal carrion and the level of human disturbance (USDA Forest Service 2002). This human disturbance relates to people and effects of people on the ground; information does not exist as to the disturbance reactions by wolverines specifically to aircraft overflights. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns. Wolverines have low reproductive rates, low population densities, and large home ranges (Hornocker and Hash 1981). Wolverine densities in winter have been estimated at 2.95/1,000 km^2 in Alaska and 9.74/1,000 km^2 in the Yukon (Golden et al *in review*)

Environmental Consequences

Direct and Indirect Effects

The primary effect to wolverines from the Proposed Action and alternatives would result from FIA inventory crews hiking to plots and the use of helicopters to access plots that cross wolverine habitat.

Under the No Action Alternative, the proposed FIA inventory would not take place, and wolverines would not be exposed to any potential disturbance from FIA inventory crews or helicopters.

Under the Action Alternatives, helicopters have the potential to cause short-term disturbance, resulting in energetic costs. Irrespective of alternative, FIA helicopter use is not expected to cause habitat abandonment because of the short-term and nonrepetitive nature of helicopter flights. However, the more frequently a helicopter is used to access FIA plots, the more likely it is that wolverines will be subject to these short-term effects and that these effects will occur more frequently.

An FIA crew hiking to plots has the potential to cause short-term disturbances to wolverines similar to helicopters (short-term disturbance resulting in energetic costs). However, the disturbance from hiking activities is of a longer duration and results in more energetic costs than helicopters because the amount of time disturbing the individuals is greater as hiking access requires more person days than helicopter access.

Of the action alternatives, Alternative 1 would have the greatest potential to result in short-term disturbance with 817 person days per season. Alternatives 4 and 5 would result in the least potential for short-term disturbance with 273 person days per season. Regardless of alternative, the Proposed Action and alternatives would not result in abandonment of habitat and there would be negligible effects to wolverine populations. This is because the mitigation that requires the crews to avoid observed wolverines by one-half mile will reduce the effects from the alternatives and the incremental differences between alternatives do not increase the effects to a higher level.

Brown Bear

Affected Environment

During the summer, bears concentrate along low-elevation valley bottoms and coastal salmon streams. Habitat modification and human activities have increased the number of brown bears killed in defense of life or property (DLP; Suring and Del Frate 2002). Several encounters have occurred at salmon streams resulting in injury to humans and injury or death to brown bears. Den emergence typically occurs in early spring when much of the landscape is still snow covered. In the summer and fall, bears range across mid-elevations zones to accumulate nutrients from berries. Bears may enter den sites in October or November, depending on annual weather conditions.

Studies on the effects of aircraft, including fixed-wing planes and helicopters, report behavioral (McLellan and Shackleton 1989 McLellan 1990) responses of brown bears to overflights. Overt behavioral responses such as running and hiding typically occur when bears are active. The literature presents differing opinions on whether brown bears habituate to noise disturbance such as

helicopter overflights, but one plot visit in a 10-year period will not result in habituation. Rather, it could result in a behavioral disturbance of short duration, such as disruption of foraging activities or displacement from a berry patch.

Environmental Consequences

Direct and Indirect Effects

The primary effects from the Proposed Action and alternatives consist of negative encounters with FIA inventory crews as opposed to helicopter use. Because this project occurs in late spring and summer, this project will not affect denning bears. The more hours spent accessing plots by foot could increase the probability of encounters with brown bear, which could disrupt maintenance activities. It could also increase the probability of negative encounters, resulting in loss of life to human, bear, or both. Disturbance from helicopter access would be less than disturbance due to researchers at a backpacking site or by hiking access because ground access increases the likelihood of encountering brown bears. Ground access is more of a concern because, unlike most species, encounters with brown bears can lead to the death of the animal.

Of the action alternatives, Alternative 1 with 817 person days per season would have the greatest potential to result in short-term disturbance or death of the animal. Alternative 2 with 477 person days would have the second greatest potential for disturbance or death and the potential effects. The effects from Alternatives 1 and 2 are expected to be minor. Alternatives 3, 4 and 5 would result in the least potential for short-term disturbance with 399 or less person days per season and the effects are negligible.

Summary of Direct and Indirect Effects to Wildlife Species

A summary of the direct and indirect effects to TES species and other species is shown in Table 3-8.

Table 3-8. Potential direct and indirect effects to TES and other species by action alternative

	Alternatives				
Species	**1 Preferred Alternative**	**2**	**3**	**4 Proposed Action**	**5**
TE species*	No Effect	No Effect	No Effect	No Effect	No Effect
Sensitive Species	No Impact	No Impact	No Impact	No Impact	No Impact
Other Species					
Bald Eagles	Negligible	Negligible	Negligible	Negligible	Negligible
Mountain Goats	Negligible	Negligible	Negligible	Negligible	Negligible
Wolverines	Negligible	Negligible	Negligible	Negligible	Negligible
Brown Bears	Minor	Minor	Negligible	Negligible	Negligible

*Threatened, endangered, and sensitive species have specific categories of effects that are required by law and policy

Cumulative Effects

Threatened, Endangered and Sensitive Species

There are no direct or indirect effects or impacts to Threatened, Endangered or Sensitive Species so there are no cumulative effects to those species.

Other Species

With the exception of a few areas (e.g., Pack Creek) and at Forest Service public recreation cabins, ground-based wilderness recreation data for the general public is not systematically tracked. Outfitter/guide information is tracked as part of special use permit administration. Most of the guided and general public recreation activities that occur take place within one-quarter to one-half mile from the saltwater shoreline or up streams accessed from the shoreline (Shoreline Outfitter/Guide FEIS 2004). These areas of use are often localized and dependent on good beach access and flat ground. The majority of inventory plots are well inland of the shoreline area. The plots are also randomly selected and occur throughout the wilderness areas so they are largely independent of areas used by recreationists. While some overlap in use near the shoreline will occur, it will be short-term (10-20 minutes) once the FIA crew is dropped off and begins hiking to the inventory plot. As a result, there will be little, if any, overlap between ground-based recreationists and the FIA crew's activities to cause overall cumulative effects on wildlife.

It is reasonably foreseeable that there will be increases in the general public's (residents and nonguided visitors) use of wilderness areas, but it will occur at a relatively slow rate in the next 3-5 years. Outfitter/guided use is the faster growing component and is projected to continue to grow and at a rate higher than the general public for the next 3-5 years (USDA Forest Service Wilderness FEIS 2003, USDA Forest Service 2005e). However, due to the location of the inventory plots and the minimal overlap in time and space, the cumulative effects from these ground-based activities on wildlife are negligible.

The analysis of cumulative effects for wildlife considered the effects from uses that contribute to noise and visual effects from fixed-wing aircraft and helicopters. There is no information that is available to quantitatively determine the soundscape (decibel levels) for each wilderness so estimated use levels from 2004 were selected as the reference year to assess the incremental changes associated with this project.

The types of uses and further discussion of the effects is included in the project planning record. The uses considered in this analysis consisted of:

- Private fixed-wing aircraft overflights and landings
- Commercial fixed-wing aircraft (point to point, overflights) that are not under Forest Service permit
- Commercial fixed-wing aircraft operating in non-wilderness under Forest Service permit

- Commercial fixed-wing aircraft operating in wilderness areas under Forest Service permit
- Commercial helicopter tours
- Private helicopters
- Forest Service and private landowner helicopter logging adjacent to wilderness areas
- Coast Guard helicopter for search and rescue
- Forest Service authorized helicopter use allowed under ANILCA
- FIA helicopter use adjacent to wilderness areas
- Forest Service fixed-wing administrative use

In addition, Alaska Region wilderness area managers developed a wilderness rating summary to estimate the level of current aircraft and helicopter use for each wilderness. This summary placed each wilderness area's use into one of three categories that were considered along with all the other uses to evaluate cumulative effects. The categories are:

Category 1: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use of either floatplanes or helicopters is between 1 to 99 landings in this wilderness per year.

Category 2: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use is between 100 to 299 landings in this wilderness per year.

Category 3: Combined estimated use of floatplanes by outfitter/guides, unguided visitors, and administrative use of either floatplanes or helicopters is more than 299 landings in this wilderness per year.

As a result of these ratings, three wilderness areas (Kootznoowoo, Nellie Juan-College Fiord, and Misty Fiords) were classified as having over 299 landings per year and two wilderness areas (Karta River, and South Baranof) were classified as having between 100 to 299 landings per year, with the remaining 15 areas having less than 100 landings (See Table 3-4).

These five wilderness areas are of particular concern because they have the highest amount of helicopter, floatplane, and recreation use. Wildlife has a greater potential to experience long-term habitat abandonment related to human disturbance in these areas because of these existing uses. The Proposed Action and alternatives add to the use of these areas.

Cumulative Effects Screening Process

To assess the cumulative effects on wildlife, a screening process was established that incorporated the types of uses that contribute to noise and visual effects and the individual wilderness ratings. Additional information regarding cumulative

effects and the screening process can be found in the project planning record. The screening process included:

Wilderness Use Ratings: The five wilderness areas with greater than 100 landings were included at the start of the process.

Timber Sales on Adjacent Land: The five wilderness areas were then evaluated to determine if helicopter logging was occurring or would occur within a five mile adjacent "buffer" of the wilderness boundary

FIA Helicopter Activity on Adjacent Land: Each of these five wilderness areas were also evaluated to determine to what extent helicopter activity from FIA's helicopter activity in non-wilderness areas was occurring within five miles of the wilderness area boundary.

Large Scale Flightseeing: Each of these five wilderness areas were reviewed to determine if "large scale" flight-seeing over and/or landing in the wilderness was occurring. Large scale was defined as greater than 1,000 authorized fixed-wing landings or overflights.

Based on the results of the screening process, Misty Fiords was the only wilderness area that has higher levels of use in and around it at present, and in the reasonably foreseeable future.

Summary of Cumulative Effects on Wildlife

Wildlife may currently experience cumulative effects from other helicopter, floatplane, and recreation use. In addition, helicopter logging could occur within five miles of three wilderness areas and helicopter activity from FIA inventory work adjacent to wilderness could contribute to potential disturbance. While Misty Fiords has the highest level of use, the incremental effect (less than one percent) of FIA plots accessed by helicopter is negligible. The effect of additional helicopter or hiking access contemplated under the alternatives is considered negligible and will not contribute to permanent habitat abandonment or cause a downward trend in any of the identified populations. In addition, the potential for habituation is negligible. This is because the flights take place over a 10-year period, are of a short duration, and are nonrepetitive.

Employee Safety

Affected Environment

The FIA project was evaluated through a risk management process by two members of the Region 10 Risk Management Cooperative to assess the risk associated with the project. The primary risks evaluated were:

- Slips, trips, and falls from traveling overland
- Repetitive motion disorders (RMDs)
- Water travel

- Air travel
- Bear encounters

These are not the only hazards associated with the project, but are identified as the main hazards.

Methodology

A four-step risk management process was used to evaluate each alternative. The four steps include:

Hazard Identification: Review project maps, job hazard analyses (JHAs), accident records for field-related injuries, types and amount of access by alternative, mishap history for fixed-wing, helicopter, and watercraft.

Hazard Assessment: Determine the potential results of each hazard in terms of injury/illness, property loss, or project completion.

Safety Control Implementation: Determine what can be done to reduce or eliminate the hazard.

Risk Decision: Make a decision about the risk using the risk assessment matrix.

A fifth step is added after the evaluation and this step monitors and evaluates the safety controls that are put into place. This step is an ongoing process that takes place once the project is initiated and takes place over the life of the project.

Types of Hazards

Each type of hazard has an associated range of potential injuries. Potential injuries from the hazards associated with FIA work can range from scratches to fatalities (Table 3-9).

Table 3-9. Type of hazard and potential injuries

Type of Hazard	Potential Injuries
Slips, trips, falls	Slips, trips, and falls while hiking can lead to a range of potential injuries including scratches, cuts, bruises, punctures, sprains, strains, broken bones, and fatalities. Foot travel can be extremely hazardous due to the rugged terrain, dense underbrush, wet, mossy, steep slopes, high cliffs, river crossings in swift, frigid water, and difficulties with medical evacuation.
Repetitive motion disorders (RMDs)	RMDs are caused by too many uninterrupted repetitions of an activity or motion, unnatural or awkward motions such as twisting the arm or wrist, overexertion, or muscle fatigue. RMDs occur most commonly in the hands, wrists, elbows, and shoulders, but can also happen in the neck, back, hips, knees, feet, legs, and ankles. Repetitive motions, such as hiking long distances or ascending/descending steep slopes with heavy backpacks, can result in RMDs such as tendonitis or bursitis and cause pain, swelling or numbness.
Watercraft operations	Watercraft operations have the potential for capsize of the watercraft, equipment failure, and collision with submerged or floating objects. Potential injuries are severe and can include fatality, hypothermia, scratches, cuts, bruises, punctures, and broken bones.
Aircraft operations	Aircraft operations create the potential for aircraft crashes. Potential injuries from aircraft operations are severe and can include fatalities, scratches, cuts, bruises, punctures, and broken bones.
Bear encounters	Encounters with black and brown bears can result in injuries. Potential injuries are severe and can include fatalities, scratches, cuts, bruises, punctures, and broken bones.

Alaska Region Injury Statistics

The Alaska Region tracks injuries that occur during the course of employment. This information is useful to gain an understanding of the potential for injuries to occur under the Proposed Action and other action alternatives.

Slips, trips, and falls: Fifty percent (65 out of 129) of all field-related injuries to Forest Service employees in the Alaska Region over the last two years are the result of slips, trips, and falls (FIA Risk Assessment 2006).

RMDs: There have been seven illnesses related to RMDs.

Watercraft operations: Of the three accidents involving watercraft in the last three years, one of them resulted in a fatality. Other boating injuries to employees involved hypothermia, cuts, and bruises.

Aircraft operations: There were two injuries in the past two years related to aircraft that were not the result of an aircraft accident (hurt shoulder getting out of plane, sprained wrist handling helicopter longline). In addition, the Alaska Region has not experienced a floatplane or helicopter accident since 1997 or in the last 39,373 hours of flying fixed-wing aircraft and in the last 12,484 hours of helicopter operations.

Bear encounters: There were two bear incidents during the 2005 field season; both of them resulted in employee injuries and one bear was killed.

The FIA crews have had several injuries in the past five years (Table 3-10). The crews worked in wilderness areas during 2005. Wilderness inventory work did not occur from 2001-2004.

Table 3-10. FIA injuries 2001-2005 (CA-1 filed)

Year	Type of Injury	Wilderness	Lost Time and Amount
2005	Knee	No	Several weeks
2005	Knee	Yes	Several weeks
2005	Neck (training)	No	Whole summer
2005	Dislocated finger	Yes	None
2004	None	N/A	N/A
2003	Hernia (training)	No	Several weeks
2002	Knee	No	Several weeks
2001	None	N/A	N/A

Risk Assessment

A risk assessment matrix (Table 3-11) is a tool used to estimate levels of risk for each hazard identified for a project. The matrix is widely used within the safety management field and is used by the military and other government agencies. The matrix estimates the probability for an accident to occur, and the potential severity if an accident does occur. Based on the information evaluated, it allows a decision to be made about the level of risk for an activity.

The combination of the probability and severity produce a level of risk at extreme, high, medium, or low. **The highest level of risk for a hazard defines the level of risk for the entire alternative**. The main hazards for this project have been evaluated using the matrix to determine the residual risk. Residual risk is defined as the risk remaining after safety controls have been identified and implemented.

Table 3-11. Risk assessment matrix*

	Probability				
Severity	**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Catastrophic	Extreme	Extreme	High	High	Medium
Critical	Extreme	High	High	Medium	Low
Marginal	High	Medium	Medium	Low	Low
Negligible	Medium	Low	Low	Low	Low

The following definitions of probability and severity apply to the risk assessment matrix:

Probability: The likelihood that an event will occur.

Frequent: Occurs often, continuously experienced.
Likely: Occurs several times.
Occasional: Occurs sporadically.
Seldom: Unlikely, but could occur at some time.
Unlikely: Can assume that it will not occur.

Severity: The expected consequence of an event in terms of degree of injury, property damage, or other mission-impairing factors.

Catastrophic: Death or permanent total disability, system loss, major property damage, not able to accomplish mission.
Critical: Permanent partial disability, temporary total disability in excess of three months, major system damage, significant property damage, significantly degrades mission capability.
Marginal: Minor injury lost workday accident, minor system damage, minor property damage, and some degradation of mission capability.
Negligible: First aid or minor medical treatment, minor system damage, minor property damage, and some degradation of mission capability.

Environmental Consequences

Risk Assessment Factors Considered for Each Action Alternative

Several factors were used to help determine the risk outcomes for each alternative. These factors consisted of: 1) identifying key operational safety controls used to reduce the potential for an accident; 2) the ability of the operational controls to mitigate the potential of an accident; and 3) past accident history. In considering these factors, the risk from all hazards will not increase or decrease at the same rate based solely on the frequency of exposure.

Slips, Trips, and Falls: When crews are hiking to inventory plots they are doing so for the first time. Crews will be hiking routes mainly developed from maps and aerial photos, but it is unknown what they will encounter once on the ground and there is the likelihood that some inventory plots are impossible to access by hiking. Overflights have been incorporated into the alternatives in order to assess potential hazards along the hiking routes. Field crews also receive wildland walking and proper footwear training. Despite these operational safety controls, walking for extended periods in steep and brushy terrain with packs weighing approximately 65 pounds exposes the crews to hazards that can only be mitigated to a limited extent by these controls. In addition, slips, trips, and falls have historically been the major source of accidents. As a result, it is likely that the more time spent hiking with heavy packs in these conditions will result in more slips, trips, and falls.

Repetitive Motion Disorders (RMDs): The operational safety controls for RMDs include rotation of crew members so the same people are not always doing the long distance hiking with heavy backpacks, rest periods, and being in top physical condition to prevent muscle fatigue. Despite these operational safety controls, the nature of extended backpacking on steep terrain can not be fully mitigated by these controls. The most effective control of RMDs for this project is to reduce the exposure to extended backpacking with heavy backpacks. RMDs were reported seven times in the Alaska Region over the last two years. As a result, it is possible that the more time spent on extended backpack trips will result in more RMDs.

Watercraft operations: All FIA field crews are transported to shore by the boat contractor who holds a Coast Guard operating license. Forest Service employees do receive training for being passengers in boats and float follow during boating operations. The Forest Service does not have operational controls on using boats in various seas (i.e., weather minimums). Boating accidents are not common but do occur and have resulted in a fatality in recent years. As a result, the potential for a boating accident will change slightly.

Aircraft operations always have the potential for catastrophic consequences because aircraft crashes generally result in fatalities. These accidents are rare, but can occur for a variety of reasons including inclement weather, mechanical failure or human error. The Forest Service has procedures to minimize these specific risks including mandatory rest times for pilots, weather minimums that restrict flying, flight following procedures, limits on flight weights, and aviation training for the field crews. The operational safety controls along with the demonstrated safety record was the basis for assuming that aircraft operation risk would be the same for each action alternative.

Bear encounters: Field crews receive bear behavior, firearm, and pepper spray training. Injuries caused by bears are not common but do occur. Reducing the amount of time spent in the field, particularly at overnight camps where cooking

and food storage takes place, is one way to mitigate the hazard of a potential bear encounter.

When injuries do occur, they occur in remote areas. Injuries in remote areas, such as Alaska Region wilderness areas, can be particularly serious because of the delay in reaching medical facilities. These delays can result in additional pain and suffering or in the case of serious injuries, result in a fatality. A thorough emergency evacuation procedure is one way to mitigate some of the risk in this operation.

Direct and Indirect Effects

Alternative 0 (No Action)

Under the No Action Alternative the FIA work would not occur. There would be no risk to FIA crews because they would not collect inventory data in the project area.

Alternative 1 (Preferred Alternative)

Slips, Trips, Falls: There is the likelihood that some of these areas may not be accessible by foot due to the very steep, brushy, icy, and wet terrain. Crews will be hiking routes with heavy packs weighing an estimated 65 pounds. Continued exposure to this environment will lead to a slip, trip, or fall and produce a potentially serious injury or fatality. Due to the increased exposure, lack of prompt medical evacuation, and possible loss of communication, attempts to hike to all the plots would result in a risk assessment outcome of extreme risk.

Repetitive Motion Disorders (RMDs): This alternative exposes employees to the greatest amount of backpacking in remote areas throughout the field season. This amount of exposure to hiking with heavy backpacks has the potential to lead to RMDs such as tendonitis and bursitis. This would result in a risk assessment outcome of medium risk.

Watercraft Operations: This alternative has the greatest number of plots that would require a skiff to bring the inventory crews to shore so they could then hike to a plot. There would be increased exposure to longer and more frequent trips and greater potential to traveling outside of protected bays. There would also be an increased need for travel up remote river drainages where encounters with rocks, gravel bars, sweepers, and strong currents are possible. This would result in a risk assessment outcome of medium risk.

Aircraft Operations: This alterative does not have helicopter landings but increases the number of floatplane flights to access remote lakes and shorelines so the crews can get as close as possible to the plots before hiking. This alternative would have the highest number of helicopter overflights to assist with safe route-finding compared to other alternatives. A total of 49 overflights would occur each year. Overall, this alternative has the most amount of fixed-wing use. This would result in a risk assessment outcome of medium risk.

Bear Encounters: This alternative would require extended backpacks to access plots. The amount of extended backpacking required along with the hiking from

base camps increases the possibility of a bear encounter. This would result in a risk assessment outcome of high risk.

The highest level of risk for a hazard defines the level of risk for each alternative. The overall risk for this alternative would be extreme risk because of the outcome for the slips, trips and falls.

Table 3-12. Alternative 1 risk assessment outcome

Type of Hazard	Probability	Severity	Outcome
Slips, Trips, Falls	Frequent	Critical	Extreme Risk
Repetitive Motions	Occasional	Marginal	Medium Risk
Watercraft Operations	Seldom	Critical	Medium Risk
Aircraft Operations	Unlikely	Catastrophic	Medium Risk
Bear Encounters	Likely	Critical	High Risk

Alternative 2

Slips, Trips, and Falls: This alternative eliminates the five-day backpack trips which reduce the amount of hiking and campsites, and the need to access potentially more hazardous areas. The number of person days would be less in this alternative than Alternative 1 because the number of person days decreases from 817 to 477 per year. Crews would still be backpacking but not for as long. This would result in a risk assessment outcome of high risk.

Repetitive Motion Disorders (RMDs): The probability of RMDs occurring would be less in this alternative than Alternative 1 because the number of person days decreases from 817 to 477 per year. Crews would still be backpacking but the extended backpack trips would not take place in this alternative and those trips have the potential to contribute more to RMDs because of the duration of the trips. The increase in helicopter landings reduces some of the hiking with heavy packs. This would result in a risk assessment outcome of medium risk.

Watercraft Operations: Boat operations would be reduced in this alternative compared to Alternative 1 because approximately 20 plots per year would be accessed by helicopter. The overall risk assessment outcome would remain medium risk because of the potentially critical severity of a potential accident.

Aircraft Operations: Crews would be flown by fixed-wing to access some points where the plots could be accessed by hiking but some of the plots would still require a skiff ride prior to hiking. There would be 20 plots accessed by helicopter and another 29 plots would have overflights for helping to determine safe routes to the plot. This would result in a risk assessment outcome of medium risk.

Bear Encounters: The decrease in person days would reduce the probability of bear encounters. Although the probability of an encounter is less, the potentially critical severity of an encounter would result in a risk assessment outcome of high risk.

The presence of a helicopter to access a portion of the plots does provide a margin of safety if an injured person needs to be evacuated.

The highest level of risk for a hazard defines the level of risk for the alternative. The overall risk for this alternative would be high risk because of the outcome from slips, trips, and falls as well as bear encounters.

Table 3-13. Alternative 2 risk assessment outcome

Type of Hazard	Probability	Severity	Outcome
Slips, Trips, Falls	Likely	Critical	High Risk
Repetitive Motions	Occasional	Marginal	Medium Risk
Watercraft Operations	Seldom	Critical	Medium Risk
Aircraft Operations	Unlikely	Catastrophic	Medium Risk
Bear Encounters	Occasional	Critical	High Risk

Alternative 3

Slips, Trips, and Falls: This alternative does not have extended backpack or other backpack trips and reduces the number of person days in Alternative 2 from 477 to 399 person days. Over half of the number of plots would still be accessed by hiking and this would result in a risk assessment outcome of medium risk.

Repetitive Motion Disorders (RMDs): The reduced number of extended backpack and backpack trips would result in shorter hikes and less weight and a risk assessment outcome of low risk.

Watercraft Operations: The number of plots accessed by using a skiff to get to shore would be less than Alternative 2 because more plots per year (33) would be accessed by helicopter. The number of floatplane flights would decrease. This would result in a risk assessment outcome of medium risk.

Aircraft Operations: The number of plots accessed by helicopter would increase in this alternative to 33 per year compared to 20 in Alternative 2. In addition, the number of overflights would decrease slightly from 29 per year in Alternative 2 to 17 in this alternative. This would result in a risk assessment outcome of medium risk.

Bear Encounters: The decrease in person days would reduce the probability of an encounter but the severity of a potential injury would remain critical. This would result in a risk assessment outcome of medium risk.

Overflights will significantly help with determining safe routes for the crews.

The presence of a helicopter to access a greater portion of the plots does provide a margin of safety if an injured person needs to be evacuated.

The highest level of risk for a hazard defines the level of risk for the alternative. The overall risk for this alternative is medium risk because of the

outcome for the slips, trips and falls, watercraft and aircraft operations, and bear encounters.

Table 3-14. Alternative 3 risk assessment outcome

Type of Hazard	Probability	Severity	Outcome
Slips, Trips, Falls	Occasional	Marginal	Medium Risk
Repetitive Motions	Seldom	Marginal	Low Risk
Watercraft Operations	Seldom	Critical	Medium Risk
Aircraft Operations	Unlikely	Catastrophic	Medium Risk
Bear Encounters	Seldom	Critical	Medium Risk

Alternative 4 (Proposed Action)

Slips, Trips, and Falls: Heavy backpack trips are completely eliminated and the number of plots accessed by helicopter increases which allows the crews to access closer to the plots. The crews still will encounter steep, rugged conditions and be exposed to slips, trips, and falls. This would result in a risk assessment outcome of medium risk.

Repetitive Motion Disorders (RMDs): Heavy backpacks are completely eliminated which would reduce RMDs. This would result in a risk assessment outcome of low risk.

Watercraft Operations: This alternative would have 54 plots accessed by helicopter and would reduce the need for watercraft to help provide access to plots. The probability of a boating accident would be unlikely and result in a risk assessment outcome of low risk.

Aircraft Operations: This alternative would have 54 plots accessed by helicopter and four overflights per year. Despite the increase in helicopter activity, the probability of a helicopter accident is unlikely. This would result in a risk assessment outcome of medium risk.

Bear Encounters: The number of person days would be 273 per year and is a decrease of 126 person days from Alternative 3. The less time crew members are traveling in the woods, the lower the probability of having an encounter. The potentially critical nature of an encounter would result in a risk assessment outcome of medium risk.

The risk associated with working in remote areas decreases in this alternative because the crews are within a day hike. In addition, the presence of a helicopter to access a greater portion of the plots does provide a margin of safety if an injured person needs to be evacuated.

The highest level of risk for a hazard defines the level of risk for the alternative. The overall risk assessment for this alternative is medium risk because of the outcome from slip, trips, and falls as well as aircraft operations and bear encounters.

Table 3-15. Alternative 4 risk assessment outcome

Type of Hazard	Probability	Severity	Outcome
Slips, Trips, Falls	Occasional	Marginal	Medium Risk
Repetitive Motions	Unlikely	Marginal	Low Risk
Watercraft Operations	Unlikely	Critical	Low Risk
Aircraft Operations	Unlikely	Catastrophic	Medium Risk
Bear Encounters	Seldom	Critical	Medium Risk

Alternative 5

Slips, Trips, and Falls: All the plots are accessed by helicopter so the probability of slips, trips, and falls in this alternative would be seldom. There would still be hiking to the plots because the helicopter does not usually drop the crew directly at the plot. The probability of slips, trips, and fall is slightly less than Alternative 4. This would result in a risk assessment outcome of low risk.

Repetitive Motion Disorders (RMDs): All the plots are accessed by helicopter so the hiking distance is shorter and the probability of an RMD is unlikely and the severity would be negligible. This would result in a risk assessment outcome of low risk.

Watercraft Operations: All the plots are scheduled to be accessed by helicopter but a small number of plots will require boat access because of lack a landing sites. There would be minimal exposure. This would result in a risk assessment outcome of low risk.

Aircraft Operations: This alternative has the highest amount of plots accessed by helicopter (91 plots per year). There would be no overflights needed. Despite the increase in helicopter activity, the probability of a helicopter accident is unlikely. This would result in a risk assessment outcome of medium risk.

Bear Encounters: Because this alternative has all the plots accessed by helicopter, the probability of an encounter would be unlikely. This would result in a risk assessment outcome of low risk.

The highest level of risk for a hazard defines the level of risk for the alternative. The overall risk assessment outcome for this alternative is medium risk because of the outcome from aircraft operations.

Table 3-16. Alternative 5 risk assessment outcome

Type of Hazard	Probability	Severity	Outcome
Slips, Trips, Falls	Seldom	Marginal	Low Risk
Repetitive Motions	Unlikely	Negligible	Low Risk
Watercraft Operations	Unlikely	Critical	Low Risk
Aircraft Operations	Unlikely	Catastrophic	Medium Risk
Bear Encounters	Unlikely	Critical	Low Risk

Table 3-17. Risk assessment by action alternative

Alternatives	Extreme Risk	High Risk	Medium Risk	Low Risk	Final Risk Outcome
1 Preferred Alternative	S	B	R, W, A		Extreme
2		S, B	R, W, A		High
3			S, W, A, B	R	Medium
4 Proposed Action			S, A, B	R,W	Medium
5			A	S, R, W, B	Medium

S = Slips, Trips, Falls; R = Repetitive Motion Disorders; W = Watercraft Operations; A = Aircraft Operations; B = Bear Encounters

Conclusion

The basis for determining the risk outcomes was the amount of residual risk after key operational safety controls and past accident history were considered. Regardless of Action Alternative, it is likely that a work-related injury will occur during FIA activities. While all the hazards cannot be totally mitigated, the alternatives with more exposure to backpacking resulted in the highest risk outcomes. There will be an increase in the likelihood of slips, trips, and falls with the possibility of a severe injury occurring if crews attempt to traverse difficult terrain with heavy packs. The situation could be compounded by an injury occurring in a remote, interior part of a wilderness that might make a rescue more difficult and time consuming.

Wilderness travel will always carry some level of risk. This review recognizes the importance of minimizing motorized access but also recognizes the need to balance that with the level of risk. Minimizing the exposure to the potentially most hazardous plots does manage the risk associated with this project.

Cumulative Effects

FIA crews also do inventory work in the non-wilderness areas of the Alaska Region and all other state, private, and federal lands within the FIA coastal unit (Southeast Alaska to coastal South-central Alaska, including Kodiak Island). An average of approximately 222 plots are inventoried each year outside wilderness areas and during the 10-year period of this proposed project, an additional 2,216 non-wilderness plots will be inventoried. Virtually all the plots in non-wilderness areas are accessed by helicopter. FIA activity outside of wilderness areas could cause additional accidents although the risk outcome would be medium. This is because the hazards that have the greatest probability of occurring (slips, trips, and falls, RMDs, bear encounters) are reduced by the use of the helicopter. As a result, the cumulative effects to FIA employee safety would be similar to the level of risk in Alternative 5 which would allow helicopter access to all of the wilderness plots.

Other Resources

This analysis also includes the effects of the alternatives on heritage, botanical resources, invasive species, fisheries resources, and air and water quality.

Heritage

Affected Environment

The Alaska Region wilderness areas contain or can contain the remains of prehistoric sites such as campsites, villages, graves and cemeteries, rock art, and rock shelters. They also have historic sites such as cabins, mines, trails, canneries, shipwrecks, military installations, sacred sites, and traditional resources (Arndt et al 1987; Mattson et al 1987). Previous heritage resource surveys within the wilderness areas and wilderness study area have been limited because the Forest Service conducts few projects within these wilderness areas that result in ground disturbance

Environmental Consequences

Direct and Indirect Effects

Potential effects of the FIA survey may be split into two classes: 1) the activities used to establish reference points and collect the survey data from the research plots; and 2) the means of access to these plots. The first are considered to be a class of undertakings that has no potential to cause effects on historic properties as provided in the Programmatic Agreement with the State Historic Preservation Office (SHPO).

The second class is an undertaking that has the potential to cause effects to historic properties. The action alternatives considered five types of access (day hike, base camp, backpack, extended backpack, and helicopter) to the inventory plots which were used to estimate the person days in the field per year.

Definitions of the potential effects to heritage resources can be found in Table 3-18 and a summary of those effects is shown in Table 3-19.

Table 3-18. Definition of potential direct and indirect effects to heritage resources

Negligible: effects may or may not cause observable changes to natural conditions; regardless, they do not reduce the integrity of a resource.
Minor: effects cause observable and short-term changes to natural conditions, but they do not reduce the integrity of a resource.
Moderate: effects cause observable and short-term changes to natural conditions, and/or they reduce the integrity of a resource.
Major: effects cause observable and long-term changes to natural conditions, and they reduce the integrity of a resource.

The two-hour day hike has the least potential to effect historic properties as the small three-person crew will pass through the area only twice to record the plot data and will have completed the work in one day. The helicopter access mode has the second least potential to cause any lasting effects to historic properties. The crew will complete the work in one day. It should be noted that helicopter noise and visual effects may cause short-term disruption in the use of sacred sites. As a result, the direct and indirect effects from Alternatives 4 and 5 are expected to be negligible.

Backpack and extended backpack access are considered to have a slightly higher potential to affect historic properties in that the overnight campsites could be inadvertently located on a heritage site. However, at the beginning of each field season, the FIA crew leader must notify the local Heritage Resource Specialist of any locations where base camps are being considered during the field season. Proposed base camp locations on known heritage sites will be relocated.

Since each camp would be for only a single night any disturbances are expected to be very minor and short-term in nature and the location is expected to fully recover to its preexisting condition. Base camps have the most potential to inadvertently affect historic properties as more activities would occur to establish a campsite for repeated use. This use is not expected to be for more than two to three nights so potential effects are still considered to be fairly minor. It is expected that the crews will practice *Leave No Trace* outdoor ethics while in the field.

Alternatives that contemplate higher number of user days (hiking, camping, or base camping) have more potential for ground disturbance that could result in effects to historic properties. However, this potential is generally considered remote and a determination of no historic properties affected can be made provided all overnight camps use *Leave No Trace* outdoor ethics. As a result, the direct and indirect effects from Alternatives 1, 2, and 3 are expected to be minor.

Table 3-19. Potential direct and indirect effects to heritage resources by action alternative

	Alternatives				
	1 Preferred Alternative	**2**	**3**	**4 Proposed Action**	**5**
Heritage Resources					
NHPA Section 106 effect	NHPA*	NHPA	NHPA	NHPA	NHPA
Environmental Effect	Minor	Minor	Minor	Negligible	Negligible
Alternative Components					
Number of plots w/camping (per year)	54	34	21	0	0
Person days (per year)	817	477	399	273	273

*NHPA = No historic properties affected

Cumulative Effects

Cumulative effects to heritage resources consist of looting and vandalism, erosion and accelerated decay, and inadvertent damages. It is also reasonably foreseeable that visitor use of wilderness areas and outfitter/guide use of these areas is expected to increase. It is possible that visitor and outfitter/guide use could contribute to the degradation of historic resources. However, FIA inventory activities in conjunction with the cumulative effects described should not exceed negligible to minor environmental effects to heritage resources.

Vegetation

This section generally describes vegetation, sensitive plants and rare plants; and how the proposed activities might affect them. The wilderness areas discussed in this report are scattered along an arc of land 900 miles long, and it is not known where specific campsites or foot travel routes might be located or exactly where helicopters might land, therefore this discussion is general. More detailed information about vegetation is found in the Vegetation Resource report (Stensvold, 2006b), and in the Biological Evaluation for Plants (Stensvold, 2006a) in the project planning record.

Affected Environment

General Vegetation

The maze of fiords and islands, streams, and mountains characterizing the Alaska Region support a wide array of vegetation types ranging from wetlands to temperate rainforests to alpine ecosystems. In addition to vegetated areas, this landscape includes extensive glaciers, periglacial areas, bare rock, gravelly streambeds and sandy beaches. Vegetation discussed here is grouped into three very general ecosystems, wetlands, temperate rainforests, and high elevation non-forested environments.

Wetlands are characterized as having a water table at or near the surface of the land, saturated soils and a flora adapted to this supersaturated regime. Included in wetland ecosystems are bogs (muskeg), fens, swamps, marshes, and salt marshes. They range in size from a few square feet to many acres.

Generally, temperate forests are dominated by western hemlock and Sitka spruce, with smaller components of yellow cedar, mountain hemlock, and lodgepole pine. Species composition varies depending on factors including latitude, altitude, aspect, drainage, geology, soils, water table, disturbance, and rainfall. Depending on the factors mentioned above, composition of the understory shrub layer can vary to include red huckleberry, blueberry, rusty menziesia, salal, copperbush, and devil's club. The forest floor is generally covered by thick carpets of mosses and liverworts. These tiny plants also blanket the decaying jumble of fallen trees and branches that are abundant in these very wet forests. Where adequate light is available, the forest floor may support plants such as oak fern, bunchberry, foamflower, and single delight. At the edges of forests, in forest openings, in avalanche chutes, or at treeline

vegetation includes deciduous trees and shrubs such as Sitka alder, red alder, elderberry, willows, and salmonberry.

High elevation non-forested communities include subalpine meadows of herbaceous plants, which are found at treeline and in protected areas above treeline. Meadows are often interspersed with patches of wind-contorted (Krumholtz) forests of dwarfed trees. Areas more exposed to wind and cold support heaths, communities dominated by dense low-growing shrubby plants. The plants of rocky outcrops and windswept exposures are small, slow growing plants that do not compete well with herbaceous vegetation. These communities are also interspersed with lichens and mosses adapted to the extreme climatic conditions of the alpine. Depending on the topography and exposure, these alpine plant communities form mosaics of vegetation of varying complexity.

Sensitive Plants

According to Forest Service policy, a Biological Evaluation (BE) was conducted to analyze the possible effects of the proposed activities on sensitive plants (Stensvold, 2006b). The 19 vascular plants designated as sensitive species in the Alaska Region are listed in Table 3-20. The determination of effects resulting from the BE is shown at the end of the direct and indirect effects section and in Table 3-21.

Table 3-20. Alaska Region sensitive plants

Aphragmus eschscholtzianus	*Papaver alboroseum*
Arnica lessingii ssp. norbergii	*Platanthera gracilis**
Botrychium tunux	*Poa laxiflora*
Botrychium yaaxudakeit	*Puccinellia glabra*
Carex lenticularis var. dolia	*Puccinellia kamtschatica*
Cirsium edule	*Hymenophyllum wrightii*
Draba kananaskis	*Romanzoffia unalaschcensis*
Glyceria leptostachya	*Senecio moresbiensis*
Isoetes truncata	*Stellaria ruscifolia* ssp. aleutica
Ligusticum calderi	

*This species is being removed from the sensitive species list, due to taxonomic changes; it has been subsumed into *Platanthera stricta* (Sheviak, 2002) which is relatively widely distributed and abundant.

The only plant federally listed or proposed by the U.S. Fish and Wildlife Service in Alaska is *Polystichum aleuticum* C. Christesen, which is endangered. It is only known from Adak Island and is not expected to occur in the project area.

Rare Plants

For the purposes of this analysis, rare plants are those known or suspected to occur on National Forest System lands in the Alaska Region that are tracked by the Alaska Natural Heritage Program (ANHP), and plants the Forest Service considers to be rare. These plants are shown in Appendix C of the Vegetation Resource report (Stensvold, 2006b). The rankings are defined in Appendix B of

the same report. The Forest Service determined rarity by evaluating the distribution and abundance of all the plants known or suspected to occur in the Alaska Region.

Environmental Consequences

Effects on Vegetation

For this analysis, a finding is made on whether the alternatives will affect TES species in accordance with the Endangered Species Act and Forest Service policy. Table 3-21 shows the definitions of potential effects to general vegetation. A summary of the effects of each alternative on all vegetation resources is located at the end of the vegetation resources section (Table 3-22).

Table 3-21. Definition of potential direct and indirect effects to general vegetation

Negligible: effects may or may not cause observable changes to natural conditions; regardless, they do not reduce the integrity of a resource.
Minor: effects cause observable and short-term changes to natural conditions, but they do not reduce the integrity of a resource.
Moderate: effects cause observable and short-term changes to natural conditions, and/or they reduce the integrity of a resource.
Major: effects cause observable and long-term changes to natural conditions, and they reduce the integrity of a resource.

Direct and Indirect Effects

Activities relating to this project that may affect general vegetation, sensitive plants, rare plants or their habitat include:

Ground disturbance from slips and falls made during hiking. This ground disturbance could damage the root systems of individual plants, potentially harming or killing them.

Trampling and ground disturbance associated with temporary camps supporting the field crews could damage the root systems of individual plants, potentially harming or killing them.

Vegetation pressed down while the helicopter lands and is on the ground. Landings and takeoffs are gentle and the pressed-down vegetation springs back quickly.

Vegetation crushing caused by passengers leaving and entering the helicopter. This trampling would occur one time during landing and be low in intensity; the plants would recover quickly.

Plants adjacent to and in the plot area would be trampled while vegetation data are taken. The effects of the trampling may include some crushed vegetation, but the effects are short lived since ground disturbance would not occur.

The effects listed above would be infrequent (once every 10 years) and low in intensity (only a few people walking to the plot and around the plot). Therefore

effects from project activities to general vegetation and rare plants under all alternatives would be negligible. The Biological Evaluation analyzing the possible effects of the proposed activities on sensitive plants resulted in a determination of No Impact (R-10 Supplement 2670.42.5(1)). Effects are summarized in Table 3-22.

Table 3-22. Potential direct and indirect effects to vegetation resources by action alternative.

	Alternatives				
Vegetation	**1 Preferred Alternative**	**2**	**3**	**4 Proposed Action**	**5**
Sensitive Species	No Impact*	No Impact	No Impact	No Impact	No Impact
General Vegetation	Negligible	Negligible	Negligible	Negligible	Negligible
Rare Plants	Negligible	Negligible	Negligible	Negligible	Negligible

No Impact is the determination of effect on sensitive species

Cumulative Effects

Other activities in wilderness areas affecting vegetation are outfitting and guiding, camping, and hiking related to recreational and subsistence uses; recreational use of Forest Service cabins and trails; agency administration activities; activities associated with special use authorizations, activities related to inholdings within wilderness areas and results of unauthorized uses of wilderness areas. Effects of these activities include crushed vegetation, soil disturbance, hardening of use areas, trail hardening, brush cutting, tree cutting, and the introduction of invasive species. When the proposed activities are compared with the activities listed above they are not significant in effect, amount or duration. In addition, because of the remoteness of the majority of plots, there is little chance of the areas being affected having overlap in time or space with those not associated with this project. Consequently, there are negligible effects to general vegetation, and no cumulative effects to sensitive plants and rare plants resulting from the proposed activities.

Invasive Species

Affected Environment

Wilderness areas of the Alaska Region currently harbor few invasive species based on limited survey results and collected anecdotal information (Schrader et al 2005). Established and expanding populations of invasive species occur primarily along travel corridors and at disturbed sites throughout the region (Alaska Committee for Noxious and Invasive Plant Management 2004; DeVelice 2003). Additional information regarding can be found in the invasive species resource report located in the project planning record.

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Effects on Invasive Species

Potential invasion routes applying to FIA sampling crews include:

Invasive Plants: Vectors: seeds and plant parts transported by helicopter skids, equipment, and hiking boots; aquatic plants transported by floatplanes.

Aquatic Organisms: Vectors: floatplanes, ballast water, boats and trailers, equipment, and rubber boots.

Table 3-23. Definition of risk for invasive species

Low: risk for introduction of and/or spread of invasive organisms, leading to reduced ecosystem integrity.
Moderate: risk for significant introduction of and/or spread of invasive organisms, leading to reduced ecosystem integrity.
High: risk of immediate introduction of and/or spread of invasive organisms, leading to reduced ecosystem integrity.

Direct and Indirect Effects

Based on a recent assessment of invasive species in Alaska national forests, there is no risk of the spread of invasive terrestrial wildlife, pathogens, and insects from this project (Schrader et al 2005). This is because there are very few of these vectors and their occurrence is very limited. The risk of the spread of invasive plant and aquatic species for all alternatives is considered low at this point in time largely because the current populations of invasive species are low, with the sources for invasion and spread very limited. This risk is also low because FIA crews are required FIA crew members shall inspect and clean their boots nightly and other equipment if necessary at the end of each day, and the helicopter skids and floor pan nightly, to remove any invasive plant materials that might have been encountered during survey work. In addition, if FIA crews visit wilderness sites that have a higher risk of invasive species being present (e.g. historic fox farms and mining sites, special use permit sites) or areas outside of wilderness (e.g. log transfer facilities, roads, gravel pits) that have a higher risk, the crews will return to the boat to clean the helicopter, shoes and other gear prior to visiting the next inventory plot.

Cumulative Effects

Currently, the primary source of cumulative effects that could cause the spread of invasive species in wilderness areas is likely to be other recreational activity. Historic use sites such as fur farms, special use sites, mineral development sites, agricultural sites, and urban centers are also important sources for existing populations of invasive plants. Generally the threat of invasive species is greatest in heavily used recreation areas or other areas where ground disturbance has occurred. Because the Proposed Action and alternatives will have little, if any, inventory activities in these areas, there is not expected to be an overlap in time and space between these activities. As a result, the overall cumulative effects for all alternatives are low.

Fisheries

Affected Environment

Endangered or Threatened salmon stocks that may spend part of their life history in Alaskan waters include five stocks of Chinook salmon, one stock of sockeye salmon, and five stocks of steelhead. All of these stocks spawn and freshwater rear in the Columbia River or Willamette River drainages. Three sensitive fish species occur on the Tongass National Forest. These include the Fish Creek Chum salmon, the Island King salmon, and the northern pike. The northern pike is found only on the Yakutat forelands and the Fish Creek chum salmon occurs near Hyder. Both of these species are not located within the project area. The Island King salmon occurs naturally on islands including the runs in King Salmon Creek and Wheeler Creek; both sites are on Admiralty Island.

Environmental Consequences

Direct and Indirect Effects

The Proposed Action and alternatives are not expected to have any direct or indirect effects to endangered, threatened species or sensitive species, or essential fish habitat because FIA inventory activity, regardless of alternative, is infrequent (takes place over 10 years), does not involve ground disturbance, and is not concentrated near fish habitat.

Cumulative Effects

Because there are no direct or indirect effects, there are no cumulative effects to fisheries.

Air Quality

Affected Environment

The air quality on the Tongass and Chugach National Forests and in the project area is generally good because of the prevalent airflow from the Pacific Ocean, the relatively small amount of industrial development, and the absence of large population centers (Chugach Forest Plan EIS, pages 3-4 through 3-7 and Tongass National Forest EIS, pages 3-9 through 3-10). None of the wilderness areas in the Alaska Region exceed National Ambient Air Quality Standards (NAAQS). Juneau's Mendenhall Valley, which is outside of the project area, is the only area in Alaska that is known to have exceeded NAAQS. Those exceedances occurred in the early 1990s and were due to woodsmoke and road dust. There have been no exceedances since that time (USDA Forest Service 2002). The primary sources of air pollution in Alaska are attributable to diesel power plants, asphalt plants, incinerators, and wildfires. Motorized transport contributes to degradation of air quality; however, it was not identified as a primary source of air pollution.

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Direct and Indirect Effects

A Bell 407 helicopter is used by FIA to access survey plots. The Bell 407 helicopter burns approximately 46 gallons of fuel per hour (Bell 407 Product Specifications, January 2006). Assuming a 105-day operating season and an average of 3 hours of flight time per day, the helicopter would consume a maximum of 14,500 gallons of fuel per year.

Similar helicopter operations and fuel usage have been quantified for other machines for more extensive operations. The Helicopter Landing Tours on the Juneau Icefield FEIS (USDA Forest Service 2002) authorized approximately 20,000 landings per year. There have been no air quality violations as a result of helicopter activity in Juneau. Negligible effects to air quality are expected to result from helicopter emissions under any of the FIA action alternatives for several reasons; the emissions are for a short duration, not substantial, are localized and then spread over a large area, and are emitted at flight elevations.

Cumulative Effects

Generally any boat, airplane, or helicopter activity that occurs in or adjacent to wilderness areas can contribute to the overall diminishment of air quality in the project area. The primary sources of air pollution described above do not occur in the project area and will not add to the diminishment of air quality in or adjacent to wilderness areas.

Although some wilderness areas are more frequently visited than others, none of these areas are approaching NAAQS thresholds. The use of FIA helicopters in conjunction with other motorized transport in the project is not expected to cause a change in air quality because the FIA helicopter use has a negligible effect on air quality. In summary, the effects of the Proposed Action and alternatives will add a negligible amount of air pollution. The additional air pollution in conjunction with other motorized transport in Alaska Region wilderness areas will not cause any of these areas to exceed NAAQS standards under any alternative.

Water Quality

Affected Environment

The wilderness areas in the Alaska Region contain thousands of ponds, rivers, streams, and lakes. All the water bodies within the wilderness areas meet State water quality standards.

Environmental Consequences

Direct and Indirect Effects

The Proposed Action and alternatives will not have any direct or indirect effects to water quality. This is because the FIA inventory, regardless of alternative, is short-term (up to several days per plot including hiking time) and does not involve ground-disturbing work.

Cumulative Effects

Because there are no direct or indirect effects, there are no cumulative effects.

Subsistence

Affected Environment

The wilderness areas of the Alaska Region provide a multitude of opportunities for subsistence activities and are an important component of the culture for those who partake in these activities. These activities include fishing, hunting, berry-picking, trapping, and gathering plants for medicinal and other traditional purposes and generally occur close to the shoreline.

Environmental Consequences

Direct and Indirect Effects: FIA activities that could affect subsistence activities are boating to an area, hiking and camping, and helicopters flying over or near subsistence areas.

Depending on the alternative, FIA crews that needed to access the shoreline on their way to an inland plot would be present for a short period in the subsistence area while they get out of a skiff before hiking to the plot. Some alternatives would rely on base camps for several days to access a portion of the camps and they may be near subsistence areas although many of these will be as close to the randomly placed plot as possible. Several of the action alternatives would also rely on helicopters to fly crews to the plots and the helicopter would pass by once in the morning and once later in the afternoon.

All of the action alternatives were evaluated using the criteria identified in the Subsistence Management and Uses Handbook (R10 FSH 2090.23). Due to the nature of the project, there are no other lands available or alternatives that would reduce or eliminate the proposed action(s) from lands needed for subsistence purposes; however, all of the action alternatives shall not result in a significant restriction of subsistence uses because:

- There are no impacts to fish and wildlife habitat;
- The majority of FIA plots are usually well inland due to the random nature of the inventory;
- The short duration the crews would be present in the area and a plot would only be visited once during the 10-year period of the inventory;
- With the exception of minor effects to brown bear in Alternatives 1 and 2, the effects to wildlife resources are negligible for all species (page 77);
- There are no potential effects to fisheries resources (page 98);
- Consultation efforts with tribes and corporations within the Alaska Region did not result in any concerns being expressed about the proposed inventory.

Cumulative Effects: It is foreseeable that increases in outfitter/guide and visitor use will occur in the next three to five years and some of this use would occur in subsistence areas. However, the overall effect in conjunction with the

FIA inventory shall not result in a significant restriction of subsistence uses. This is because of the primarily negligible effect on wildlife and fisheries resources and limited overlap in time and space that FIA crews would have with subsistence users.

Alternative Components and Effects from Excluding Non-Forested Plots

An analysis was completed to determine how the alternative components and potential effects changed by excluding the non-forested plots. This analysis was done in response to public comments that the non-forested plots should be excluded from the inventory because they are not part of the core FIA data that are required by Congress, and it would help minimize potential effects. This analysis also helped determine if additional alternatives needed to be added to the Final EIS that would exclude the non-forested plots.

Alternative Effects

Overall, the effects from the inventory cannot increase by excluding non-forested plots. The effects can remain the same or decrease because person days, overflights, landings, and camping all decrease.

Wilderness Character: The effects to two qualities of wilderness character decrease. The undeveloped quality impacted by helicopter use, and the outstanding opportunities for solitude quality have effects decrease from moderate to minor, but only in Alternative 4. This is because the effects are based on a level of helicopter landings over the summer season, and excluding non-forested plots decreases the landings below the defined level. The cumulative effect on the undeveloped quality for motorized use remains at moderate and the cumulative effect on the outstanding opportunities for solitude remains at major because of the overflights that would still occur.

Even though the amount of monumentation will decrease, the effects from monumentation will not change. This is because there will continue to be a monumentation placed at each of the remaining forested plots.

Wildlife: All of the existing alternatives currently have the lowest possible effect (negligible) on all species, with the exception of brown bears (minor) in Alternatives 1 and 2. Excluding the non-forested plots would not change the effects to all species. In addition, the effects to brown bears would remain minor for Alternatives 1 and 2. Despite the decrease in person days and the amount of camping, there are still a substantial amount of plots that would require three-day backpack trips that could result in potential negative interactions with bears.

Safety: The effects from excluding non-forested plots are:

> The existing Alternative 1 final risk outcome would change from extreme risk to high risk because of a decrease in slips, trips and falls from traveling

to fewer plots. Slips, trips, and falls are the primary contributor to the risk outcome based on person days, and amount of backpacking and hiking.

The existing Alternative 2 final risk outcome would change from high risk to medium risk because slips, trips, and falls, as well as bears are less of a hazard with the decrease in person days, and amount of backpacking and hiking.

None of the other existing alternatives have a change in risk outcome because aircraft operations are rated as medium and that does not change.

Heritage Resources: There are no changes in effects from dropping the non-forested plots. Although fewer plots will be inventoried, each alternative still retains the same proportional combination of day hiking, overnight camping, and helicopter use. The nature of the activities proposed has not changed and the primary concern is whether camping occurs in an alternative. For heritage resources, the environmental effects for each alternative remain unchanged. More importantly, each alternative would continue to have a finding of "No Historic Properties Affected" under the terms of Section 106 of the National Historic Preservation Act.

All Other Resources: There are no changes in effects to all other resources because their effects are already at the lowest level based on the threshold definitions for the resources or there are no effects. For example, the effect to sensitive plant species is currently No Impact and cannot decrease.

Conclusion

The current EIS range of alternatives analyzes the maximum level of potential effects to all resources. The direct effects from the different alternative components are largely the same, even if non-forested plots are excluded, with a few effects to wilderness character and safety decreasing. As a result, there is not enough difference between alternative components or effects to warrant additional analysis of alternatives regarding non-forested plots. Excluding the non-forested plots is an option that could be applied to any of the action alternatives.

Table 3-24. Comparison of action alternatives by significant issues and potential direct and indirect effects

Issues and Effects	Alternative				
	1 Preferred Alternative	2	3	4 Proposed Action	5
Wilderness Character					
Untrammeled: unhindered and free from modern human control or manipulation	None	None	None	None	None
Natural: ecological systems are substantially free from effects of modern civilization	None	Negligible	Negligible	Negligible	Negligible
Undeveloped: helicopter use	Negligible	Minor	Minor	Moderate*	Major
Undeveloped: monumentation	Major	Major	Major	Major	Major
Outstanding opportunities for solitude or primitive, unconfined recreation	Negligible	Minor	Minor	Moderate*	Major
Wildlife					
TE species	No Effect	No Effect	No Effect	No Effect	No Effect
Sensitive Species	No Impact	No Impact	No Impact	No Impact	No Impact
Other Species					
Bald Eagles	Negligible	Negligible	Negligible	Negligible	Negligible
Mountain Goats	Negligible	Negligible	Negligible	Negligible	Negligible
Wolverines	Negligible	Negligible	Negligible	Negligible	Negligible
Bears	Minor	Minor	Negligible	Negligible	Negligible
Employee Safety-Risk					
Slips, Trips, Falls	Extreme*	High*	Medium	Medium	Low
Repetitive Motion Disorders	Medium	Medium	Low	Low	Low
Watercraft Operations	Medium	Medium	Medium	Low	Low
Aircraft Operations	Medium	Medium	Medium	Medium	Medium
Bear Encounters	High	High	Medium	Medium	Low

*These effects would change if non-forested plots are excluded:
Wilderness Character: Alternative 4 would be Minor
Safety: Alternative 1 would be High, Alternative 2 would be Medium

Other Disclosures

Environmental Justice

In accordance with Executive Order 12898, all Action Alternatives were assessed to determine whether they would have disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority or low income populations. The FIA survey will take place in Alaska Region wilderness areas that are remote and largely uninhabited; therefore, there is no disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority or low income populations.

Unavoidable Adverse Effects

Potential adverse effects are identified in this analysis. Most are minor, and can be mitigated through management and mitigation requirements. The exception is the effect of FIA activities on wilderness character, as any increase in human influence in wilderness areas has the potential to adversely affect wilderness character, and all action alternatives will increase human influence in the project area.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are decisions affecting nonrenewable resources such as soils, wetlands, unroaded areas, and heritage resources. Such commitments are considered irreversible when the resource has deteriorated to the point that renewal can occur only over a great period of time, at great expense, or not at all. This analysis describes the effects of the Proposed Action and alternatives for each resource, and no irreversible effects are expected to occur as a result of this project.

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