APPENDIX D
OLD-GROWTH HABITAT CONSERVATION STRATEGY, WILDLIFE STANDARDS AND GUIDELINES, AND WILDLIFE VIABILITY

Appendix D

Old-Growth Habitat Conservation Strategy, Wildlife Standards and Guidelines, and Wildlife Viability

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1. INTRODUCTION

This appendix provides a description of the background, rationale, and assumptions, for the changes to the Tongass old-growth habitat conservation strategy, proposed by the alternatives evaluated in the 2008 Forest Plan amendment Final Environmental Impact Statement (FEIS). In addition, it describes the assumptions and rationale for application of the wildlife viability ratings to the alternatives. This appendix brings forward and updates information contained in Appendix N to the 1997 FEIS.

Chapter 2 addresses the old-growth habitat conservation strategy. It includes a summary of the historical background, a description of the 1997 strategy including modifications to the strategy between 1997 and 2007, and an overview of the new science that is relevant to the strategy. Sections 2.1 and 2.2 begin by presenting the historical background of the strategy and describe the strategy, as it was proposed in 1997. These two sections are largely summarized from Appendix N to the 1997 FEIS. Section 2.3 summarizes the modifications to the strategy that have occurred through Forest Plan amendments and land adjustments from 1997 through 2007 and Section 2.4 summarizes new relevant science that has been developed since 1997.

Modifications to the strategy proposed by the 2008 FEIS alternatives are described in Section 2.5. In this FEIS, Alternative 5 (No Action) incorporates the 1997 strategy, as modified between 1997 and 2007, while the six action alternatives propose modifications. Alternatives 1, 2, 3, and 6 propose the same refined network of Old-Growth Habitat Land Use Designations (LUDs) and incorporate the same changes to the wildlife standards and guidelines, but differ in the amount and distribution of some of the other non-development LUDs that also comprise the reserve system. Section 2.5 describes the background, rationale, and modifications to the strategy proposed by these four alternatives. These modifications include changes to the old-growth reserve (OGR) network, changes in other non-development LUDs, and changes to species-specific standards and guidelines. Alternatives 4 and 7 propose more extensive changes to the conservation strategy and standards and guidelines. Section 2.5 also summarizes the rationale and changes to the strategy incorporated in these alternatives. The changes for all of the alternatives are compared to Alternative 5 (the 1997, as amended, Forest Plan).

In 1995/1996 and 1997 a series of expert risk assessment panels were conducted to evaluate the various alternatives used in the 1997 FEIS and predecessor documents. The purpose of the panels was to evaluate various alternatives for the likelihood of maintaining sufficient, well distributed habitat to maintain viable populations of old-growth associated wildlife species over a 100-year horizon. These panel assessments, along with new information and an alternate method, were used as a tool to evaluate wildlife viability for the 2008 FEIS alternatives. Chapter 3 describes the panel assessments, summarizes results of the panel assessments that are relevant to the 2008 alternatives, discusses new relevant science, and then summarizes the application of the panel assessments to the 2008 alternatives, including rationale and assumptions. Section 3.1 presents historical background for the Tongass wildlife risk assessment panels and ratings, Section 3.2 describes the panel assessment process, and Section 3.3 summarizes the 1995/1996 and 1997 panel assessment results. These first three sections of Chapter 3 are largely summarized from the risk assessment panel reports and Appendix N to the 1997 FEIS. Section 3.4 summarizes new science related to wildlife viability assessment that has been developed since 1997. The application of the 1995/1996 and 1997 panel assessments to the 2008 FEIS alternatives is described in Section 3.5. Finally, Section 3.6 presents an alternative approach to assessing viability.

Chapter 4 presents a summary of the major conclusions that are relevant to the 2008 Forest Plan amendment and the alternatives evaluated in the EIS. Finally, Chapter 5 lists the references cited.

2. OLD-GROWTH HABITAT CONSERVATION STRATEGY

2.1. Historical Background of the Conservation Strategy

2.1.1. Overview

An integrated science-based old-growth forest habitat conservation strategy was developed and adopted during the 1997 Forest Plan Revision process. The old-growth strategy has two basic components. The first is a forest-wide reserve network that protects the integrity of the old-growth forest by retaining blocks of intact, largely undisturbed habitat. The OGRs include a system of large, medium, and small Habitat Conservation Areas (HCAs) allocated to the Old-Growth Habitat LUD, and full protection of all islands less than 1,000 acres in size. The reserve network also includes all other non-development LUDs. These include Wilderness, National Monument, Legislated LUD II, Wild River, Remote and Semi-Remote Recreation, Research Natural Area, Municipal Watershed, and all other LUDs that essentially maintain the integrity of the old-growth ecosystem. The second component of the old-growth habitat conservation strategy is management of the matrix, e.g., the lands with LUD allocations where commercial timber harvest may occur. Within the matrix, components of the old-growth ecosystem are maintained by standards and guidelines to protect important areas and provide old-growth forest habitat connectivity. The analysis presented in this section describes the rationale for the strategy and its specific components.

Development of the old-growth strategy relied on several key scientific documents that provided the basic foundation for addressing wildlife viability. These included the Interagency Viable Population Committee (VPOP) Conservation Strategy (Suring et al. 1993), the Pacific Northwest Research Station Peer Review of the VPOP Strategy (Kiester and Echkardt 1994), and the VPOP Response to the Pacific Northwest Research Station Peer Review (Suring et al. 1994). In addition, the Alexander Archipelago Wolf (Person et al. 1996) and Northern Goshawk (Iverson et al. 1996) conservation assessments provided the basis for design of some components of the strategy as well as a basis for examining whether the old-growth strategy would sustain viable and well-distributed populations of these two species. This section provides a discussion of the major features, findings, and recommendations of each of the three conservation planning (VPOP-related) documents, a consideration of features and recommendations in each document, and the integration of features in the deliberative process to arrive at an overall strategy to address viability of old-growth associated species. As such, it represents a summary of much of the information presented in Appendix N to the 1997 Forest Plan.

2.1.2. Habitat Reserve Approach

There is a substantial science base for an old-growth habitat reserve approach for addressing wildlife viability. Habitat reserves have often been the focal point of conservation strategies since the pioneering work of MacArthur and Wilson (1967) on the theory of island biogeography: that the equilibrium number of species on an island generally depends on island size, and island distance from (usually mainland) source populations. Reserves are viewed as islands of undisturbed or natural habitat within a landscape of management-altered or dissimilar habitat. Reserves attempt to protect the integrity of an isolated landscape. From this theory, five general concepts of reserve design have evolved in conservation planning (Thomas et al. 1990):

- Well-distributed species are less prone to extinction than species confined to small portions of their range;
- Larger reserves supporting many pairs of individuals are superior to smaller reserves supporting only a few pairs;
- Reserves that are close together are better than ones far apart;
- Reserves should have the least amount of induced fragmentation possible; and

- Reserves should be connected, either through specific corridors (such as beach fringe or riparian areas) or through maintaining habitat characteristics similar to the reserves on the lands between them.

A reserve-based strategy relies on blocks of intact, largely undisturbed habitats (such as old-growth forest) of the appropriate size, spacing, and composition to meet a desired design that will maintain viable, well-distributed populations of one or more species. The HCA network used for the conservation of spotted owl habitat in the Pacific Northwest is a classic example (Thomas et al. 1990).

Potential drawbacks of a reserve approach are the failure to consider natural disturbance processes-the dynamic nature of ecosystems, and not being able to preserve landscape integrity (Irwin and Wigley 1992). These can be overcome by combining a reserve system with some type of matrix management approach (Thomas et al. 1990, Franklin 1993). As a complement to reserves, matrix management can serve at least three important roles: 1) providing habitat at smaller spatial scales, 2) increasing the effectiveness of the reserves, and 3) improving landscape connectivity.

2.1.3. VPOP Strategy

The Interagency Viable Population Committee (VPOP) performed pioneering work in designing a landscape conservation strategy to address wildlife viability. Their strategy and extensive supporting analysis are contained in *A Proposed Strategy for Maintaining Well-Distributed, Viable Populations of Wildlife Associated With Old-Growth Forests in Southeast Alaska* (Suring et al. 1993). VPOP was commissioned by the Tongass Land Management Plan (Forest Plan) Revision Team to provide recommendations for sustaining habitat to help ensure the maintenance of well-distributed viable populations of all old-growth associated wildlife species across the Tongass. VPOP systematically screened all wildlife species and identified those old-growth associated species they considered to be most sensitive to habitat loss and fragmentation of the old-growth ecosystem. Their 'coarse filter' landscape strategy designed to consider the entire complement of old-growth associated species, included a system of large (40,000-acre) and medium (10,000-acre) HCAs with spacing and habitat composition requirements well distributed across the Tongass. Small (1,600-acre) HCAs in each major watershed (>10,000 acres) and individual species-specific management guidelines also were recommended.

Landscape connectivity was an integral feature of the original VPOP landscape conservation strategy (Suring et al. 1993). VPOP reviewed the available literature and concluded that there was limited empirical support for corridors but that this should not preclude their inclusion in landscape conservation planning. They reasoned that landscape habitat connectivity was an important component of conservation planning to facilitate animal dispersal and movement, whether specifically designed as corridors or through overall management of a habitat matrix. They recommended a 500-foot beach fringe buffer Forest-wide and 200-foot buffers on anadromous fish streams. Breaks in these buffer corridors should be less than 65 feet to facilitate flying squirrel dispersal.

VPOP mapped the large and medium reserves and provided guidance for locating the small reserves, stating that their mapping effort represented only one possible application of the OGR system across the forest. VPOP concluded that their strategy represented "the minimum amount and distribution of habitat necessary to assure a high likelihood of maintaining viable, well-distributed populations of old-growth associated wildlife species across the Tongass National Forest" (p. 37).

2.1.4. Pacific Northwest Research Station Review

The Forest Service Pacific Northwest Research Station was requested by the Alaska Region to conduct an independent scientific peer review of the VPOP strategy. Kiester and Eckhardt (1994) obtained technical reviews from 18 scientists from North America with substantial knowledge and experience in species ecology or conservation biology. Kiester and Eckhardt (1994) synthesized these technical reviews and published all reports in the document *Review of Wildlife Management and Conservation Biology on the Tongass National Forest: A Synthesis with Recommendations* (Pacific Northwest Research Station Review).

The general concepts in VPOP's multiscale habitat conservation strategy received positive support from the scientists involved in the Pacific Northwest Research Station Review: Beckman (p. 37): "The proposal of HCAs of three sizes somewhat uniformly scattered across the landscape seems like a reasonable strategy..."; Forsman (p. 48): "...proposed network of conservation areas is a reasonable start in combination with protection of known (goshawk) nest areas within the matrix."; Hansen (p. 50): "The core approach of this report (strategy) is scientifically sound and generally consistent with modern conservation biology."; Jarvis (p. 71): "The strategy is an innovative and bold attempt to apply species, community, and ecosystem concepts to applied management."; Lande (p. 78): "...a good initial attempt to develop a strategy for maintaining biodiversity."; Lidicker (p. 87): "The strategy outlined is a giant step in the right direction, but improvements are needed..."; Marcot (p. 101): "...the process and basis for the proposed conservation strategy is scientifically sound given our current knowledge base..."; and Walters (p.194): "...the overall management strategy that considers landscape level features is excellent. The approach is well-grounded in the best current information in conservation biology...". Kiester and Eckhardt (p. 5) concluded in their summary review that "the Strategy (VPOP) receives high marks. It represents a solid attempt to integrate species viability concerns with the HCA approach."

The Pacific Northwest Research Station Review identified several weaknesses in the VPOP strategy. For example, corridors were considered inadequate, there was insufficient attention directed to the matrix lands, and HCAs were considered to be too small by many scientists. Kiester and Eckhardt (1994 p. 5) concluded that "the particular pattern of HCAs that it [the VPOP strategy] suggests will not ensure viability of all species"--although no individual species were specifically identified. Careful examination of all reports by the 18 scientists that participated in the Pacific Northwest Research Station Review revealed repeated concerns relative to brown bears and wolves (Lande p. 82; Lidicker p. 91; McLellan p. 132, Paquet p. 143; Pletscher p. 147; Powell p. 156, and in the summary by Kiester and Eckhardt, p. 16, 17) and that 40,000-acre large HCAs recommended by VPOP were too small to sustain populations of these wide-ranging species. Lande recommended that at least one very large HCA be maintained in each ecological province or island (p. 81); Lidicker recommended a "few large areas, one per island or island group" (p. 91); McCullough (p. 116) recommended fewer but larger HCAs to support continuous populations; and Pletscher (p. 147) suggested an "inverse HCA" concept of very large preserved landscapes with small areas allocated for timber harvest.

Importantly, Kiester and Eckhardt (1994, p.3) noted that the Pacific Northwest Research Station Review only considered the network of mapped VPOP large and medium HCAs and Congressionally protected areas such as Wilderness, Monuments and Legislated LUD II areas. The VPOP reserve network was not examined in the context of the entire forest plan or a fully articulated planning alternative containing the strategy. The scientists were unable to consider other LUDs that effectively function as reserves and conserve the old-growth ecosystem—a very important component incorporated into the development of the old-growth habitat conservation strategy in the revised Forest Plan and this analysis.

Corridors and landscape connectivity received considerable attention among the scientists involved in the Pacific Northwest Research Station Review, and somewhat differing opinions emerged regarding how to address landscape connectivity. Lidicker recommended 1,000-foot corridors (p. 91), while Lande (p. 82) recommended corridors of up to 4,000 feet wide. Other scientists questioned the value of explicitly designed corridors. McCullough (p. 116) noted that "corridors are of considerable debate" and recommended larger reserves to minimize reliance on dispersal corridors; Paquet (p. 137) stated "there are few controlled data with which to assess the conservation role of corridors, thus it is difficult to support or refute their value" but added "…maintenance or restoration of connectivity in the landscape is a prudent strategy"; Pletscher (p 147) stated "There are few empirical studies documenting the value of narrow corridors" and recommended more attention be focused on overall management of the matrix; and Powell (p. 154) agreed with VPOP regarding uncertainty of corridors and recommended more attention be given to the intervening landscape matrix to facilitate wildlife movement and dispersal. Kiester and Eckhardt (p. 17) stated that overall landscape connectivity was an essential component of an old-growth conservation strategy and wider corridors were necessary (especially for marten), particularly relative to ecological pinch points, but cautioned that corridors are "virtually untested in practice."

In their summary chapter, Kiester and Eckhardt (1994) provided many recommendations that specifically relate to forest planning and features of landscape design:

- Existing largest blocks of contiguous high-volume old-growth forest should not be further fragmented by timber harvesting or road building.
- Incorporate larger reserves.
- Incorporate wider corridors.
- Do not differentially cut low altitude, high-volume old growth
- Consider an inverse HCA concept.

They provided many other sound management recommendations not directly related to landscape planning design, such as adaptive management, biological inventory, gap analysis, and population viability analyses.

2.1.5. VPOP Response

Suring et al. (1994) specifically responded to individual recommendations made in the Kiester and Eckhardt (1994) review of the VPOP Conservation Strategy in the document: *Response to the Peer Review of: A Proposed Strategy for Maintaining Well-distributed, Viable Populations of Wildlife Associated with Old-Growth Forests in Southeast Alaska* (VPOP Response). In this brief (11 pages with appendices) response, Suring et al. (1994) indicated that the document represented an "initial response" outlining additional elements that would be considered in their preparation of a final Conservation Strategy as provided for in the peer review process, stating "additional support will be needed by the Committee (VPOP) from the Forest Service to adequately incorporate the recommendations of the peer reviewers into our manuscript and to publish that manuscript" (Suring et al. 1994, p. 3).

Within the VPOP Response, seven specific recommendations were made that were responsive to Pacific Northwest Research Station Review comments. All recommendations were considered during the Viability Synthesis Workshop (Iverson and Rene, 1997) to identify building block concepts for forest plan alternative development. All VPOP Response recommendations were analyzed spatially and quantitatively (Iverson 1996a). In doing so, the Forest Plan interdisciplinary team (IDT) concluded that the features described in the recommendations would not collectively represent a fundamentally different alternative than existed within the range for forest plan alternatives considered in the Revision planning process and that general concepts recommended (e.g., larger reserves and wider corridors) were already addressed.

Specifically, from the Pacific Northwest Research Station Review recommendation to "keep landscape options open, and do not further fragment existing large blocks of high-volume old growth," the VPOP Response generated the following recommendation: "it is important that the largest remaining patches not be fragmented. This may (emphasis added) be accomplished by restricting logging and road building to areas other than the three largest old-growth forest patches within each ecological province" (p.8). The Pacific Northwest Research Station Review referred to blocks of old growth while the VPOP response referenced "patches"; the Pacific Northwest Research Station Review recommendation specifically mentioned "high-volume" old growth—VPOP did not; the VPOP Response only recommended that the three largest old-growth forest patches be protected—the Pacific Northwest Research Station Review suggested all blocks. Despite slight but important differences between these two recommendations, the Forest Service concluded that minimizing additional fragmentation of large areas of old-growth forest with a focus on the high-volume class strata was the basic intent of the recommendations.

Noting the limitations in their original conservation strategy identified by the Pacific Northwest Research Station Review, the VPOP Response considered the diversity of opinion among the scientists concerning corridors and provided a series of explicit corridor recommendations. They recommended that a beach fringe corridor of 3,300 feet be established Forest-wide within which only selective uneven-aged management could be applied. They also recommended that 1,000-foot and 1,600-foot no harvest corridors be designated to connect medium and large HCAs, respectively. These corridors should be located below 800 feet in elevation.

2.2. The 1997 Old-Growth Conservation Strategy

The 1997 Forest Plan IDT carefully reviewed the landscape design recommendations contained in the documents discussed above. In consideration of all multiple-use issues and concerns, they designed a habitat strategy that was responsive to the recommendations contained in these documents. This strategy represents the integration of many elements, some of which are specific to addressing wildlife viability, others of which respond to other issues, such as Congressional legislation (Wilderness, National Monument, and Legislated LUD II), riparian habitat management from the Anadromous Fish Habitat Assessment, or the allocation of lands to Remote and Semi-Remote Recreation in recognition of recreation and tourism uses.

After considering the Pacific Northwest Research Station Review by prominent scientists and considering all other available information, the IDT incorporated the VPOP HCA strategy as the cornerstone of the old-growth forest habitat strategy in the 1997 revised Forest Plan. This represents a fundamental 'coarse filter' approach to addressing wildlife viability and the conservation of biodiversity. In addition, a variety of other coarse filter standards and guidelines provided connectivity between the reserves. At the "fine filter" level, species-specific standards recommended by VPOP (e.g., brown bear, goshawk, wolf, great blue heron, etc.) were fully considered in light of additional information such as conservation assessments, panel assessment results, etc. and appropriate standards and guidelines were incorporated into the Threatened, Endangered, and Sensitive Species and Wildlife sections of the Forest Plan for species that needed additional protection measures to assure their viability and well-distributed status.

The following sections describe the strategy. First, the Forest-wide reserve network is discussed. Next, the management of lands outside the reserve network (the "matrix") is described with subsections on each category of standards and guidelines that affect this management.

2.2.1. Forest-wide Habitat Reserve Network

2.2.1.1. Introduction

The coarse-filter approach was designed to maintain a functional and interconnected old-growth ecosystem, which in turn will maintain the component parts (composition and structure) and processes (function) of that ecosystem (p. 3-11, U.S.D.A. 1997c). In general, the home range and dispersal capabilities of old-growth associated species of concern were considered in determining the size, spacing, and number of reserves.

The system of Forest-wide habitat reserves adopted by the Forest Plan consists of large, medium, and small reserves. Of the estimated 5 million acres of productive old growth (POG) in 1997, the reserve system sets aside 3.6 million acres, and nearly 1 million additional acres are protected through the various standards and guidelines prescribed for management of the lands outside the reserves (U.S.D.A. 2003). The percentage of POG reserved within each of the 21 biogeographic provinces on the Tongass ranges from 38 to100 percent (Iverson and DeGayner 1997). The percent of the reserve system that is high-volume old growth (greater than 25,000 board feet per acre) is slightly higher than the Forest-wide average (44 percent and 43 percent, respectively) (U.S.D.A. 1997a).

2.2.1.2. Description and Design Features of the Reserve Network

A summary description of the reserve types, as they were defined in the 1997 Forest Plan, is provided below. In addition, details regarding the design features of the reserve network are presented following the description.

Description and General Design of Each Reserve Type

Large Reserves:

- There are 38 large reserves on the Tongass. These are contiguous landscapes, typically at least 40,000 acres in size and including at least 20,000 acres of POG forest. At least 10,000 acres of POG was intended to be in the high-volume stratum. Large reserves consist of a variety of non-development LUDs including the Old-Growth Habitat LUD.

- Large reserves are intended to be no more than 20 miles apart and are distributed across the entire Forest. Large reserves within the range of brown bears were intended to have at least one Class I anadromous fish stream.

Medium Reserves:

- The Tongass includes 112 medium reserves. These are contiguous landscapes of approximately 10,000 acres including at least 5,000 acres of POG forest. At least 2,500 acres of the POG was intended to be in the high-volume stratum. Medium reserves consist of a variety of non-development LUDs including the Old-Growth Habitat LUD.
- Medium reserves are intended to be no more than 8 miles from the nearest large or medium reserve and are distributed across the entire Forest.

Small Reserves:

- The Tongass includes a network of 237 small reserves, which are defined by Old-Growth Habitat LUDs. They generally contain at least 16 percent of the area of a value comparison unit (VCU) in a contiguous landscape, with at least 50 percent of the area in POG forest.
- They typically contain a minimum of 400 acres of POG.

Small Islands:

- The Tongass Forest Plan protects all islands less than 1,000 acres from additional harvest of old-growth forest. These areas are mapped as non-development LUDs, typically Semi-Remote Recreation.

Additional Design Features and Assumptions of Reserve Network

This section describes additional design criteria and assumptions used to design the OGRs system. A basic assumption was that future reviews of most individual medium and large OGRs or reviews of the entire conservation strategy would need to consider the total acres of old-growth habitat and other non-development LUDs that maintain the integrity of the old-growth forest ecosystem and contribute to a Forest-wide system of reserves within National Forest System lands. Islands less than 1000 acres that are designated as non-development LUDs may be excluded from acreage calculations.

General Design Criteria

A. OGRs were located so that spacing is maintained in the four cardinal directions.
B. Reserves are more circular rather than linear in shape to maximize the amount of interior (secure from the effects of forest edge) forest habitat.
C. The amount of early seral habitat within mapped reserves was minimized to the extent feasible. In VCUs where managed stands constitute a high portion of the total acres, including seral habitat that previously supported high volume stands to the OGR was favored if it achieved a more circular shape, maintained connectivity or included rare habitats (e.g., karst).
D. The amount of roads and log transfer facilities within mapped reserves were minimized to the extent feasible.
E. Riparian, beach and estuary habitats were considered as contributing elements to OGRs.
F. Site-specific factors in placing reserves were considered to help meet multiple biodiversity or wildlife habitat objectives. Factors included, but were not limited to:
    1. The largest remaining blocks of contiguous old growth within a watershed. Old-growth forest that constitutes scattered fragments of unsuitable timberland generally did not contribute to meeting small reserve design.
    2. Rare features such as underrepresented forest plant associations or stands with some of the Forest's highest volume timber stands.
    3. Known or suspected goshawk nesting habitat.
    4. Known or suspected marbled murrelet nesting habitat.

5. Important deer winter range to maintain important deer habitat capability to meet public demand for use of the deer resource.

There was no requirement to ensure connectivity among all small OGRs or between small OGRs and non-development LUDs (which form parts of large and medium OGRs). POG forest occurring within other features of the strategy (e.g., beach fringe, riparian, other non-development LUDs) contributes to overall landscape connectivity in the evaluation. It was anticipated that there would be a need to provide additional corridors only in rare situations. Medium and large OGRs were designed to provide connectivity between other old-growth LUDs and other non-development LUDs. The following parameters were used to ensure OGRs maintained connectivity.

A. Only one connection in one direction was necessary.
B. The beach fringe serves as a connector.
C. The connection did not have to be the shortest distance.

Additional Criteria for the Design of Small OGRs

This subsection provides a summary of additional criteria that were used in the design and layout of small OGRs.

A. Small OGRs were not required under the following circumstances:
   1. In VCUs where the total acres and acres of POG within non-development LUDs met or exceeded the minimum acreage criteria.
   2. In VCUs with a computational allocation of less than 800 acres of POG forest. An OGR may have been designed contiguous with old-growth acres in a non-development LUD in an adjacent VCU.
   3. In VCUs that were partially designated as very large, large, or medium OGRs even if these did not meet the minimum acre criteria for a small OGRs. In some cases, small OGRs have been designated in these VCUs for specific purposes.

B. Small OGRs may have been designated under the following circumstance:
   1. VCUs that have been separated may have been combined for computational purposes. These VCUs are denoted by an integer other than zero as the fourth digit of the VCU number (e.g., 5971, 5972, 5973). An OGR was located in at least one of these VCUs. In some cases, small OGRs were designated in more than one of these VCUs for specific purposes.

2.2.1.3. Rationale for the Reserve Network

The mapped system of 150 large and medium HCAs originally designed by VPOP as “one possible application of the proposed strategy” was integrated into the Forest Plan through allocation to the Old-Growth Habitat LUD and other non-development LUDs. Spatial modifications to the original VPOP large and medium HCAs were made; this is provided for in the VPOP report as long as HCA design criteria for size, spacing, and composition are maintained (Suring et al. 1993, p. 30). In their HCA composition analysis, Suring et al (1993) also identified limitations in their mapped strategy. Subsequent modifications were made to large and medium HCAs to correct limitations. Modifications were made for several reasons:

- The original VPOP delineation did not meet minimum HCA criteria (e.g., St. James Bay Large HCA);
- The original delineation incorporated large amounts of fragmented clearcut landscape (e.g., Couverden and Kelp Bay large HCAs);
- The original VPOP delineation exceeded minimum criteria (Ratz Harbor, Aaron’s Creek medium HCAs);
- The integrity of the original HCA was substantially compromised by recent timber harvest that was inconsistent with HCA objectives (Game Creek Large HCA); and
- The reserve location was adjusted to achieve multiple-use objectives such as timber harvest.

Even after these modifications, all large and medium HCAs do not precisely match the specific VPOP size, spacing and habitat composition design criteria. Based on a detailed analysis of how well the original mapped VPOP reserves and the design criteria were integrated into the 1997 Forest Plan (Iverson 1997), VPOP found that over 90 percent of the 149 HCAs they mapped forest-wide met the minimum spacing criteria, and those that did not were generally isolated islands or within Wilderness (Suring et al. 1993, Table 8, 9). Very few HCAs were completely moved (Iverson, 1997); thus the current location of mapped reserves is considered in general compliance with the original VPOP design. While site-specific compliance is not always perfect, either exceeding or occasionally deficient in VPOP design criteria, fine-tuning application of the strategy would take many iterations. As VPOP concluded, "a 'perfect' application of this conservation strategy does not exist" (Suring et al. 1993, p. 35). Furthermore, standards and guidelines in the Old-Growth LUD provide for the examination of the size, spacing, and composition criteria for each reserve at the project level and provide for necessary adjustments to ensure minimum design criteria are met.

Small (1,600-acre) HCAs in each 10,000-acre watershed were recommended by VPOP, to be mapped during project implementation. VPOP identified two objectives for small HCAs (Suring et al. 1993, p. 28): "to provide temporary functional habitat for animals dispersing between large and medium HCAs and to ensure that species of concern have a relatively high likelihood of occurring in each 10,000+ acre watershed." The IDT identified and explicitly mapped the small reserves in the Forest Plan as part of the Old-Growth LUD. These small reserves also contribute to the overall landscape matrix outside large and medium HCAs (see Section 2.2.2 Matrix Management). Approximately 237 small reserves were mapped. These included nearly 267,000 acres of POG forest within a total of 480,000 acres (Appendix 1 to Appendix N of the 1997 Forest Plan Revision FEIS). These reserves represent an important component of the Forest-wide old-growth habitat conservation strategy.

The need for larger habitat reserves (larger than provided by VPOP) and minimizing fragmentation, in general, and specifically for brown bears and wolves, was a consistent recommendation expressed by the Pacific Northwest Research Station Review scientists. The 1997 Forest Plan, in response to observations of the Pacific Northwest Research Station Review scientists and management considerations contained in the interagency wolf conservation assessment, contained at least one very large reserve within each of the 21 biogeographic provinces across the Tongass to address large-scale distribution of large OGRs (Appendix 5 to Appendix N of the 1997 Forest Plan Revision FEIS). This action was specifically responsive to Lande's recommendation (p. 81, in Kiester and Eckhardt 1994) of one large reserve per province and to other scientist's concerns that VPOP's HCAs were too small. A quantitative definition of large was not provided in any reference; however, multiples in excess of the VPOP large HCAs of 40,000 acres may be considered as 'large' (1-2 times as large) or 'very large' (3 or more times as large).

The VPOP Response also recommended the following: "it **may** (emphasis added) also be necessary to establish 0.5- to 1-mile buffers around all large and medium HCAs as a "special management zone" permitting removal of up to 25 percent of the standing volume in 5-acre units using uneven-aged timber management. This recommendation relates to the need for larger old-growth forest reserves. This feature has been incorporated into the Forest Plan in a different way than proposed in the VPOP Response. As discussed above, at least one very large reserve per province was allocated. Furthermore, the VPOP Response recommendation would have permitted substantial harvest (up to 25 percent) of the expanded area. The Forest Plan protects entire reserves without selective harvest and associated additional reduction of old-growth forest.

Both the Pacific Northwest Research Station Review and VPOP Response expressed concern for disproportionate harvest of higher volume old-growth stands. VPOP Response specifically recommended (p. 9) that "it is necessary to defer logging and road building in volume class 6 and 7 old-growth forest (as determined by field reconnaissance) below 800 feet elevation until a biological survey is completed." The Forest Plan Revision IDT recognized the concern for higher volume stands and took a broader approach toward protecting larger reserves and intact landscapes, which necessarily include higher volume stands. The IDT did not believe that a focus on protecting small isolated stands of the former volume class 6 and 7 that may be imbedded within a mosaic of clearcuts, susceptible to windthrow, was a prudent management approach to addressing conservation of old-growth associated species.

The final component of the reserve strategy addresses potentially endemic taxa (species or sub-species) that may exist on small islands. MacDonald and Cook (1994) reported 27 mammalian taxa endemic to Southeast Alaska. Many may have limited dispersal capabilities and are restricted to individual islands (e.g., Coronation Island vole); some may also be susceptible to loss and fragmentation of old-growth habitat. Populations existing on small islands (oceanic or habitat fragments) are more susceptible to local extinction (Wilcove et al. 1986, Burkey 1995). The archipelago of Southeast Alaska contains over 22,000 islands (Iverson 1996b) and uncertain but likely high levels of biotic endemism (MacDonald and Cook 1994). Lidicker (in Kiester and Eckhardt, 1994, p. 91) identified a concern for small island endemic taxa and recommended that no logging occur on islands of less than 1,000 acres to reduce risks to these taxa, and further recommended that at least one reserve be maintained on larger islands. The Other Mammal Assessment Panel expressed similar concerns relative to endemic taxa (Julin 1996).

In response to these concerns about endemic taxa with possibly unique gene pools that may be restricted to small islands, the Forest Plan protected all islands less than 1,000 acres from additional harvest of old-growth forest, in direct response to the Lidicker recommendation and concern expressed by the Other Mammal Assessment Panel.

2.2.2. Matrix Management

The second component of the old-growth forest habitat conservation strategy is management of the area outside reserves (the "matrix") that is subject to timber harvest. This topic was of notable concern to the Pacific Northwest Research Station Review scientists who suggested that more attention be directed to this component of landscape conservation planning. They particularly noted the need to provide enhanced landscape connectivity and to manage human disturbance of the land similar to natural disturbance regimes (Kiester and Eckhardt 1994: Hansen p. 52; Lande p. 82; Lidicker p. 87; McCullough p. 109; McClellan p. 133).

Some management protections within the matrix are spatially explicit, such as the 1,000-foot beach and estuary fringe, and the riparian buffers for maintaining the integrity of the aquatic and riparian ecosystems. In addition, other forest-wide standards and guidelines preclude or significantly limit timber harvest in areas of high hazard soils, steep slopes, karst terrain, visually sensitive travel routes and use areas, and in timber stands technically not feasible to harvest. Finally, a number of species-specific standards and guidelines provide additional protection to old growth within the matrix.

2.2.2.1. Beach/Estuary Fringe and Riparian Habitats

Beach and estuary fringe, and riparian habitats, have special importance as components of old-growth forests, serving as wildlife travel corridors, providing unique wildlife habitats, and providing a forest interface with marine or riverine influences that may distinguish them as separate ecosystems within the larger old-growth forest ecosystem. Riparian areas are important for fisheries in providing, among other resources, the source of large woody debris that creates pools for rearing habitat, and in controlling stream temperatures and the amount of sediment reaching streams. Riparian areas provide habitat for terrestrial species associated with aquatic environments (amphibians, for instance, or mammals such as river otter and beaver), and for terrestrial species for which fish from streams are important food (brown and black bears). Considering the dendritic nature of riparian systems that begin high in watersheds, these riparian areas provide forested corridors connecting higher elevation regions in upper watersheds with lower elevation forests in valley bottoms. Riparian areas often contain plant species which can live only where water is available year-round. Riparian soils often support large spruce trees and some of the most highly-productive stands of old growth.

The beach fringe, the forested area adjacent to salt-water shorelines, is thought to be an important wildlife travel corridor, a transition zone between interior forest and salt water influences, and a unique habitat (or micro-climate) in itself. The beach fringe is a very important feature on the Tongass given the extensive amount of shoreline (more than 13,000 miles) that exists on the more than 22,000 islands. The beach fringe provides horizontal or low-elevation connectivity between watersheds, many of which otherwise have very steep sides and/or non-forested ridgetops. In conjunction with riparian areas, which provide connectivity within watersheds, the beach fringe is thought to be a component of the major travel corridor system used by many resident wildlife species.

Interagency habitat capability models developed previously for management indicator species of the Tongass produced the highest habitat suitability value in POG forests within the 500-foot beach fringe zone for the bald eagle, marten, and river otter (Suring 1993). The beach fringe was rated second only to the 1,000-foot estuary fringe for brown and black bears in overall habitat quality, and higher deer habitat values generally occur in high-volume old growth below 800-foot elevation, much of which occurs in the beach zone with a moderating maritime-influenced microclimate. A revised marten habitat capability model rated the beach fringe old-growth forests highest among all habitat components (Flynn 1995).

There are indications that the value of the beach zone habitat may extend beyond 500 feet. Gende et al. (1998) reported reduced bald eagle nesting densities and success in landscapes adjacent to clearcuts and recommended a beach buffer zone of at least 1,000 feet. The 1,000-foot beach fringe was also used frequently by radio-marked goshawks (Iverson et al. 1996). The importance of the beach fringe zone has long been recognized, and was a component of the Retention Factor Method used in the 1979 Tongass Plan, as amended (USDA Forest Service, 1986) (specifically recognizing the importance of the 1,000-foot beach fringe for brown/black bear, 600-foot for furbearers, and 0.25 mile inland from the beach for deer winter range).

In developing the old-growth forest habitat strategy, the information described above and the available literature relative to Southeast Alaska were carefully examined. The Forest Plan Revision IDT concluded that explicit corridors should be a component of a landscape conservation strategy, that a 1,000-foot beach and estuary fringe corridor was clearly justified by the available information but that no evidence supported a 3,300-foot buffer recommended by the VPOP Response. The IDT further reasoned that a 1,000-foot no-harvest beach and estuary fringe corridor was comparable or possibly superior to a 3,300-foot corridor that permitted up to 25 percent volume removal in 5-acre patch cuts as recommended by the VPOP Response. Accordingly, the Forest Plan establishes a Beach and Estuary Fringe Forest-wide Standard and Guideline that prevents timber harvest within 1,000 feet inland from mean high tide. The 1,000-foot beach fringe serves many functions: providing more effective landscape linkages between habitat reserves, protecting long-term bald eagle habitat capability, buffering the primary beach fringe zone (0 to 500 feet) from windthrow (Hodges 1982, Harris 1989), maintaining a functional interior forest condition within the entire primary beach fringe (Concannon 1995), and sustaining very important habitat for goshawks (Iverson et al. 1996).

In addition, the Forest Plan incorporated, as a minimum, the riparian habitat recommendations in the Anadromous Fish Habitat Assessment (AFHA 1995). Riparian habitat buffers also provide elevational corridors within forested watersheds. Mapping the small old-growth habitat reserves (see above) also provides additional landscape connectivity. Together, the beach and riparian habitat management features and the mapping of small reserves represented a substantial response to the landscape linkage element of conservation planning and significantly contributed to management of the overall matrix among habitat reserves.

2.2.2.2. Landscape Connectivity Standard and Guideline

The Forest Plan contains a standard and guideline that provides for the maintenance of a contiguous forested corridor, where it exists, connecting each large or medium habitat reserve to at least one other reserve. This standard and guideline is to be implemented during the environmental analysis for projects proposing to harvest timber, construct roads, or otherwise significantly alter vegetative cover. In addition, young-growth treatments to accelerate old growth characteristics to help increase connectivity for wildlife are encouraged.

2.2.2.3. Species-Specific Standards and Guidelines

A variety of species-specific standards and guidelines were adopted to strengthen the conservation strategy for individual species and species groups. Many of these have positive effects for a variety of old-growth-associated species. For some species, like the northern goshawk and the American marten, additional habitat conservation measures were prescribed in areas of the Forest where intensive timber harvest had occurred.

Stand level habitat management objectives, that contributed to maintaining features of old-growth forest within the matrix, were established in the 1997 Forest Plan Revision to reduce the adverse effects of clearcut timber harvest on marten and goshawk habitat use by retaining important forest structure during harvest. These habitat management measures were added to the Forest Plan in response to panel assessments (see Section III.B). In the North and Central Prince of Wales Biogeographic province, where risks of sustaining habitat for goshawks was greatest (Iverson et al. 1996), the 1997 Forest Plan Revision standards and guidelines provide for the retention of forest structure during harvest in VCUs where over 33 percent of the original POG has been harvested and harvest units are over 2 acres. This management standard and guidelines maintains an average of at least 30 percent canopy closure after harvest and requires that an average of at least 8 large (20 to 30 inches diameter at breast height [DBH]) trees/acre are retained at harvest. The objective of this provision was to retain some foraging habitat value after harvest; silvicultural prescriptions that provide for retention were considered to be superior to clearcut harvest (Iverson et al. 1996).

Similar stand level structural retention standards and guidelines in the Forest Plan were established to manage high value marten habitat. These standards and guidelines applied to the five higher risk biogeographic provinces identified by VPOP (Suring et al. 1993, p. 41) (East Chichagof, Kupreanof/Mitkof, Etolin Island and Vicinity (except Zarembo), Revilladagado Island and Vicinity, and North and Central Prince of Wales Island). In VCUs within these provinces where over 33 percent of the original POG had been harvested, including additional future harvest, high value marten habitat was to be managed to retain important forest structure for marten. Harvest units over 2 acres in size in high value marten habitat (e.g., high volume timber strata and below 1,500 feet in elevation) retained after harvest: an average of over 30 percent canopy closure, an average of at least 8 large trees/acre (20 to 30 inches DBH), an average of at least 3 large decadent (20 to 30 inches DBH dead or dying trees) trees/acre, and an average of at least 3 pieces/acres of large (20 to 30 inches DBH) down logs. For all other VCUs within these five provinces, the following structure was retained in harvest units in high-value marten habitat: approximately 10 to 20 percent of original stand structure will be retained with an average of 4 large trees/acre (20 to 30 inches DBH), an average of 3 large decadent trees/acre (20 to 30 inches DBH), and an average of at least 3 pieces/acres of large (20 to 30 inches DBH) down logs.

For both the goshawk and marten stand management standards and guidelines above, harvest units under 2 acres did not need to maintain any of the prescribed amounts of forest stand structure. However, to provide for retention of important forest structure, the effective silvicultural rotation was increased to 200 years.

In addition, other fine-filter species-specific standards and guidelines contribute to the old-growth strategy. These include standards and guidelines for raptor nest habitat protection, wolf den protection, brown bear foraging habitat along certain streams, and others. The major species-specific standards and guidelines include:

- Brown Bear Foraging Habitat: Establish forested buffers, where available, of approximately 500 feet from the stream at sites where additional protective measures are needed to provide cover among brown bears while feeding, or between brown bears and humans.
- Heron and Raptor Nest Protection: Protect active rookeries and raptor nesting habitat with a forested 600-foot windfirm buffer, where available.
- Marbled Murrelet Nest Protection: Protect identified marbled murrelet nests with a 600-foot radius of undisturbed forest habitat.
- Wolf Dens: Maintain a 1,200-foot forested buffer, where available, around known active wolf dens.
- Mountain Goat Travel Corridors and Winter Habitat: Identify and maintain travel corridors between important seasonal sites. Where feasible, maintain important mountain goat winter habitat capability.

2.2.2.4. Other Non-Wildlife Standards and Guidelines

In addition, although the conservation strategy was designed without consideration of the contribution of standards and guidelines that restrict timber harvest to protect resources other than wildlife, there are many other standards and guidelines that restrict or limit timber harvest. These other Forest-wide standards and guidelines preclude or significantly limit timber harvest in areas of high hazard soils, steep slopes, karst terrain, visually sensitive travel routes and use areas, and in timber stands technically not feasible to harvest.

2.2.3. Analysis of the 1997 Old-Growth Strategy

Appendix N to the 1997 FEIS presented an analysis of the 1997 Old-Growth Strategy. This analysis documented the amount of habitat protection produced by the Forest Plan and compared it with the recommendations of VPOP and other recommendations. The following section summarizes this analysis (see Section IV.A.6 of Appendix N to the 1997 FEIS for the details).

2.2.3.1. Amount and Distribution of Old-Growth Forest

The analysis presented in Appendix N to the 1997 FEIS noted that the first and most prominent feature of the old-growth habitat strategy in the 1997 Forest Plan was the substantial amount of POG forest that is protected forest-wide in both the reserves and in the matrix areas that are allocated to timber management (70.1 percent in reserves and 19.0 percent in the matrix). A total of 84 percent of the POG that was present in 1954 was estimated to be present in 100 years assuming the maximum timber harvest levels per decade allowed in the 1997 Forest Plan. This is equivalent to an estimated 90 percent of existing POG.

Adequate distribution of old growth habitats, and not necessarily the forest-wide total amounts, was a principal element of the VPOP conservation strategy (Suring et al. 1993). The proportion of old-growth protected in reserves varied by biogeographic province, but ranged from 38 percent (Kupreanof/Mitkof Province) to 100 percent (Admiralty and West Chichagof Provinces). Within protected old-growth forests, all volume classes of POG were protected as well. High-volume old growth generally contains the largest trees and averages 35,000 board feet per acre (Julin and Caouette 1997). An average of 44 percent of the POG in reserves was estimated to be high volume, whereas 43 percent of the old growth forest-wide was high volume. The proportion of high-volume old growth in reserves in 18 of 21 provinces equaled or exceeded the proportion present in the province as a whole.

The 1997 Forest Plan exceeded the minimum strategy recommended by VPOP relative to sustaining viable wildlife populations. While fully integrating the large and medium VPOP HCAs and the mapping of the small reserves, the 1997 Forest Plan protected substantial additional POG forest to further reduce risks to wildlife viability and enhance protection of biological diversity. For comparison, reserves allocated in the Forest Plan with at least 5,000 contiguous acres of POG (the minimum POG requirement for VPOP medium HCAs) exceeded the amount recommended by VPOP by 147 percent forest-wide (Appendix 2 of Appendix N to the 1997 FEIS). Old-growth allocated to reserves exceeded the amount recommended by VPOP in 20 of 21 biogeographic provinces, ranging from 9 to 460 percent over VPOP recommendations. This comparison was conservative: it did not include old-growth forest in contiguous reserves with less than 5,000 acres of POG, and did not include the substantial old-growth forest that would remain in the matrix.

The old growth strategy was noted to contain at least one large contiguous reserve relative to the province size in each of the 21 biogeographic provinces across the Tongass to address large scale distribution of large OGRs (Appendix 5 of Appendix N to the 1997 FEIS). Seventeen of the 21 provinces have at least 1 very large reserve (e.g. over 180,000 contiguous acres). For example, in the North Central Prince of Wales Province, a contiguous reserve of 200,584 acres (Honker/Sarkar/Karta) was provided in the Forest Plan—5 times larger than a VPOP large HCA (40,000 acres). Two provinces had a large reserve exceeding 75,000 acres; the two remaining provinces were intermediate sized-islands or aggregates of smaller islands and had contiguous reserves of from 30 to 40,000 acres and virtually all federal lands within the province were in a reserve land allocation (Dall Island and Southern Outer Islands).

High-quality old-growth forest was mapped in the largest reserves as well. The proportion of high-volume old growth (used as one indirect measure of old-growth habitat quality) in the largest reserves was equal to or greater than the proportion of high-volume old growth throughout the province in 16 of 21 provinces forest-wide (Appendix 5, of Appendix N to the 1997 FEIS). Many of these reserves previously existed (e.g., Admiralty and Misty Fiords National Monuments), while others were explicitly created to achieve this objective (South and Central Prince of Wales Island, Kupreanof/Miktof and East Chichagof Island).

The comprehensive old-growth habitat strategy in the Forest Plan was also responsive to the Pacific Northwest Research Station Review recommendation to not further fragment existing blocks of high-volume old growth by incorporating many existing roadless areas in reserves. An average of 89 percent (range 55 to 100 percent in each of 21 biogeographic provinces) of the Tongass was roadless (Appendix 4), an indirect measure of unfragmented (from clearcut harvest) landscapes. An average of 84 percent of the roadless acreage on the Tongass was allocated to “non-development” LUDs in the 1997 Forest Plan and would, thus, retain the roadless and unfragmented character of the landscape. A substantial portion of the Tongass would remain roadless and unfragmented in the Forest Plan

Additional concerns regarding habitat fragmentation were expressed by the VPOP Response that recommended that the three largest old-growth forest patches within each ecological province should be protected from logging and roadbuilding. An examination of how well the old-growth strategy in the Forest Plan responded to these general recommendations to maintain large blocks of old-growth forest was conducted. However, it was noted that there are various ways to define forest blocks or “patches”. Without some patch definition restrictions, virtually all old-growth forest on any island could be considered one contiguous and interconnected patch.

Two analyses were conducted to examine the recommendation regarding preservation of large blocks of old-growth forest. The first examined the concept of contiguous blocks of interior old-growth forest. Interior forest was defined as greater than 300 feet into the forest from the productive/nonproductive forest edge. The resulting five largest interior forest blocks in each biogeographic province were compared to the Forest Plan land allocations to determine the proportion of these blocks protected in a reserve. Forest-wide, 73 percent of the area of these five largest interior old-growth blocks was protected for a total of 476,000 acres (Appendix 6 to Appendix N of the 1997 FEIS). A small portion of these acres may no longer meet the definition of interior forest acres after the maximum timber harvest levels allowed in of the Forest Plan for 100 years are harvested. The proportion varied by province, from 38 percent protected in the East Baranof Biogeographic Province to 100 percent on West Chichagof, Admiralty, and North and South Misty Fiords Biogeographic Provinces.

A second analysis examined the largest contiguous blocks of only high volume old-growth forest and the proportion protected in reserves in the Forest Plan. Overall, within a biogeographic province, these high-volume blocks were much smaller than the interior forest blocks of all POG (Appendix 6 and Appendix 7 to Appendix N of the 1997 FEIS). Forest-wide, an average of 83 percent (province range: 36 to 100 percent) of the five largest contiguous high-volume blocks in each province was protected in reserves for a total of 225,000 acres (Appendix 6 to Appendix N of the 1997 FEIS). These first two methods of many possible delineations of “large blocks” provided somewhat different results. There was no analysis to support the “three largest old-growth forest patches” recommendation—certainly nothing compared to the in-depth analysis VPOP contributed in their initial conservation strategy (278 pp.) or the scientific reviews provided by the Pacific Northwest Research Station Review 18 scientists (282 pp.). Nonetheless, the Forest Plan provides substantial (73 to 83 percent) protection to old-growth blocks considered in this analysis.

Regarding the matrix, it was noted that the allocation of forest stands and landscapes to some form of timber harvest did not mean that all trees and stands would be harvested leaving only a continuous “sea of second growth.” There are numerous standards and guidelines limiting timber harvest in these matrix lands to protect specific resource and landscape components. An average of at least 57 percent (Appendix 8 to Appendix N of the 1997 FEIS) of the original (pre-1954) POG in these landscapes (the three timber harvest LUDs) would not be harvested and would remain standing throughout the planning horizon of 100 years, even with application of the maximum allowable timber harvest under the Forest Plan. A total of 69 percent of all existing POG in the matrix would remain after full plan implementation.

The relative quality of habitat within the three principal features of the matrix, the beach and estuary fringe, riparian habitat management areas, and other lands not available for timber harvest, are identified at both the province and VCU spatial scales. The beach and estuary fringe accounted for 15 percent of the POG protected in the matrix; riparian habitat accounted for about 24 percent, and the “other lands” accounted for the remaining 61 percent. As discussed earlier, the proportion of high-volume old growth was one measure of habitat quality: the beach fringe averaged 45 percent and the riparian areas averaged 43 percent high-volume old-growth forest.

2.2.3.2. Island Effects

The potential risk to island endemic species that may be closely associated with old-growth forests was evaluated by conducting an analysis of islands of varying sizes (Iverson 1996b). This evaluation revealed a very low risk to islands ranging in size from 1,000 to 10,000-acres in Southeast Alaska. It was noted that there are 58 islands of this size range, but only 8 had POG forest that was suitable for timber harvest in the Forest Plan representing only 2.2 percent of the POG on these islands (Table D-1). However, long-term risk may be elevated on some of these 8 islands considering past as well as potential additional harvest (e.g., Shelikof, Sokolof, Marble, and Orr Islands).

Risks were slightly higher for islands ranging from 10,000 to 100,000 acres, with 7 of 19 having suitable POG potentially available for harvest. Heceta Island was identified as the largest island in this category (41,000 acres of federal land) with POG suitable for timber harvest. Several of these islands could also have elevated risks due to the cumulative effects of past as well as potential additional harvest (e.g., Tuxekan, Catherine, Suemez, and Heceta Islands. However, most POG (92 percent) and most scheduled for timber harvest (95 percent) occurs on the largest islands exceeding 100,000 acres. The Forest Plan wouldl not add additional risk to islands under 1,000 acres and would minimize risks to islands under 50,000 acres, with a cumulative maximum of 2,100 acres of old-growth forest that may be harvested over the next 100 years. This analysis assumed maximum allowable harvest every decade for 100 years under the Forest Plan. Furthermore, the analysis assumed a potential harvest of nearly 600,000 acres of POG, whereas only 474,000 acres are actually scheduled for potential harvest.

In recognition of the uncertainty about island endemic species and their vulnerability, the Forest Plan contained a “survey and manage” standard and guideline designed to substantially reduce the risk to endemic mammals on these islands. If surveys indicate the presence of these taxa, proposed projects would be designed to ensure their long-term persistence on the island.

Table D-1.
Analysis of the Range of Island Sizes across the Tongass National Forest and the Amount of Productive Old-Growth at Potential Risk (in 1997)[1,2]

Island Size[3] (acres)	No. of Islands	Total Area	Total POG	No. Islands w/POG Suitable for Harvest	Acres POG	% POG	1995 Second Growth
1 to 1,000	461	68,807	43,201	0	0	0	3,660
1,001 to 10,000	58	196,503	95,647	8	2,105	2.2	13,659
10,001 to 100,000	19	502,271	272,552	7	25,759	9.5	29,710
Over 100,000	19	16,018,366	4,652,201	18	579,064	12.4	356,440
Total	**557**	**16,785,947**	**5,063,601**	**33**	**606,928[(4)]**	**12.0**	**403,469**

1 From Table 7 in Appendix N to the 1997 Forest Plan FEIS.
2 The proportion of the POG that is suitable for timber harvest over the next 100 years in the Forest Plan is a measure of relative risk to potential island endemic taxa that may be associated with old-growth forests.
3 Includes only federal lands.
4 Only 474,000 (80 percent) of these suitable acres are scheduled for harvest over the 100-year planning period.

2.2.3.3. Habitat Connectivity

The analysis in Appendix N of the 1997 FEIS noted that there is general agreement among scientists that habitat connectivity is an important component of a landscape conservation strategy (Kiester and Eckhardt 1994, Lidicker 1995). There is, however, uncertainty regarding how connectivity should be achieved in an integrated conservation strategy: through explicitly designed corridors; by designing larger reserves thereby decreasing dispersal distances and facilitating population interchange; or by using an overall matrix management design (e.g., the “50-40-11” matrix prescription designed to provide marginal foraging habitat between reserves for dispersing northern spotted owls [Thomas et al. 1990]).

In light of the uncertainty regarding a variety of approaches to provide landscape connectivity, a further review and analysis was conducted by the 1997 Forest Plan IDT. Thus, the 1997 Forest Plan incorporated a combination of all three landscape conservation design approaches to address landscape connectivity. It has not relied on a single strategy. Beach and riparian corridors of specific widths were established that provide significant within-island habitat connectivity; habitat reserves were enlarged (see Old-Growth Habitat Reserves above) often minimizing dispersal distances between many reserves; and standards and guidelines that govern management of the matrix outside reserves (including beach and riparian buffers) were partially designed to contribute to retaining a substantial old-growth forest component to provide connectivity. If site-specific project analyses identify deficiencies in landscape connectivity, the Forest Plan Old Growth Habitat LUD provided the opportunity to re-examine small habitat reserves, which may be adjusted to provide the necessary connectivity (see Small Old-Growth Habitat Reserves, below).

An additional approach to achieve landscape connectivity is to use timber harvest practices that retain some forest structure within the stand after harvest. Application of the marten and goshawk stand level management standard and guidelines was anticipated to contribute to maintenance of potentially important stand structure in landscapes with substantial amounts of even-aged clearcut harvest with little within-stand residual structure. The goshawk management standard and guideline was to be applied to the most heavily harvested and fragmented VCUs on Prince of Wales Island. The marten standard and guideline was to apply in the same VCUs plus additional VCUs in the North Central Prince of Wales, Revilla/Cleveland and Vicinity, East Chichagof, Mitkof/Kupreanof, and Etolin and Vicinity provinces. Since the marten standard and guideline applied to VCUs that currently exceeded 33 percent of POG harvested, as well as VCUs that would exceed that amount through future projects, this standard and guideline was anticipated to apply to additional VCUs in the future. Retention of these substantial amounts of within-stand structure served to minimize the adverse impacts of additional timber harvest.

Another feature of connectivity identified by the Pacific Northwest Research Station Review were critical links or “pinchpoints” connecting major landscapes within islands (Marcot in Kiester and Eckhardt 1994, p. 103). Such pinchpoints must be carefully protected (Kiester and Eckhardt 1994, p. 17). The 1997 Forest Plan IDT identified six such landscape pinchpoints, all relatively narrow areas between larger land units where future alterations in habitat could significantly reduce natural connectivity and limit the ability of land-based species to disperse or migrate. These areas and the degree of protection afforded by the 1997 Forest Plan at the time of its adoption include:

1. The portage between Tenakee Inlet and West Port Frederick on Chichagof Island is a narrow neck of land connecting northeast Chichagof Island to the main body of the rest of the island. This is in the East Chichagof biogeographic province. This area is completely protected with a large old-growth habitat reserve using the Old-Growth Habitat LUD.
2. The area connecting Lisianski Inlet with the North Arm of Peril Strait is a narrow region that connects two major portions of Chichagof Island. This area is fully protected as a Legislated LUD II area.
3. The area between Port Camden, Bay of Pillars, and Three-Mile Arm on Kuiu Island (Kuiu Island biogeographic province), a narrow neck of land connecting the northern and eastern part of the island to the rest of Kuiu Island. This area is protected with the Old-Growth Habitat LUD through a combination of several adjacent small old-growth habitat reserves.
4. The narrow area between Lindenburg Peninsula and the remainder of Kupreanof Island is largely protected by the Petersburg Creek Duncan Salt Chuck Wilderness. The remaining small area not included in the Wilderness between Portage Bay and Duncan Salt Chuck is primarily peatland; the 1,000-foot beach fringe provides additional connectivity.
5. The Neck Lake area between Whale Passage and El Capitan Passage on Prince of Wales Island (North Central Prince of Wales biogeographic province) has had significant past and on-going forest management activities. It also is a relatively narrow piece of land connecting the extreme northern end of Prince of Wales Island to the remainder of the island. A cross-island connection is nearly protected with a small reserve around Neck Lake and fully protected further south with

the very large natural setting reserve around Sarkar Lakes. Connectivity is also provided on both sides of the narrow pinchpoint with the 1,000-foot beach fringe corridor.

6. Sulzer Portage is between West Arm Cholmondeley Sound and Portage Bay at the head of Hetta Inlet on Prince of Wales Island. This relatively narrow neck of land joins the southeast part of Prince of Wales Island to the remainder of the island, connecting North Central and South Prince of Wales biogeographic provinces. This area has had considerable timber harvesting on both national forest and adjacent private lands. Due to a recent transfer of land ownership the area is now all private land, dividing the northcentral and south portions of Prince of Wales Island with a non-national forest strip 1 to 2 miles wide. Continued timber harvesting is anticipated on these private lands, with the potential of creating dispersal barriers. However, clearcuts and advanced second growth forests (50 to 100 years old) are unlikely to create complete barriers to movement for deer, wolves, marten and squirrels or other species of concern.

2.2.3.4. Summary

In summary, the Appendix N analysis noted that the 1997 Forest Plan IDT concluded that the original VPOP strategy was a sound and effective landscape approach to address the long-term conservation of old-growth associated wildlife species. VPOP used a coarse filter conservation planning approach to develop a comprehensive, multi-scale landscape conservation strategy. They incorporated the entire community of old-growth associated species into their analysis and focused on those species with the greatest viability or distribution concerns in the development of their strategy. Additional scientific information, such as conservation assessments and recommendations contained in the Pacific Northwest Research Station Review, were incorporated into the Forest Plan to further strengthen the original VPOP strategy. The VPOP Response was considered as a brief "initial response" of some possible considerations that may have been integrated into a final report. While VPOP Response recommendations were not explicitly incorporated, many of the elements of the VPOP Response were addressed in concept in the Forest Plan (wider corridors, larger reserves, protection of high-volume old-growth, etc.).

The old-growth habitat conservation strategy in the 1997 Forest Plan was carefully crafted in response to these fundamental conservation planning documents. Based upon consideration of the best available information related to conservation planning, the Appendix N analysis concluded that the 1997 Forest Plan provided a sufficient amount and distribution of habitat to maintain viable populations of old-growth associated species after 100 years of Plan implementation. Due largely to uncertainty, the 1997 Forest Plan did not, however, represent a "no risk" conservation strategy; rather it represented a balance of wildlife conservation measures that consider the best available scientific information and reflect an acceptable level of risk for continued species viability.

2.3. Modifications to the Strategy between 1997 and 2007

Since 1997, there have been 24 project analyses that have modified small or medium OGR boundaries and adjacent LUDs (Table D-2). Overall, these changes have resulted in an increase in reserve area and an increase in the amount of POG included within reserves. The net result of these amendments is that the acres suitable for timber harvest have been reduced by approximately 16,000 (Table D-2). The 2007 Forest Plan (defined as the 1997 Forest Plan, as amended through 2007) reflects these changes.

In addition to these changes in OGR boundaries, a number of ownership adjustments and other slight LUD modifications have been made. The combined effect of these changes on the areas within reserves and the matrix is shown in Table D-3. This table shows that while the total area of the Forest decreased by about 110,000 acres, primarily due to land adjustments, the acreage of development LUDs decreased by 112,000 acres and the acreage within reserves increased by about 2,000 acres over the period 1997 through 2007.

Table D-2.
Summary of Changes in Suitable Acres due to Forest Plan Amendments that Produce the 2007 Forest Plan[1]

Project Name (acres)	Small or Medium OGR	Project Year	Non-dev to Dev LUD Suitable Acres	Dev to Non-dev LUD Suitable Acres	Net Change in Suitable Acres
Canal Hoya	Small	1998	0	151	-151
Chasina	Small	1998	0	78	-78
Cholmondeley	Small/Medium	2003	894	6,873	-5,979
Control Lake	Small	1998	446	142	+304
Couverden	Small	2005	0	790	-790
Crystal Creek	Small	1998	481	1,153	-672
Doughnut	Small	2000	0	19	-19
Finger Mountain	Small	2003	0	593	-593
Fire Cove Salvage	Small	2002	186	633	-447
Kensington Mine	Small	2004	0	1,615	-1,615
Kuakan	Small	2000	416	542	-126
Luck Lake	Small	2000	257	794	-537
Madan	Small	2003	377	1,501	-1,124
Nemo Loop (Thoms Lake)	Small	1998	177	932	-755
Niblack	Small	1998	252	0	+252
Overlook	Small	2006	354	578	-224
Polk Small Sales	Small	2000	0	153	-153
Salty	Small	2000	99	126	-27
Scott Peak	Small	2006	1,089	1,962	-879
Sea Level	Small	1999	185	500	-315
Threemile	Small	2004	458	826	-368
Todahl Backline	Small	1998	2	363	-361
Tuxekan	Small	2006	431	1,614	-1,183
Woodpecker	Small	2003	180	130	+50
Total			**6,284**	**22,068**	**-15,784**

[1] The 2007 Forest Plan is defined as the 1997 Forest Plan, as amended through 2007.
Source: Non-significant Forest Plan Amendment for Tuxekan Project, October 2006

Table D-3.
Summary of Acreages in Reserves and Matrix under the 2007 and the 1997 versions of the Forest Plan

Alternative	Reserves: Old-Growth Habitat LUD	Reserves: Other Non-Development LUDs	Reserves: Total in Non-Development LUDs	Matrix	Total	Percent of Forest in Reserves
2007 Forest Plan[1/]	1,182,424	11,985,410	13,167,834	3,605,974	16,773,808	78.5%
1997 Forest Plan[2/]	1,131,059	12,034,860	13,165,919	3,717,081	16,883,000	78.0%

[1/] Based on the 2007 Forest Plan (defined as the 1997 Forest Plan, as amended through 2007) and Tongass GIS.
[2/] Based on 1997 Forest Plan table on p. 4-2 and Table 3-77 of 1997 FEIS.

Table D-4 summarizes the POG acreage in reserves and the matrix for the 2007 and 1997 versions of the Forest Plan. The 2007 acreage of POG within OGRs, including all non-development LUDs is 3,518,425, which represents 71.1 percent of all POG on the Forest (Table D-4). Within the matrix, there is an additional 925,051 acres of old growth (18.7 percent) that is protected within the Beach and Estuary Fringe, Riparian Management Areas, and other unsuitable areas. This estimate includes unsuitable areas that are not yet mapped (e.g., Riparian Management Areas along unmapped streams, unmapped unstable slopes, unmapped high vulnerability karst lands). Finally, there is an estimated 28,598 acres of

POG that is suitable, but would not be scheduled due to economics and other factors. As a result, the 2007 Forest Plan results in the protection of 90.3 percent of all existing POG on the Forest, assuming the full Allowable Sale Quantity (ASQ) is harvested each decade. Table D-4 also compares these acreages and percentages with the same acreage categories in 1997, at the time that the Forest Plan Revision was adopted.

The maximum percentages that could be harvested are similar between the 1997 Forest Plan and the 2007 Forest Plan when one looks at only the larger POG types. Under the 2008 Forest Plan, a total of 71.3 percent of the high-volume POG (SD Model types 5N, 5S, and 67) and 67.8 percent of the big-tree POG (SD Model type 67) would be included within reserves. Overall, 88.9 percent of the existing high-volume POG and 88.6 percent of the big-tree POG would not be harvested.

Table D-4.
Summary of Productive Old-Growth Acreage in Reserves, Protected in the Matrix, and Suitable for Timber Harvest in 2008

Year	POG Area in Reserves	Matrix POG Protected or Not Scheduled for Harvest	Matrix POG Suitable and Scheduled for Harvest (represents the maximum POG to be harvested)	Total Existing POG[1/]
2007 Forest Plan[2/] (acres)	3,518,425	970,176	462,556	4,951,156
2007 Forest Plan[2/] (percent)	71.1%	19.6%	9.3%	100.0%
1997 Forest Plan (acres)	3,551,482	1,038,492	473,597	5,063,571[2/]
1997 Forest Plan (percent)	70.1%	20.5%	9.4%	100.0%

[1/] Note that the Tongass land base has changed since 1997 due to land adjustments and harvest has occurred.
[2/] The 2007 Forest Plan is defined as the 1997 Forest Plan, as amended through 2007.
Sources: Table 3.9-12 in Biodiversity Section for 2008 numbers; Appendix N to the 1997 Tongass FEIS and Appendices to Appendix N for 1997 numbers.

2.4. New Relevant Science since 1997

This section describes new information related to conservation planning and science developed since 1997. It summarizes general information on conservation strategies, as well as species-specific information that are particularly relevant to the Tongass Conservation Strategy.

2.4.1. Conservation Strategies

2.4.1.1. General

Haufler (2006) conducted a comprehensive review of conservation science produced since 1997 and its relationship to the Tongass Forest Plan. In his review, he described major types of conservation strategies, as well as concepts that form the basis for those strategies (e.g., landscape ecology, corridors and landscape linkages, and habitat loss and fragmentation) and related new science (new science related to population viability was also addressed but is summarized in Section 3.0), and related these to the science behind the Tongass Conservation Strategy. This effort included a review of recent literature as well as recently completed and on-going conservation initiatives to identify approaches and strategies used by agencies and other organizations in their conservation planning efforts. This section provides a summary of that review.

The term “conservation strategy” refers to the framework and the underlying basis and assumptions used in planning to maintain or enhance biological diversity (Haufler 2006). Most conservation strategies share the common objective of conserving biodiversity, which has been succinctly defined by the United Nations Environment Programme (1991) as: “the variety of and variability within and among living organisms and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.” To do so, the concepts of representation (i.e., addressing the range of environmental conditions in the planning area), resiliency (i.e., being capable of withstanding natural and human-caused changes in the environment), and redundancy (i.e., consisting of a sufficient number of areas to withstand larger scale stochastic events) have been emphasized as being important in delineating effective reserve designs (Shaffer and Stein 2000).

Conservation strategies can be distinguished based on whether they take a coarse filter or fine filter approach to conserving biodiversity. Coarse filter strategies focus on ecological communities or functional ecosystems where planning incorporates an appropriate mix of ecosystems that will maintain or enhance biological diversity and ecosystem integrity within a landscape (Haufler 2006). Recent approaches that form the basis of coarse filter strategies include the habitat diversity approach (i.e., maintaining or restoring adequate amounts of existing vegetation communities; Groves (2003), the historical reference approach (i.e., prioritizing conservation efforts based on a comparison of existing and historical conditions; Haufler 2000, Poiani et al. 2000), and the historic range of variability approach (i.e., maintaining the landscape within the historic ranges of variability; Aplet and Keeton 1999). However, there is little agreement on how to apply coarse filter approaches, with few examples of well designed coarse filter initiatives.

In contrast, fine filter conservation strategies focuses on species or groupings of species to address the ecological objective of maintaining the species or groupings of species within a landscape. Fine filter approaches include the use of umbrella species, indicator species, keystone species, flagship species, ecological engineers, focal species, declining species, at-risk species to represent other, co-occurring species. Groves (2003) and Noon and Dale (2002) provide an overview of these species-specific approaches. Under a fine filter strategy conservation areas are often identified using indices such as species richness, species diversity, or are based on biological hotspots, with the objective of protecting the maximum number of species (Chaplin et al. 2000). However, there is generally poor support in the literature for the fine filter approach because of the difficulty in identifying appropriate species to serve as surrogates, or whether this is even possible (Carignan and Villard 2002), and the inability of this approach to adequately represent all levels of biodiversity (e.g., landscape and ecosystem levels; Schwartz 1999, Chaplin et al. 2000, Groves 2003).

A central element in conservation planning, as indicated above under the two basic frameworks for conservation strategies, is the identification of conservation areas such as reserves or reserve networks. Conservation strategies may differ in their view of conservation areas, with some placing priority on their protected status (e.g., wilderness) such that they are kept separate from human influence (i.e., a compositionalism viewpoint; Callicott et al. 1999), with others emphasizing the functional capabilities of protected areas which may include working landscapes (the functionalism view; Callicott et al. 1999; Haufler et al. 1990, 2000). Though the latter view recognizes that reserves are an important tool for conserving biodiversity, it strives to balance human and conservation needs and focuses on providing functional ecosystems.

Another element that distinguishes conservation strategies is their primary focus. That is, whether they are concerned with rare or declining species or ecosystems or with representation of all species or ecosystems (Haufler 2006). A rarity focus typically devotes funding and effort to the identification of rare or declining elements (e.g., old-growth forest) and the protection of these elements in reserves. A representation focus strives to maintain the full spectrum of ecosystem elements (i.e., all forest structural stages) in adequate amounts and distribution across the planning landscape.

Haufler (2006) noted that most conservation strategies combine many of the approaches described. This more comprehensive approach to conservation planning enables the testing of the effectiveness of each plan element (e.g., implementing a fine filter approach to test the effectiveness of the coarse filter approach; Haufler 1999, 2000) and also addresses the shortcomings of any one strategy or view point.

2.4.1.2. Landscape Ecology

Landscape ecology and the associated concepts of scale, landscape effects, and habitat networks, have also received considerable attention in recent literature and have become a fundamental part of conservation planning. At the landscape scale, the influence of spatial arrangements, amounts, and sizes of habitat patches in landscapes, and the relationships of these factors with ecological processes are important advances (Turner 2005, Freemark et al. 2002). Both the grain (patch-based versus landscape-based) and extent (delineation of planning areas) of landscape analyses have been identified as critical elements in conservation planning, as they influence the results and implications of modeling efforts (Bassett and Edwards 2003).

2.4.1.3. Landscape Linkages and Corridors

Since the 1990s, a common element of conservation planning has been to ensure that adequate connectivity between habitat reserves is maintained to facilitate movement across the landscape and thus exchange between populations. Traditionally, connectivity has been viewed in the form of structural, often linear, elements of the landscape (i.e., riparian buffers) that literally act as corridors through which species move between larger habitat patches within the surrounding matrix. However knowledge of species ecology and dispersal capabilities, coupled with new understanding of landscape ecology, has broadened this view to include linkage zones, or areas within the landscape that may not physically connected but include appropriate habitat elements that provide functional connectivity (Tischendorf and Fahrig 2000). Landscape linkages address movement capabilities, habitat patches, landscape configurations, matrix conditions, barriers, and their ability to maintain continuous populations (Haufler 2006).

2.4.1.4. Habitat Loss and Fragmentation

Numerous recent empirical studies have evaluated the effects of habitat loss and fragmentation on a variety of species. Results of these studies indicated that 1) habitat and fragmentation are not independent, with the degree of habitat fragmentation influencing the magnitude of direct effects from habitat loss (Goodsell and Connell 2002); 2) fragmentation and resulting distribution of remaining habitat is of primary concern in managed landscapes where there has already been substantial habitat loss/conversion (Freemark et al. 2002); 3) interior and specialist species, as well as those that are rare or isolated will be the most affected by habitat loss and fragmentation (Bender et al. 1998, Davies et al. 2000), 4) habitat conversion may benefit some species (McGarigal and McComb 1999); 5) the amount and configuration of remaining habitat were influential in the landscape occupancy (Villard et al. 1998, McIntyre and Wiens 1999, Radford 2005); 6) the quality of remaining habitat may be more important than the quantity (Braden et al. 1997). Notably, studies evaluating the effects of fragmentation in various landscapes indicated that some of the negative effects of fragmentation on vertebrates observed where ecosystems have been converted to urban or agricultural uses have not been found in landscapes where timber harvest is the primary land use (Freemark 2002)

Theoretical studies have also been conducted that provide some insight on how the effects of habitat loss may operate. With (1999) described two perspectives that have resulted from these efforts. One is based on the theory of island biogeography where the objective is to identify the appropriate distribution of habitat patches which are compared to island surrounded by a matrix of non-habitat. The other is based on landscape permeability and the ability of species to move through the landscape (dispersal abilities), and views that landscape as a mosaic consisting of a spatially complex variety of habitat conditions.

The issue of habitat adequacy, or the threshold at which the amount of remaining habitat is insufficient to facilitate species persistence, has also been the subject of recent research. Risks of extinction tend to display non-linear responses as the effects of habitat fragmentation increase (With and King 1999, Flather et al. 2002). Under theoretical studies, threshold effects of habitat loss have been noted at 60 to 80 percent (Flather et al. 2002, Fahrig 1997). However, empirical studies have found the adequacy question difficult to isolate because of complexities in landscape mosaics, matrix conditions, temporal changes, and the various habitat needs of different species. Empirical studies note species losses typically above a 90 percent threshold (Radford and Bennett 2004, Virkkala and Toivnen 1999).

2.4.1.5. Relationship to the Tongass Conservation Plan

The conservation strategy was described as a “habitat-based wildlife conservation strategy that employed old-growth associated umbrella species to design a coarse filter/fine filter approach for species conservation" (Haufler 2006). Based on Haufler's (2006) review, the science underpinning the Tongass conservation strategy is supported by recent literature. New information suggests that additional consideration of windthrow effects, which may occur at greater magnitudes than once thought (Kramer et al. 2001) and have farther reaching effects on habitat selection of some species (DeGayner et al. 2005), and a finer scale analysis of the distribution of plant associations (e.g., VanHees and Mead 2005) may be warranted to enhance the existing coarse filter component of the conservation strategy (Haufler 2006). At this time, plant association mapping for the Tongass does not exist, and the development of such mapping would be an enormously expensive undertaking. In lieu of evaluating how representative are the reserves based on plant associations, ecological subsection and biogeographic province mapping was used in conjunction with old-growth types as a surrogate. Likewise, a finer-scale assessment of viability for some species, particularly endemics (see *Wildlife* section for discussion of new science related to endemism on the Tongass) may be warranted to ensure the coarse filter component of the conservation strategy is meeting the needs of all species, including those that are rare or occupy limited distributions (Haufler 2006). However, Haufler (2006) concluded that "the developments in the field of conservation science produced since 1996 indicate that the conservation strategies used in the plan are still valid at the present."

In April 2006, an Interagency Conservation Strategy Review workshop was held to review the Tongass Land Management Plan conservation strategy in light of new information since 1997 (USDA Forest Service 2007). The objectives of the workshop were to:

1. Facilitate robust discussion between an interagency workgroup and invited scientific and technical experts regarding new information attained since 1997 that may be relevant to the conservation strategy; and
2. Generate and discuss science-informed "Considerations" relative to the strategy."

Considerations included identification of the need to attain additional information or conduct additional analysis regarding a scientific question or issue, the need for change to the conservation strategy, or other investments or work. The workshop included technical presentations regarding recent and current studies on species and species groups of concern on the Tongass. A broad conclusion of the workshop was that the conservation strategy continues to be supported by science (USDA Forest Service 2007). Although the information presented emphasized that there is still uncertainty associated with managing wildlife habitat on the Tongass, the new information presented has increased our knowledge of species/habitat relationships, reinforced the idea that retaining old growth in a system of Forest-wide reserves is appropriate for many species, and reiterated that having a very conservative approach to conservation of old-growth-associated species is still warranted and supported by science.

2.4.2. Species-Specific Science

This section presents a summary of the new information for individual species that is relevant to the Tongass Conservation Strategy, with focus on those species that are directly relevant to proposed changes to the Conservation Strategy. The majority of this information was presented at the April 2006 Interagency Conservation Strategy Review workshop and is summarized in a report (USDA Forest Service 2007). Reference to this information, as well as more complete discussion of this new information, can be found throughout the *Wildlife* section in Chapter 3 of the FEIS. This section summarizes the key highlights of information with particular focus on goshawk and marten, since these two species have specific standards and guidelines amended.

2.4.2.1. Northern Goshawk (including the Queen Charlotte goshawk subspecies)

The results of 10 years of research on the Queen Charlotte goshawk in Southeast Alaska were summarized at the Conservation Strategy workshop (Flatten et al. 2001,2002; Lewis 2005; Lewis et al. 2001, 2006). This research was in various studies, some of which is published and some of which is available in agency reports. A total of 69 adult goshawks (37 females and 32 males) were radiotagged from 1992 to 2001. Using 2-year and 1-year tags on females and males, respectively, greater than 2,800 relocations were recorded over approximately 500 km^2 of the Tongass National Forest.

Nest trees are typically found in the largest trees available relative to the nest stand. Basal area was higher at the nest tree (> 60 percent) than the surrounding stand (< 60 percent). Aerial photo analysis also showed a difference between the amount of forest, productive forest, and canopy cover at the nest site versus random sites; however, although it was statistically significant, it may not be biologically significant. Eighty-nine percent of the 63 nest sites evaluated had multi-storied canopies.

Two large spatial scales (816 ha and 2,088 ha) were used to provide a summary of the vegetation surrounding 78 known nest sites based on GIS analyses. POG on NFS land represented 37 to 40 percent of the circular areas around these nest sites on average, followed by unproductive forest on NFS land at 24 percent, and NFS young growth at 9 to 10 percent. Nonforest on NFS land made up 5 percent and non-NFS land and saltwater made up the remaining 23 to 25 percent (see EIS planning record). Sixty-eight to 70 percent of the POG on NFS land inside the circles was protected in reserves or in the matrix. Use by adult males and females during the nesting and non-nesting season showed a consistently higher use of POG forest in proportion to availability. Habitat use of the 1,000-foot beach and estuary buffer was higher for females than for males during nesting and non-nesting seasons and peaked again at approximately 3,000, and 4,000 feet from the beach fringe.

Using the same approach discussed above, a hypothetical post-fledging area (PFA) was developed using a radius centered on a nest site and determined by the mean distance moved by northern goshawk juveniles (approximately 1,500 m) from the nest. Based on habitat categories of suitable (medium- and high-volume old growth), low-volume old growth, harvested, and nonproductive forest, approximately 45 percent of the mean PFA was in nonproductive forest, followed by suitable habitat (39 percent), low-volume old growth (8 percent), and harvested (4 percent). Results of this hypothetical PFA analysis indicate that about 40 percent of the PFA on average will be medium- or high-volume POG, of which 55 percent was in a Timber LUD or non-NFS lands.

Adult goshawk home ranges were large, much larger than most other home ranges documented in North America. Median home range sizes ranged from 3,900 ha to 11,800 ha for adult females during the nesting and non-nesting season, respectively. Male home ranges were slightly larger in size ranging from 4,300 ha to 11,900 ha during the nesting and non-nesting seasons, respectively.

Movements by nesting pairs within a territory between year 1 and year 2 ranged from 0.1 to 3.2 km with the majority (67 percent) moving less than 0.4 km. Female goshawks tend to move much greater distances between nests in sequential years than males with approximately 35 percent of females leaving their nesting area, re-pair, and nest in a new area the next year. However, of 24 nesting territories, 54 percent remained within 0.36 km radius of the previous years nest and all movements were within 3.2 km of the nest site. Nesting pairs split up more often and between-year nesting dispersal of adult female goshawks is much higher than anywhere else they have been studied in detail in North America.

The diet of goshawks in Southeast Alaska is dominated by a few key prey (grouse, medium-sized birds, and red squirrels, where present). Prey rich areas include the northern half of the Tongass National Forest, where blue grouse and red squirrel are the dominant prey items taken. On Prince of Wales Island (POW) and other islands where sooty grouse and red squirrel are not present, spruce grouse, Steller's jay, and ptarmigan are the dominant prey items taken. Small mammals make up a small portion of the overall diet in this area. Ten nests were monitored as part of the study and of all food deliveries to the nest, 78 percent of the goshawk diet in Southeast Alaska consisted of bird species, with grouse the most commonly delivered prey item. From a broader diet pattern using stable isotope and prey associations, forest-dwelling prey items are, not surprisingly, dominant, but there is also a component of tidal and wetland prey species in their diet.

Recent studies confirm the importance of management for prey in relation to goshawk productivity (Kenward 2007). Salafsky et al. (2007) recommend that goshawk management strategies incorporate forest management practices that increase the abundance and diversity of available prey resources. The differences in prey species abundance and distribution across the Tongass may help explain some of the variation in productivity, territory size and nest site selection (Lewis et al. 2006, see also compiled information in U.S. Fish and Wildlife Service 2007).

In a review of over 180 publications on goshawk habitat relationships, Reynolds (2004) reported that, although goshawks predominantly nest in mature and old-growth forest characterized by closed-canopy stands of large, dense trees, there is considerable variation in nest sites among populations, with goshawks in Oregon and Nevada nesting in stands with canopy cover as low as 31 percent. Reynolds (2004) also reported that outside of the nesting season, the variation in habitats used by goshawks is even greater (multiple forest age classes, edges, and openings) and is apparently related to differences among habitat in prey abundance and availability (i.e., goshawks may nest or forage more often in habitat where prey is more abundant). Reynolds (2004) concluded that the main factors limiting goshawks were habitat structure for both nesting and foraging (rather than composition) and prey. This idea was also demonstrated by Reynolds et al (1992) who used a food web-based, ecological approach to develop forest management recommendations for goshawks in the Southwest United States. Taking into account both goshawk habitat requirements and the habitat requirements of 14 of their prey species, Reynolds et al. (1992) recommended that no more than 60 percent of a desired landscape of goshawk and prey habitats consist of mature to old-growth forests, and that post-fledging family areas (i.e., the area immediately surrounding the nesting area) should include habitat attributes important to prey species, including snags, downed logs, woody debris, large trees, openings with herbaceous and shrubby understories, and an intermixing of forest vegetative stages. Reynolds et al. (2006) concluded that management prescriptions based on the ecology (e.g., composition, structure, pattern, and dynamics) of a forest ecosystem, is a more appropriate basis for developing desired forest conditions that support goshawks and their prey.

Management recommendations for goshawks have been incorporated into multiple Forest Plans across the United States. Many of these are based on Reynolds et al. (1992), which includes recommendations for goshawk habitat for a variety of spatial scales, including nest sites and post-fledging family areas. These recommendations are specific to habitats in the southwestern United States, though they have been used in other geographic areas. While information from these studies regarding goshawk habitat relationships is useful across a broad geographic areas, specific recommendations for standards and guidelines is less useful. Because of significant differences in habitat and the extent of human influences on natural processes between Alaska and the Southwest, specific management prescriptions have limited applicability to Southeast Alaska.

In addition to these findings, limited new research has shown goshawk use of young-growth stands. Although POG is still considered the optimal nesting habitat for this species, non-productive forest types and second-growth stands are also used by goshawks for movement and foraging (and sometimes nesting), emphasizing the importance of matrix lands in goshawk management (McClaren 2004, Boyce et al. 2006, Reynolds et al. 2006). Some nests have been found in maturing second-growth (previously harvested) stands (Bosakowski et al. 1999, McClaren 2003). On Vancouver Island, most second-growth stands supporting nests were 60 to 80 years old, and suitable structure was apparently achieved in as little as 50 years (McClaren 2003). Additionally, Doyle (2004b) found that blue grouse, an important prey species for goshawks on the Queen Charlotte Islands, selected stands with more open canopies indicating that there may be a threshold below which timber harvest would not adversely affect grouse, or goshawks as their predators. On Douglas Island in Southeast Alaska, goshawks have been observed to nest in 80-90 year old stands (Kim Titus, Alaska Department of Fish and Game. pers. comm., 2007).

Management of the nest stands around known goshawk nests continues to be an important factor in goshawk conservation; some Forest Plans incorporate management of an area around the nest for fledglings (USDA Forest Service 2006). With respect to nest site management, Reynolds et al. (1992) recommended nest buffers of 30 acres, with maintenance of at least 3 known nests and 3 replacement nests (totaling 180 acres) within a 600 acre post-fledging family area. Thus, they recommend that 30 percent of the post-fledging family area should be retained for nesting habitat, with rest in a variety of successional stages. Management for goshawk nests is complicated by the difficulty in finding nests, particularly in the remote terrain of Southeast Alaska, where detection rates appear to be lower than in other areas (U.S. Fish and Wildlife Service 2007). Goshawks often have multiple alternate nests within a territory, which further complicates management of nest sites (USDA Forest Service 2007). Recent research in the southwestern U.S. confirms the difficultly in managing for goshawks only at the nest scale because detectability of goshawks is highly variable among individuals as a result of extensive year-to-year and spatial variation in breeding. Goshawks do not always nest every year, often skipping nesting for one or more years; this behavior is most likely due to prey abundance and availability (Reynolds et al. 2005).

2.4.2.2. American marten

Several new studies and concerns related to the conservation of marten were presented at the Interagency Conservation Strategy Review: An Assessment of New Information Since 1997 in April 2006 (USDA Forest Service 2007). Marten experts reviewed and summarized new information relevant to Tongass management issues. New information was presented relative to the level of endemism in marten on the Tongass. Preliminary molecular analyses distinguish two lineages of marten and indicate that they have very different evolutionary histories (Stone and Cook 2002, Small et al. 2003, Cook et al. 2006). The two lineages (*americana* and *caurina*) are considered by some to be two species, but have not been formally identified as such. The *caurina* lineage is known to inhabit only two islands within the archipelago (Admiralty and Kuiu Islands; Cook et al. 2006). There are two contact zones (i.e., zones where the lineages coincide) in North America, one in Southeast Alaska and one in Montana (Cook et al. 2006). In addition, there are records that marten were introduced on many islands in Southeast Alaska in including Prince of Wales, Baranof, Chichagof and nearby smaller islands (MacDonald and Cook 2007). The authors speculate that the endemic lineage of marten (*caurina*) may have occurred on more islands than Kuiu and Admirality and may have been extripated by introductions of *americana*.

Between 1990 and 1998, studies were conducted on Chichagof Island to assess marten habitat selection at multiple scales, demographics, diet, and prey availability. Results indicated that marten numbers fluctuated greatly over time in response to food availability and trapping mortality (Flynn et al. 2004). Habitat requirements reflect a strong interaction between food, cover, climate, and predation, with forest cover being particularly important for travel, dens and resting sites, hunting and avoiding predation, and staying dry. Martens selected forest stands with increasing amounts of structure (e.g., selected stands with a greater number of large trees and multiple stories); with stronger selection occurring in winter. Important habitat features included large logs and stumps in decay classes 4 and 5 and the bases of large live trees, which they use for dens and resting sites. Habitat data were consistent with the Forest Plan definition of high value marten habitat.

Several studies have indicated that marten are sensitive to fragmentation (Hargis et al. 1999, Flynn et al. 2004). Based on metapopulation theory, spatially isolated populations will persist in suitable habitats if regularly recolonized (Ruggiero et al. 1994).

To determine whether the results of the Chichagof Island studies were applicable across the Tongass, eight study areas in Southeast Alaska were established between 2001 and 2003, representing different marten populations (Flynn et al. 2004). Hypotheses include 1) marten abundance is greater than or equal to 25 marten per large OGR (which was an assumption for the Forest Plan Conservation Strategy) and 2) marten densities would be greater on areas with habitat composition similar to OGRs, but with more diverse and abundant food resources.

This study indicated that only the Chichagof Island site had abundance estimates of greater than 25 females per OGR and only the Point Couverden and Thomas Bay sites had upper confidence intervals greater than 25 females per OGR. A large variation in small mammal abundance was observed, with long-tailed voles only abundant on Chichagof Island, Keen's mice common except on the mainland, and red-backed voles occupying a limited distribution but numerous where they occurred (e.g., Etolin Island, Point Couverden, Thomas Bay, and Yakutat). Marten fed on long-tailed voles when they were available, and generally avoided Keen's mice and red-backed voles. However, when vole numbers were low, marten switched to salmon. Marten numbers were best predicted by long-tailed vole abundance (positive correlation) and Keen's mice abundance (negative correlation); red-backed voles were not a significant factor. The ungulate index was marginally significant and fragmentation indices were correlated with marten density.

Based on these results, marten experts at the Conservation Strategy Review concluded that the OGR system appears to be an appropriate model for marten conservation, though they felt that management needed to be tailored to specific island populations (Cook and McDonald 2001, Cook et al. 2001). They believe that OGRs may not provide enough habitat in themselves to maintain healthy populations and additional conservation measures may be necessary, such as managing matrix lands as productive habitat and maintaining corridors between OGRs (Flynn et al. 2004). Studies of marten home ranges have shown that they encompass areas of timber harvest and roads, elevating the importance of matrix management in providing functional connectivity across the landscape for marten (Flynn et al. 2004).

Studies on Mitkof Island indicated that martens selected for POG and used a wide variety of POG types but used some clearcuts 26 to 40 years of age; on Mitkof these clearcuts where characterized by abundant understory forage and small mammals (Flynn et al. 2004). Home ranges of marten were well distributed across the landscape and included areas with timber harvest and roads. Although they selected against it, they seemed to readily travel across areas of noncommercial forest as well as POG and clearcuts with established conifer cover. Prey quality and quantity appear to be very important in predicting marten abundance and distribution.

2.4.2.3. Other Species

Research has also identified new endemic species, and refuted species thought to be endemic. Regardless, changing the list of endemic species considered by the panel assessment would not change the fact that they occupy limited distributions and some are sensitive to habitat conversion related to timber harvest. However, new science is continuing to emphasize the importance of the Alexander Archipelago as a center for endemism from a global perspective (Cook and MacDonald 2001, Cook et al. 2006).

Recent research on small endemic mammals in Southeast Alaska has focused on documenting distribution and increasing information regarding genetic variation. There has been little work, except for marten and flying squirrel, directed at habitat relationships. Therefore, while we know more about endemic mammalian abundance and distribution across the Tongass, there is not much additional information to support significant changes to the Conservation Strategy for endemic mammals.

Recent analyses presented at the Tongass Conservation Strategy Review Workshop (2006) updated the relationship between road density and wolf mortality related to legal and illegal hunting and trapping. This analysis was based on a regression analysis of average wolf harvest by Wildlife Analysis Area (WAA) between 1990 and 1995 against total road density for lands below 370 m elevation. Results presented the probability of an overkill (average harvest of greater than 30 percent of the population) or destructive harvest (harvest greater than 90 percent of the population occurring once between 1985 and 1999) of the wolf population on Prince of Wales Island, taking into account road density and whether the road system was connected to a main road system with access to a ferry. Results indicated that the probability of overkill for WAAs with road density greater than 0.7 miles per square mile at 40 percent, if the WAA is connected to a main road system and 13 percent if not. Results also indicated that 32 percent of WAAs on Prince of Wales Island had road densities indicative of a high probability of overkill and 52 percent had road densities indicating a high probability of having had at least one destructive harvest between 1985 and 1999. These results indicated that roads exerted a strong influence on wolf mortality, particularly when connected to main road systems. However, it is important to note that roads themselves do not decrease habitat capability for wolves, but increased density of roads may lead to higher hunting and trapping mortality through improved human access. There are other methods available to address unsustainable hunting and trapping mortality including changes to both State and Federal hunting and trapping regulations and increased enforcement.

2.5. Modifications to the Strategy under 2008 Forest Plan Amendment

The comprehensive science-based conservation strategy included in the 1997 Forest Plan is a scientifically sound foundation from which to base management decisions. Its system of large, medium and small OGRs across the Forest was implicitly designed to assure well distributed, viable wildlife populations. Alternative 5 of the 2008 Forest Plan Amendment Final EIS maintains the 2007 Forest Plan (1997 Forest Plan, as amended through 2007) old-growth conservation strategy, as described in Sections 2.2 and 2.3. Alternatives 1, 2, 3, and 6 of the 2008 Forest Plan Amendment Final EIS retain the main components of the conservation strategy (i.e., the OGR system and non-development LUDs, the beach fringe, riparian buffers); in addition, they expand the areas within the Forest-wide reserve network and incorporate some modifications to the standards and guidelines. This section describes the differences between the 2007 Forest Plan's conservation strategy, as represented by Alternative 5, and the conservation strategy proposed under Alternatives 1, 2, 3, and 6.

Alternatives 4 and 7 differ from the other five alternatives in that they eliminate or modify significant portions of the conservation strategy and these are also addressed in this section and compared with Alternative 5 as well as the 1997 Forest Plan. Alternative 4 modifies the coarse filter component by identifying Old-Growth Habitat LUDs in only four of the most heavily modified biogeographic provinces (North Central Prince of Wales, Kupreanof/Mitkof Islands, Dall Island and Vicinity, and East Chichagof Island) in addition to maintaining two individual reserves including the Wright Lake (mainland southeast of Wrangell), and Myers Chuck (Cleveland Peninsula northwest of Ketchikan) reserves and creating one near Eva Lake (northeast Baranoff Island) in an area currently designated as Semi-Remote Recreation. In addition, all VCUs outside of these biogeographic provinces would be required to retain 33 percent of their old growth with no requirement to consider spacing, location, size, shape, or composition in the design of the retained acres, as is provided by the 2007 Forest Plan Old-Growth Habitat Reserve Criteria (see Section 2.2.1.2, *Description and Design Features of the Reserve Network*). As under all other alternatives, OGRs are also provided by other non-development LUDs, although, with the exception of Alternative 7, the acreage is less under Alternative 4 than under all other alternatives. Alternative 7 maintains substantial area in non-development LUDs, but entirely eliminates the Old-Growth Habitat LUD and would not have a specific retention requirement.

Of the other alternatives, Alternatives 1, 2 and 3 all have significantly less old-growth harvest as compared to Alternative 6. This Appendix therefore focuses on effects to Alternative 6 because this is the benchmark by which to measure effects to these three other alternatives. Adverse effects to wildlife would be less under Alternatives 1, 2 and 3 based on the volume of old growth projected to be harvested and this is fully discussed in the Wildlife Section of the FEIS.

2.5.1. Changes to Forest-wide Reserve Network (coarse-filter approach)

The Forest-wide Reserve network is expanded under Alternatives 1, 2, 3, and 6, relative to Alternative 5 (the 1997 Forest Plan Revision as amended). This expansion includes additional acreage in the Old-Growth Habitat LUDs relative to Alternative 5 and relative to the original 1997 Forest Plan. The expansion of the Old-Growth Habitat LUDs is the same for all four alternatives. In addition, the acreage in non-development LUDs is expanded for each of the four alternatives, with the amount of the expansion varying by alternative. As noted above, Alternative 4 identifies a smaller area than Alternative 1, 2, 3, 5, or 6 in Old-Growth Habitat LUDs and Alternative 7 does not identify any area.

2.5.1.1. Changes to Old-Growth Habitat LUDs

The original 1997 Plan noted that small OGRs had received less analysis and mapping precision than was necessary to meet the Plan standards. Large and medium OGRs received a rigorous review to be sure that they achieved the conservation strategy objectives (1997 Forest Plan, p. 3-82). However, the small OGRs received differing levels of reviews. Therefore, the Forest Plan and the Tongass National Forest Land and Resource Plan Implementation Policy Clarification (referred to as TPIT; USDA Forest Service 1998;) provided for the further evaluation and possible adjustment of the locations of small OGRs (USDA Forest Service 1997, Forest Plan, p. 3-82).

The 1997 Forest Plan standards and guidelines for OGRs state that during project level environmental analyses for project areas that include or are adjacent to a mapped OGR, the size, spacing and habitat composition of mapped reserves may be further evaluated (USDA Forest Service 1997, Forest Plan, p. 3-82). TPIT (USDA Forest Service 1998, p. 1) stated that an interagency team of biologists (referred to as the interagency team) would jointly evaluate the location and composition of the small OGR as mapped in the Forest Plan using criteria in Forest Plan Appendix K. The objective of the interagency team review described above was to develop a consensus biological recommendation on small reserve locations that was consistent with the Forest Plan. The Forest Service line officer retained decision authority to implement recommended changes or modify them. Because changes in OGRs resulted in a change in LUD, a Forest Plan amendment was required to implement changes.

As described in Section 2.3, analysis and mapping refinement of OGRs associated with 24 project areas has been conducted since 1997 (Table D-2). These adjustments were incorporated into the Forest Plan via non-significant Forest Plan amendments. Efforts to complete this higher level of analysis and mapping on all other small reserves have been ongoing since 1997. As part of the current Forest Plan Amendment process, the Forest worked with the Alaska Department of Fish and Game (hereafter referred to as ADFG) and the U. S. Fish and Wildlife Service (hereafter referred to as FWS) to complete a more comprehensive review and mapping effort. This process was conducted in 2006 and 2007 and included the development of a biological recommendation for adjustment of OGR boundaries, a refinement of that proposal with Forest Service Ranger District staff, and a further refinement by the Forest Supervisor. This refinement process was conducted in order to consider multiple-use objectives in addition to pure biological ones. The final proposal is included in Alternatives 1, 2, 3, and 6 of the Final EIS. Alternative 5 retains the 1997 Plan (as amended) reserve network and the reserves of Alternatives 4 and 7 are not affected by this proposal.

The final proposal for modifying small OGR boundaries was based on reviewing all small OGRs and a few medium reserves. As a result, OGR locations were generally finalized for all but 13 small OGRs. OGR locations are expected to change in the future only if a project occurs near these 13 reserves or under other limited circumstances (see Appendix K to the Final EIS). The net result of the review was an increase of 39,000 acres in the Old-Growth Habitat LUD, from 1,182,000 to 1,221,000. In addition to this expansion, some areas containing Old-Growth Habitat LUDs were converted to other non-development LUDs (e.g., Special Interest Area and Semi-Remote Recreation) and remain a part of the OGR network. These areas are discussed in the next subsection and the net result of all these changes is summarized in Section 2.5.1.3.

Not only was the total acres in the Old-Growth Habitat LUD increased, but the quality of the small OGRs was also improved. Updated local information was used, in many cases, to increase the protection of key old-growth species habitat, including known goshawk nests, important black bear, mountain goat and brown bear habitat, riparian habitat, anadromous streams and beach fringe. In addition, connectivity was another consideration in updated small OGRd locations. Rationale for making these adjustments were documented in an OGR tracking table for the refinement effort (located in the planning record).

2.5.1.2. Changes in Other Non-Development LUDs

The Old-Growth Habitat LUDs discussed in the previous subsection are a critical piece of the OGR network, but many other non-development LUDs represent important parts as well. Although the area in Old-Growth Habitat LUDs is the same for Alternatives 1, 2, 3, and 6, the total area in other non-development LUD categories varies. Alternatives 4, 5, and 7 vary in both their Old-Growth Habitat LUD and their other non-development LUD acreage. The acreage in many individual non-development LUD categories is constant regardless of the alternative (e.g., wilderness, LUD II, research natural area); however, the acreage in three non-development LUD categories (other than Old-Growth Habitat) differs among alternatives. These categories include: Special Interest Area, Semi-Remote Recreation, and Remote Recreation. Special Interest Area acreage was expanded by 47,000 acres relative to Alternative 5 (the 1997 Forest Plan, as amended), under Alternatives 1, 2, 3, 4, 6, and 7. The change in Semi-Remote and Remote Recreation acreages varies by alternative. For Alternative 6, the area in these two LUDs increased by 63,000 acres compared with Alternative 5. For Alternatives 1, 2, and 3, these LUD acreages increased by 2,681,000, 1,591,000, and 717,000 acres, respectively, while for Alternatives 4 and 7 the LUD acreages decreased by 379,000 and 308,000 acres, respectively.

The net increase in non-development LUD acreage (not counting the Old-Growth Habitat LUD) relative to Alternative 5, would be 110,000 acres for Alternative 6 and would range from 763,000 to 2,728,000 acres for Alternative 3, 2, and 1 in that order, respectively. Under Alternatives 4 and 7, non-development LUDs other than Old-Growth, would decrease by 333,000 and 261,000 acres, respectively. While it is recognized that not all acres within these LUDs are old growth, there would be a net increase in the reserve system under Alternatives 1, 2, 3, and 6 that is proportional to the increase in non-development LUD acres and a proportional decrease under Alternatives 4 and 7.

2.5.1.3. Net Changes to the Forest-wide Reserve Network

The acreage in reserves, given the above changes in the Old-Growth Habitat LUD and other non-development LUDs, is compared with the acreage in the matrix for the alternatives and compared with the 1997 version of the Forest Plan in Table D-5. This comparison shows that the 1997 version of the Plan included 78.0 percent of the Forest in reserves. As a result of land adjustments and OGR changes between 1997 and 2007, the 2007 Forest Plan (equivalent to Alternative 5) now has 78.5 percent of the Forest in reserves. Alternatives 1, 2, 3, and 6 would each result in a higher percentage yet, ranging from 79.4 percent in reserves under Alternative 6 to 95.0 percent in reserves under Alternative 1. Under Alternative 4, the percentage in reserves would be reduced to 71.8 percent, and under Alternative 7 this percentage would be reduced to 69.9 percent.

Table D-5.
Summary of Acreages in Reserves and Matrix under the Alternatives compared with the Forest Plan in 1997

	Reserves					
Alternative	**Old-Growth Habitat LUD**	**Other Non-Dev. LUDs**	**Total in Non-Dev. LUDs**	**Matrix**	**Total**	**Percent of Forest in Reserves**
Alternative 1	1,221,173	14,712,270	15,933,443	840,359	16,773,802	95.0%
Alternative 2	1,221,173	13,623,148	14,844,321	1,929,485	16,773,806	88.5%
Alternative 3	1,221,173	12,748,685	13,969,858	2,803,945	16,773,803	83.3%
Alternative 4	393,360	11,652,756	12,046,116	4,727,686	16,773,802	71.8%
Alternative 5 (1997 Forest Plan)	1,182,424	11,985,410	13,167,834	3,605,974	16,773,808	78.5%
Alternative 6	1,221,173	12,095,212	13,316,385	3,457,420	16,773,805	79.4%
Alternative 7	0	11,724,107	11,724,107	5,049,695	16,773,802	69.9%
1997 Forest Plan	1,131,059	12,034,860	13,165,919	3,717,081	16,883,000	78.0%

Sources: Final EIS Chapter 2 for the Alternative numbers; Appendix N to the 1997 Tongass FEIS and Appendices to Appendix N for 1997 numbers.

A summary of POG acres in reserves and in various matrix categories is provided in Table D-6. This table presents POG acreages for the Forest-wide reserve network under Alternatives 1, 2, 3, and 6, given the above changes in the Old-Growth Habitat LUD and other non-development LUDs, as well as under Alternatives 4, 5, and 7, which do not include the above changes in the Old-Growth Habitat LUD. The table also compares these alternatives with the 1997 version of the Forest Plan. Based on these numbers, the 1997 version of the Forest Plan included 70.1 percent of the existing POG in reserves; combined with the protected and unscheduled POG in the matrix, 90.6 percent of the current POG was protected or not scheduled to be harvested. Again, Alternatives 1, 2, 3, and 6 would each result in higher percentages for both of these categories, with 72.0 percent of the POG in reserves and 91.0 percent of the existing POG protected or not scheduled for harvest under Alternative 6.

Under Alternative 5 (the 2007 Forest Plan), 71 percent of the existing high-volume POG (SD Model types 5N, 5S, and 67) and 68 percent of the existing large-tree POG (SD Model type 67) would be included within reserves (Table D-6). Overall, 90 percent of the existing high-volume POG and 89 percent of the large-tree POG would not be harvested. These percentages would all remain the same or increase under Alternatives 1, 2, 3, or 6 because of the changes made to OGRs and other LUDs, which resulted in a greater portion of the forest types consisting of larger trees being included within reserves. Under Alternative 6, for example, 73 percent of the high-volume POG and 70 percent of the large-tree POG would be included within reserves. Overall, 90 percent of the existing high-volume POG and 89 percent of the large-tree POG would not be harvested. Alternatives 1, 2, and 3 would protect higher percentages of high-volume and large-tree POG in reserves and in the matrix. Under Alternatives 4 and 7, on the other hand, lower percentages would be protected. Approximately 57 to 60 percent of the high-volume POG and 53 to 57 percent of the large-tree POG would be in reserves under Alternatives 7 and 4, respectively. Overall, 82 to 85 percent of the high-volume POG and 80 to 84 percent of the large-tree POG would be protected from harvest.

Table D-6.
Estimated Acreage and Percentage of All Existing POG, High-Volume POG, and SD67 POG in Reserves[1] and Matrix Lands (minimum protected vs. maximum harvested) [2] by Alternative

Alt.	POG Category	Amount in Reserves[1]		Amount in Matrix[2]				Total Existing POG[3]	
				Minimum Protected		Maximum Harvested			
		Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	All POG	4,615,995	93%	249,182	5%	85,972	2%	4,951,148	100%
	High-Volume POG	1,862,441	93%	104,444	5%	41,460	2%	2,008,345	100%
	SD67 POG	477,813	89%	43,253	8%	16,385	3%	537,451	100%
2	All POG	4,167,367	84%	569,270	11%	214,511	4%	4,951,149	100%
	High-Volume POG	1,674,500	83%	232,318	12%	101,529	5%	2,008,346	100%
	SD67 POG	425,744	79%	77,417	14%	34,291	6%	537,451	100%
3	All POG	3,866,467	78%	771,255	16%	313,426	6%	4,951,148	100%
	High-Volume POG	1,572,277	78%	294,628	15%	141,440	7%	2,008,345	100%
	SD67 POG	401,011	75%	90,844	17%	45,596	8%	537,451	100%
4	All POG	2,965,670	60%	1,329,005	27%	656,473	13%	4,951,148	100%
	High-Volume POG	1,203,702	60%	511,928	25%	292,714	15%	2,008,345	100%
	SD67 POG	307,863	57%	145,418	27%	84,169	16%	537,451	100%
5	All POG	3,518,425	71%	970,176	20%	462,556	9%	4,951,156	100%
	High-Volume POG	1,431,634	71%	378,068	19%	198,647	10%	2,008,349	100%
	SD67 POG	364,183	68%	113,501	21%	59,767	11%	537,451	100%
6	All POG	3,563,600	72%	942,410	19%	445,103	9%	4,951,114	100%
	High-Volume POG	1,458,202	73%	352,379	18%	197,760	10%	2,008,342	100%
	SD67 POG	375,671	70%	103,085	19%	58,696	11%	537,451	100%
7	All POG	2,807,478	57%	1,336,275	27%	807,396	16%	4,951,148	100%
	High-Volume POG	1,143,122	57%	502,283	25%	362,940	18%	2,008,345	100%
	SD67 POG	287,295	53%	144,188	27%	105,968	20%	537,451	100%
1997 Forest Plan	All POG	3,551,482	70%	1,038,492	21%	473,597	9%	5,063,571	100%
	High-Volume POG[4]	1,562,652	72%	373,857	17%	219,268	10%	2,155,788	100%
	SD67 POG[4]	--	--	--	--	--	--	--	--

[1] Reserves include all non-development LUDs (e.g., Old-Growth Habitat, Semi-Remote Recreation, Remote Recreation, Wilderness, National Monument, etc.).
[2] Matrix includes all development LUDs (Timber Production, Modified Landscape, Scenic Viewshed, and Experimental Forest). Maximum harvested assumes the maximum acreage permitted by the Allowable Sale Quantity is harvested each decade.
[3] Note that the Tongass land base has changed since 1997 due to land adjustments and harvest has occurred.
[4] High-volume POG numbers were derived from percentages given in Appendices 3 and 8 to Appendix N of the 1997 Tongass FEIS; numbers were not available for SD67 POG. There are differences in the method of calculation for high-volume POG between 1997 and 2008, so the absolute numbers should not be compared – only the percentages.

Sources: Table 3.9-12 in Biodiversity Section for the 2008 alternative numbers; Appendix N to the 1997 Tongass FEIS and Appendices to Appendix N for 1997 numbers.

2.5.2. Changes to Standards and Guidelines (fine-filter approach)

This section describes and provides background/rationale for the changes to standards and guidelines proposed under the seven alternatives. The first section provides a summary listing of the primary changes in standards and guidelines from the 1997 Forest Plan. Following this section, a series of sections provide background and rationale for the most important individual changes.

2.5.2.1. Overview of Changes to Standards and Guidelines by Alternative

Most of the standards and guidelines identified in the 1997 Forest Plan remain the same for all of the alternatives. The standards and guidelines for Alternative 5 would be exactly the same and most standards and guidelines related to the conservation strategy do not change under Alternatives 1, 2, 3, and 6. This includes key supporting standards, like the 1,000-foot beach buffer and riparian buffers that were deemed critically important for wildlife connectivity; these are brought forward into the amended Plan under these alternatives. However, there are four primary changes, four additional important but non-substantive changes, and some minor editorial changes to standards and guidelines that relate to Alternatives 1, 2, 3, and 6. The four primary changes associated with these alternatives are listed in a subsection below, followed by the important non-substantive changes (minor changes are not listed).

In addition, many of the changes associated with Alternatives 1, 2, 3, and 6 and several additional important changes are associated with Alternatives 4 and 7. These changes are identified in separate subsections below.

Primary Changes Associated with Alternatives 1, 2, 3, and 6

1. Added a new Forest-wide Legacy Forest Structure (hereafter referred to as Legacy) standard and guideline that requires retention of 30 percent of the acreage in harvest units greater than 20 acres in size for VCUs with high amounts of past and/or anticipated future timber harvest. This replaced the goshawk foraging standard and guideline and the marten standard and guideline that required varying degrees of retention of old growth trees in harvest units.
2. Changed the goshawk nesting habitat standard and guideline for confirmed and probable nests to allow timber harvest or other activities if, based on annual monitoring, the nest site is found to be inactive for 2 consecutive years. (note – active nest sites include sites that are occupied, whether or not there is actual nesting documented).
3. Added a stipulation to allow for alternative goshawk nest site management with projects under contract. If a new nest is located within an area that is under a timber sale or other contract, the activity may proceed if at least 300 acres of POG, including at least one contiguous block of 100 acres, remains within a 0.75-mile circular radius of the nest. Timing restrictions would apply to allow that year's brood to successfully fledge from the nest.
4. Clarified that the landscape connectivity standard was to provide connectivity between large and medium reserves only. Also, given the assessment of small OGRs done for the amendment (see below), no additional areas were determined to need additional assessment at the project level and this is reflected in the amended standard.

Other Important Clarifying Changes Associated with Alternatives 1, 2, 3, and 6

1. The endemic terrestrial mammal standard was changed to allow for use of existing data on endemic mammal distribution. Surveys would only be necessary where existing information is not adequate to assess project level effects.
2. Edited the marten road standard to clarify that road management would be considered only where road access and associated human caused mortality has been determined to be the significant contributing factor to unsustainable marten mortality and this would be done in collaboration with the Alaska Department of Fish and Game (ADF&G).
3. Edited the wolf road standard to clarify that road management would be considered only where road access and associated human caused mortality has been determined to be the significant contributing factor to unsustainable wolf mortality, and this would be done in collaboration with ADF&G. It also directs an assessment of both total and open road density when human access considerations are necessary. The wolf standard was changed so that both access management on National Forest System lands and hunter/trapper harvest regulations are considered.

4. Edited the wolf standard to clarify the use of the deer habitat capability model and standardized this to a habitat capability of 18 deer/square mile. The wolf standard was also changed to direct biologists to consider local knowledge of habitat conditions, spatial location of habitat and other factors rather than solely relying upon model results.

Changes Associated with Alternative 4

All of the changes associated with Alternatives 1, 2, 3, and 6 also apply to Alternative 4, except the Legacy standard and guideline. Neither the Legacy nor the goshawk foraging standard and guideline and marten standards and guidelines apply to Alternative 4. In addition, as noted in the introduction to Section 2.5, Alternative 4 has a standard that requires a minimum of 33 percent of POG be retained in VCUs outside of the four biogeographic provinces that include areas with designated Old-Growth Habitat LUDs.

Changes Associated with Alternative 7

All of the changes associated with Alternatives 1, 2, 3, and 6 also apply to Alternative 7, except for the Legacy standard and guideline and the goshawk nest buffer standard and guideline. Neither the Legacy nor the goshawk foraging and marten standards and guidelines apply to Alternative 7 and there would be no nest buffer standard and guideline that is specific to goshawks; only the general heron and raptor nest protection standard and guideline would apply. In addition, riparian buffers along Class III streams are not required under Alternative 7 and the beach and estuary fringe is reduced to 500 feet.

2.5.2.2. Legacy Standard and Guideline – Alternatives 1, 2, 3, & 6

Background from 1997 Tongass Land and Resource Management Plan

The Legacy Forest-wide standard and guideline is an ecological, rather than single-species approach, that retains old-growth forest structure within harvest openings greater than 20 acres in areas that have had or are anticipated to have high timber harvest. The legacy standard and guideline evolved from considerations presented at the Interagency Conservation Strategy Review workshop (summarized in USDA Forest Service 2007). This standard and guideline was developed after discussions with ADFG and FWS at several interagency meetings in 1997. It replaces the species-specific goshawk foraging and marten standards and guidelines from the 1997 Forest Plan Revision to provide protection for goshawk, marten and other wildlife species across a broader landscape. Goshawk foraging and marten standards and guidelines, that prescribed retaining canopy cover in high risk biogeographic provinces, were conservation measures added to the Forest Plan in the Record of Decision to provide additional protections and to increase the already high likelihood that implementing the Forest Plan would maintain habitat to provide for viable populations of goshawks and moderate likelihood that implementing the Forest Plan would maintain habitat to provide for viable populations of marten. This subsection provides a summary of the background for the new Legacy standard and guideline by describing the history of the goshawk foraging and marten standards and guidelines.

American Marten

The risk assessment panel convened in 1997 indicated that there was a better than equal likelihood that implementation of Alternative 11 for 100 years would result in significant gaps in marten habitat distribution on the Tongass (DeGayner 1997). Alternative 11, with modifications, was the Alternative selected in the Record of Decision for the 1997 FEIS. Their interpretation of the outcomes that were used as the basis for risk assessment is as follows (a complete description of the panel assessments with the 5 outcomes is described later in this document in the Wildlife Viability Ratings section). Outcome III, defined as providing habitat to maintain breeding populations but with significant gaps in historic distribution, was interpreted by the panelists as an array of potential conditions. At one end of this array were gaps in habitat as small as the territory of a single marten. At the other end this array was conditions with broad gaps in habitat distribution and significant limitations on population interactions. The panelists considered some part of this array of conditions as meeting the definition of viable and well-distributed. The panelists assigned a total of 91 likelihood outcome points to the sum of Outcomes 1 + II + III. This included 38 likelihood points in Outcomes I and II, which they considered to represent a viable and well distributed condition. It also includes 55 likelihood points in Outcome III, some portion of which represents a viable and well distributed condition. The panelists indicated there was a very low likelihood that marten would exist only in refugia or be extirpated from the Tongass after 100 years of Forest Plan implementation with a combined Outcome IV and V score of 9. The panelists indicated that matrix management was the feature of the 1997 Alternative 11, as rated, that contributed to the assignment of likelihood points to outcomes that were not well-distributed. They indicated that clearcut silviculture on a 100-year rotation would result in further fragmentation of marten habitat.

The panel evaluators defined the spatial scale of a gap to be one vacant marten territory. A marten territory was considered to be from one to three square miles. The consequence of a gap is some measure of reduced gene flow within the population. Panel evaluators indicated that a population can accommodate a certain, but unknown, level of gaps and still remain viable. The greater the size and number of gaps, however, the higher the risk of reducing gene flow. To avoid creation of gaps by forest management practices, panel evaluators recommended uneven aged harvest, in contrast to clear cutting in blocks, be coupled with a reduced level of timber harvest in the matrix lands. The panel recognized the high degree of natural fragmentation on the Tongass National Forest. The panel could not, however, identify the threshold of POG remaining at which a landscape or a territory would not be suitable for marten reproduction (DeGayner 1997).

The panel was very conservative in their assessment of the definition of a gap, which lead to the assignment of most points in Outcome III. The overall assessment of a moderate likelihood of maintaining viable marten hinged on the 55 likelihood points in Outcome III and the fact that some undetermined portion of this outcome likelihood represented a viable and well distributed condition. It is also important to note that the panel assessed the 1997 Alternative 11 without the additional conservation measures that were added at the decision stage. Even without these additional measures, the panel projected no likelihood that marten would be extirpated from the entire forest under this alternative. Forest Plan was strengthened at the decision stage subsequent to the panel assessment, primarily due to the level of concern about the likelihood of marten populations remaining well-distributed across the Tongass for at least 100 years.

The measures used to strengthen the alternative were based on comments provided by the panelists, information drawn from past studies on marten, and information on existing habitat conditions on the Tongass. Three different measures were applied to Alternative 11 to improve the likelihood of maintaining habitat to support well-distributed populations of marten.

1. Within the five higher risk biogeographic provinces, stands would be managed under practices other than clearcutting.
2. Access management would be used to reduce marten mortality in areas where mortality rates due to trapping/hunting have been identified as a serious risk to marten populations.
3. Additional assurance of maintaining connections between habitat blocks throughout the Tongass would be considered.

Implementation of the above strategy increased the likelihood of maintaining habitat that supports well-distributed marten populations. While it was anticipated that there would likely be gaps in this distribution, there was a low likelihood that there would be significant isolation among marten populations resulting from implementation of the 1997 Forest Plan.

Goshawk

Alternative 11 of the 1997 Forest Plan was rated as having very low likelihood of goshawks existing in refugia or being extirpated from the Tongass after 100 years of Forest Plan implementation. However, because the goshawk was considered for listing under the Endangered Species Act, Alternative 11 was reviewed at the decision stage to determine if features of the alternative could be modified to improve the projected outcome. An additional measure for goshawk habitat was prescribed for Prince of Wales Island where POG was fragmented by past management actions. In VCUs, where over 33 percent of POG has been converted to young stands by past management, any additional management of POG was restricted to 2-acre clearcuts or managed to leave significant structure in harvested stands. Taken in combination with other measures already in place in the Forest Plan, these additional measures increased the already high likelihood of providing habitat sufficient to maintain viable and well-distributed goshawk populations.

New information Since 1997

Scientific Literature: A considerable number of new studies on goshawks and marten relevant to the Tongass situation have been conducted since 1997. Many new studies and concerns related to the conservation of marten and goshawk were presented at the Interagency Conservation Strategy Review: An Assessment of New Information Since 1997 in April 2006 (USDA Forest Service 2007). This information is summarized along with other studies in Section 2.4.2.

Implementation of Goshawk Foraging and Marten Standards and Guidelines and Forest Plan since 1997: The 1997 goshawk foraging and marten standards and guidelines, coupled with the associated Tongass Plan Implementation Team (TPIT) Clarifications, are lengthy and complex. This complexity has lead to inconsistent interpretation and application across the Tongass (Conservation Strategy Review 2007). In addition, translating canopy cover to standard silviculture terminology has been problematic. The TPIT worked collaboratively to attempt to clarify these standards and guidelines in 1998 and allowed flexibility in the implementation of these standards. Unfortunately, this clarification was lengthier than the original standard and guideline and did not necessarily result in increased clarity. One result of the TPIT clarification was to allow flexibility to clump leave trees when operability concerns or ecological reasons made uniform placement difficult or impossible.

There have also been issues during the implementation of goshawk foraging and marten standards and guidelines. Recent compiled information indicates the lack of consistency in their Forest-wide application, despite the TPIT clarifications. A survey of Tongass District wildlife biologists done in 2007 indicates a high degree of inconsistency and uncertainty in the application of goshawk foraging and marten standard and guidelines (Fadden 2007a). Biologists were not consistent in their interpretation of the standards and guidelines and believed that there was not consistent interpretation Forest-wide. In addition, it was not necessarily clear to biologists how these standards and guidelines actually benefited marten and goshawk.

Review of a sample of planned timber sales since 1997 also demonstrates the inconsistency in application on the ground, with the goshawk foraging and marten standards being implemented using a simple percentage of the stand on some timber sales, using basal area on others, and using trees per acre on others (Fadden 2007b). All of the measures resulted in different effects on the ground, ranging from a clumped leave patches to partial harvest scattered across the unit. Within most timber sales reviewed, implementation of both marten and goshawk standards did take into account other leave areas (stream buffers, karst, etc.), which counted towards the final target (Fadden 2007b). Recommendations in this report included the need to simplify these standards to provide for more consistent application.

Monitoring of timber harvest implemented since 1997 indicates that, overall, timber harvest is occurring at a scale much less than was anticipated in the 1997 Forest Plan EIS. Annual timber harvest has been much less than the Forest Plan Allowable Sale Quantity (ASQ) of 267 mmbf. In 2004, actual harvest was 17 percent of the ASQ and in 2005, harvest was 24 percent of the ASQ. In addition, there is trend toward a decrease in size of traditional clearcuts and a decrease in opening size. Since 1997, the average clearcut harvest size is 11 acres (Conservation Strategy Review 2007). As a consequence, the effects on wildlife have been considerably lower than the level predicted by the 1997 Forest Plan FEIS.

The trend toward smaller opening sizes coupled with the increased use of partial harvest are factors that make timber sales less economical, as well as more difficult to log. A combination of factors including market issues and increased fuel and logging costs are also factors in timber sale economics; however, when coupled with less volume per acre and higher logging costs due to partial harvest, it has exacerbated the economic issues, particularly at the scale of an individual timber sale (as presented at the Interagency Conservation Strategy Review: An Assessment of New Information Since 1997 in April 2006; USDA Forest Service 2007).

The 1997 Forest Plan sought to provide for economic considerations while implementing conservation measures for species of concern. Monitoring of timber sale economics indicates that this approach, which has resulted in significantly smaller timber harvest unit size and more partial harvest, is likely contributing to significant difficulties in implementing economic timber sales. More information regarding timber sale economics can be found in the *Economic and Social* section of the Final EIS.

While this information indicates the challenge in providing for economic timber sales, the trends discussed above represent several positive consequences for wildlife. The main positive consequence is that more habitat for old-growth associated species is retained as old growth. The second consequence is the ameliorating effects of forest succession. Negative effects to goshawk and marten are strongly associated with the effects of past large-scale timber harvest on the Tongass. Past harvest resulted in much larger openings than are allowed under the 1997 Forest Plan, often occurring within riparian areas and beach buffers, which are high value wildlife habitats. Neither riparian areas nor beach buffers are harvested under the 1997 Forest Plan, nor would they be harvested under 2008 FEIS Alternatives 1, 2, 3, or 6. As young forests mature, they gradually become more suitable for goshawks and marten. Previously, little emphasis was given to the young second-growth component of the matrix in terms of its ability to contribute structure, function, or value to wildlife. However, there appears to be a growing perception that, with active management, young stands can contribute at least some of the values commonly associated with old-growth (Barbour et al. 2005). Key features of old-growth forest include large, old decadent trees, multiple canopy layers, standing snags, down woody debris, and a diverse and abundant herb layer. These features can be maintained or created by retaining structures and organisms at the time of regeneration harvest of old-growth forest and through active management of young, even-aged stands. Some potential approaches to even-aged management involve thinning of older, "commercial"-aged young-growth stands (Deal 2001, Deal and Tappeiner 2002, Deal et al. 2002), including red alder (*Alnus rubra*) in the reforestation of harvested areas to expedite the production of large-diameter conifers (Deal 1997, Deal et al. 2004, Hanley et al. 2006), and the initial use of alternatives to clearcutting (McClellan et al. 2000). It should be emphasized that additional research on the implementation of these techniques is needed.

For example, both pre-commercial and commercial thinning of young-growth stands have beneficial impacts to black-tailed deer by opening up the forest and promoting the growth of understory vegetation. Likewise, active young-growth management has the potential to benefit both marten and goshawk through an increase in small mammal populations (red squirrels and red-backed voles, major prey items of these species, benefit from more open forests with abundant understory vegetation) and by speeding the succession of older young-growth stands toward old-growth condition (Hanley 1996, 2005). Thinning also may benefit forest-dwelling birds, some of which are prey for goshawk (Dellasala et al. 1996). Although the time frame in which young-growth stands become suitable habitat for some old growth associated species is beyond the lifespan of the 10-15 years of this Forest Plan, it is something to be considered as part of a long-term vision for management of the Tongass. It must be noted however that their research on the effectiveness of young-growth management is on going and peer-reviewed results are not yet available. The evidence in support of the potential short and long term benefits of young-growth management for multiple values is derived from a series of demonstration projects that have tested various second-growth management methods (e.g., Zaborske et al. 2002; Deal et al. 2004; McClellan 2004, 2005; McClellan et al. 2005; Wipfli et al. 2003), retrospective assessments (Hanley and Barnard 1998), and other observations. Thus, there remains uncertainty about the true benefits of second-growth management to wildlife. Although active management will likely improve habitat conditions in young conifer stands, significant questions remain regarding the types of treatments, treatment timing, and cost/benefit tradeoffs.

This does not imply that young growth is the same quality habitat as old growth, nor does it ignore the negative consequences of the stem-exclusion phase, which is characterized by dense young trees that shade out most of the understory and thus, provide low habitat value for most wildlife species. But once stands transition out of this stage, they gradually begin to provide the components of good quality wildlife habitat, including larger trees, small canopy gaps, a diverse understory, snags and downed logs. Stands typically do not begin to take on the characteristics of old growth until they reach at least 150 years of age (Alaback 1982). However there is some evidence that some species associated with older forests may in fact use much younger stands (for example, goshawks - see Section 2.4.2.1).

Besides the benefits of succession, another benefit of aging young-growth stands is the increased potential value of these stands for commercial forest products and their ability to replace old growth trees for a significant portion of the supply of timber in Southeast Alaska in the future. Managing young-growth forests in Southeast Alaska is likely to become an increasingly important component of forest management on the Tongass in the coming years. Young-growth stands can be treated through thinning and other intermediate treatments to concentrate growth in fewer, larger trees, improve lumber quality, and/or to enhance habitat conditions for wildlife. Treatments applied to young stands may have a profound effect on the types of materials available in the future, including log diameter, knot size, and wood strength (see *Timber* section of Final EIS for more discussion).

Overall the consequence of substantially less harvest of old growth in the past decade coupled with the increased growth and potential value of young growth for wildlife is beneficial and supports that assumptions made regarding risks to species viability made in the 1997 Plan were conservative. This conclusion is supported by observations that some old growth associated species use younger forests that anticipated in the 1997 Forest Plan (for example, goshawks), that a shift to more commercial forest products coming from young growth forests is occurring and is likely to accelerate over the next two to three decades, and that the beneficial effects to wildlife by less harvest of old growth over the past decade than is greater than was anticipated under the 1997 Forest Plan. This is particularly significant in places with the oldest young growth, which includes some portions of Prince of Wales Island. Of the 187,000 acres of past harvest on Prince of Wales Island, 8,000 acres are now age 50 or older, 42,000 acres are now age 40 to 49, and 54,000 acres are now age 30 to 39. Within 20-30 years, much of the young growth on Prince of Wales Island may be approaching suitable nest habitat for goshawks.

Annual Monitoring and ADFG Reports: According to the 2006 Tongass National Forest Annual Monitoring and Evaluation Report, habitat capability for marten was expected to decrease slightly because of timber harvest activities and road construction across the Tongass. However since timber harvest levels have been substantially less than anticipated, this report documents that effects anticipated to marten under the Forest Plan have been less than anticipated. The most recent ADF&G Furbearer Report (Alaska Department of Fish and Game 2004) suggests that marten populations are stable or increasing across most of the Tongass; the exception potentially being near Juneau. In 2003, over 2700 marten were trapped in Southeast Alaska and both trappers and agency personal reported stable or increasing marten populations in most Game Management Units (GMUs). The two areas with the highest harvest levels are GMUs 2 and 4, which include Prince of Wales Island and Chichigof Island, areas with some of the highest past timber harvest on the Tongass. The link, if any, between habitat changes on the Tongass National Forest and changes in the marten population is difficult to determine. Fluctuations in prey abundance or spatially different trapping pressure are confounding factors. Areas on the Tongass with the most timber harvest continue to have stable or increasing marten populations and trapping regulations have not changed significantly on the Tongass.

Queen Charlotte Goshawk Status Review and Findings: The U.S. Fish and Wildlife Service was petitioned to list the Queen Charlotte goshawk as endangered in May 1994. In June 1995, the Service published a 12-month finding that listing was not warranted. The finding was challenged in U.S. District Court, which remanded the finding to the FWS with instructions to base the finding on the existing management plan for the Tongass National Forest, rather than one in development at the time. The FWS released a new finding (also “not warranted”) in August 1997, which was also challenged in April 1998, and which the court remanded again to the FWS in July 1999, with instructions to provide a reliable population estimate for the subspecies The government appealed this decision in the U. S. Court of Appeals, which overturned the requirement for a population estimate, but remanded the case to the District Court for further consideration of the remainder of the finding. In May 2004, the District Court remanded the finding to the FWS with instructions to evaluate whether Vancouver Island in British Columbia is a “significant portion” of the subspecies’ range and, if so, to determine whether the bird should be listed (U. S Fish and Wildlife Service 2007)

In order to reach an informed decision with respect to the court’s remaining questions on the significance of Vancouver Island and whether the subspecies should be listed, the FWS recently updated the status of the subspecies range-wide. In addition, the FWS published a new finding in November 2007 regarding the status of the Queen Charlotte goshawk. In this report, they concluded that Vancouver Island is a significant portion of the Queen Charlotte goshawk's range and that listing the subspecies on Vancouver Island is warranted. In addition to addressing the court's remand, they assessed whether listing was warranted for the Queen Charlotte goshawk beyond Vancouver Island. Their review indicated that the subspecies' populations in British Columbia and Alaska each constitute distinct population segments (DPSs) of the Queen Charlotte goshawk. Based on differences in forest management, with substantially greater habitat loss in British Columbia, they found that they had sufficient information about biological vulnerability and threats to the goshawk to determine that the entire British Columbia DPS warrants listing as threatened or endangered. They also found that the best available information on biological vulnerability and threats to the goshawk does not support listing the Alaska DPS as threatened or endangered at this time. Of note are the following key items from the FWS review:

- The majority of POG that existed in Southeast Alaska prior to large-scale logging would remain over time. Most (77 percent) of this habitat is on the Tongass.
- There is no data to indicate how much goshawk populations have declined as a result of timber harvest. Based on one approach, the FWS believes that populations may have declined by 15 percent in Southeast Alaska and as much as 45 percent in British Columbia.
- The most important factor related to goshawk demographics is adult survival. Adult survival is a function of prey abundance and availability.
- Southeast Alaska is relatively prey-poor for goshawks, especially on the islands of the south Tongass. For example, Prince of Wales Island lacks red squirrels and sooty grouse, which are important prey for goshawks on the mainland and islands in the north Tongass. Many studies from across the range of the goshawk suggest that prey availability is one of the most important factors regulating goshawk population size in Southeast Alaska.
- Studies from across the range of the goshawk suggest they select nest stands that have a higher proportion of mature and old forests than random sites.
- Goshawks use a wide range of habitats for foraging within the matrix, including non-forest, young forest, low-volume forests, and clearcuts.
- Goshawks, even juveniles, can travel relatively long distances across salt water, indicating that there are not likely to be barriers to goshawk movement among the islands in Southeast Alaska.

Importance of Retention of Forest Structure After timber harvest and Spatial Considerations

While the benefits of leaving old growth structure after timber harvest are well documented in the scientific literature, the need to leave it after timber harvest on the Tongass is not as clear, given the conservation strategy, the fact that slightly over 90 percent of the existing POG is protected under the 2007 Forest Plan and that there are economic consequences of leaving structure post timber harvest (see Section 2.3). However, past timber harvest has been concentrated in certain portions of the Tongass. While it is true that Forest-wide, the vast majority of old growth would be retained, there are biogeographic provinces and watersheds that have and are predicted to have much higher reductions in old growth than the average. For example, as reported in the 2008 FEIS, the North Central Prince of Wales biogeographic province currently has 74 percent of the original POG and it is anticipated that this would be reduced to 63 percent of the original POG after 100 years of timber harvest at maximum levels allowed by the Forest Plan under Alternative 6. Considering only large tree POG, North Central Prince of Wales province would retain 57 percent of original large-tree POG; however, the East Baranof province would retain only 31 percent. In these and similar areas, there would be elevated risk that there could be gaps in distribution of some species and reduction in connectivity between old-growth patches after 100 years of timber harvest at maximum levels allowed by the Forest Plan.

Many studies validate the importance of retention of legacy trees and patches of old growth after timber harvest for many forest associated species (Masurek and Zielinski 2004, Carey 2000). Retention of this old growth structure affects forest developmental pathways, indirectly affecting wildlife abundance by retaining necessary structural features in both mature and young forests (Deal 2007). In Southeast Alaska, many bird species utilize legacy trees as nesting, foraging, perching, and roosting sites (Sidle and

Suring 1986). The lack of these structural features within forests can negatively impact many old growth associated species (Bunnell *et al.* 1999, 2002, Aubry *et al.* 1999, Bevis *et al.* 2002, Deal 2001, 2007). Work on flying squirrels in Southeast Alaska indicates the importance of the matrix in providing adequate dispersal habitat in order to maintain connectivity between OGRs. Flying squirrels, being arboreal, require these structural components and are found primarily in mature and old growth forests but are also found at lower densities in peatland –scrub forests (Smith and Person 2007).

While numerous studies validate the importance of retention of this structure, research is not available, especially for Southeast Alaska, to guide specific silvicultural prescriptions or to help prescribe specific amounts of leave trees for individual wildlife species. Most Forest Plans in other parts of the United States have incorporated various retention prescriptions. The closest plan ecologically to Southeast Alaska is the Northwest Forest Plan that covers Oregon and Washington. The Northwest Forest Plan requires green-tree retention in at least 15 percent of the area within logging units. It is recommended that at least 70 percent of this retention be implemented in patches or clumps of up to one hectare (about 2.5 acres). In addition to this green-tree retention, the retention of snags and large decadent trees within these green-tree retention clumps is recommended. These prescriptions were developed based on the professional judgment and collective biological knowledge of individuals who have studied the ecological processes characterizing the forests of the Pacific Northwest (Aubry et al. 1999). A large-scale and long-term experiment (the Demonstration of Ecosystem Management Options (DEMO) study) to evaluate the ecological effects and public perception of green-tree retention in western Washington and Oregon is underway. Among the key findings to date are that the pattern of retention is not as important as the amount of retention; however, the retention of 2.5-acre clumps can provide refuges with ecological and mircroclimatic conditions that enable many sensitive species to persist, at least in the short term (USDA Forest Service 2007).

In Southeast Alaska, research has described the characteristics of wind-created openings (Nowacki and Kramer 1998). Understanding the range of natural wind disturbance gaps can help in the development of management prescriptions. Within the four areas studied by Nowacki and Kramer (1998), mean gap size sustaining large-scale wind events ranged from 10 to 39 acres in four study areas, with the range in size of individual gaps from 1 to 1,000 acres. Within gaps, there was also a range in the amount of remnant trees remaining after a windthrow event, with some remnant structure in most gaps. Most gaps had a range from 0 to 50 percent of the stand remaining post wind event.

The 1997 Forest Plan used a harvest unit threshold of 2 acres, for the implementation of goshawk foraging and marten standards and guidelines. No documentation of why this acre threshold was used can be found in the 1997 FEIS; however, there is reference to the practice of group selection in the timber section of the 1997 FEIS. The group selection method prescribes the removal of small groups of trees to create openings in the stand. The forest created, using this method, is a mosaic of small groups of trees of uniform age and height with the goal of regenerating an uneven-aged stand structure across the landscape. Group sizes range from 0.1 acre to approximately 2 acres in size. Research and experience with this method is extremely limited in Southeast Alaska. The ideas behind using this method in Southeast Alaska are to protect excessively steep or unstable soils and reduce the impacts to scenic and wildlife resources.

Rationale for Legacy Standard and Guideline

The legacy standard and guideline as a replacement for the species-specific goshawk foraging and marten standard and guidelines is proposed for the following reasons:

1. It provides a science-based measure of retention of old-growth habitat characteristics (large trees, down logs, snags) Forest-wide rather than only in places where there were concerns related to goshawk and marten. This will provide habitat protections in high risk biogeographic provinces across the forest for more species of concern (including endemic small mammals and forest birds) than the goshawk and marten standards and guidelines in the 2007 Forest Plan.
2. It provides an alternate method for retaining connectivity and prey base for marten and goshawk at the watershed scale. Legacy would apply in 49 VCUs Forest-wide in 7 biogeographic provinces. Goshawk foraging standards under the 2007 Forest Plan apply in 22 VCUs on Prince

of Wales Island only (1 province). Marten standards for high risk provinces under the 2007 Forest Plan apply in 12 VCUs in 2 provinces. Marten standards for moderate risk provinces in the 2007 Forest Plan apply in 107 VCUs in 6 provinces. These standards for low risk provinces apply in 112 VCUs in 6 provinces.

3. Overall, considered in combination with other improvements to the Conservation Strategy, including increased quality of small OGRs, increased old-growth protection in key areas, and increased quantity (acreage) of OGRs, habitat for viable populations of goshawk and marten across the Tongass would be maintained.
4. The Legacy standard and guideline is simpler to implement and will likely have more consistent implementation Forest wide than the previous goshawk foraging and marten standards and guidelines.

These four reasons are explained in detail below.

1. Providing a science-based measure of retention of old-growth habitat characteristics (large trees, down logs, snags) Forest-wide and the value to multiple species.
A review of current science, as described previously, supports both the value of the retention of old growth structure to a wide range of species and the value of taking a broader approach, rather than taking a single-species approach as did the goshawk foraging and marten standards. While the value of retaining old-growth forest components within landscapes managed for timber production has a sound basis in science, there is no scienific basis to support specific prescriptive standards for marten, goshawk or most individual species. In other words, while there may be a scientific basis that supports that partial harvest has less impact to goshawk or marten habitat than clearcutting, there is no scientific basis to support any specific management prescription. Clearly, there is a gradient of the value of habitat conditions for many species, with large contiguous blocks of old growth being most beneficial for many old growth associated species in Southeast Alaska and large expanses of clearcut forest being the least beneficial. But without specific studies indicating what specific prescriptions are of most value, the management decision for these prescriptions are made by considering the risk to the resource (in this case wildlife habitat needs) with the feasibility requirements for other management (in this case, economic timber harvest).

Furthermore, while 1997 Forest Plan prescribed retention of 10 to 30 percent canopy cover as a measure to help maintain connectivity for marten and to maintain foraging habitat for goshawk, there is no scientific basis to support that this relatively low amount of retained canopy cover in a stand provides measurable protection specific to goshawk or marten or their prey. Also there is no scientific basis to support that this degree of retention of canopy cover is effective for maintaining connectivity in fragmented landscapes. The studies summarized previously indicate that more than significantly more than 30 percent canopy cover would need to be retained to meet these objectives. While increased amounts of retention post timber harvest may benefit old growth associated species, including marten and goshawk, they present conflicts in providing for economical timber harvest.

Based on current science, leaving old growth structure post timber harvest in clumps is preferable to leaving the structure in a more uniform configuration across a clearcut because clumps of trees are more likely to be used by a variety of wildlife species, they may benefit other organisms in the forest, and they are more windfirm than scattered trees. As noted above, the DEMO study in western Washington and Oregon has found that many plant and animal species that are sensitive to timber harvest were able to persist in retention clumps of 2.5 acres, indicating that such patches may serve as local sources of recolonization into adjacent harvested areas as the new stand develops (USDA Forest Service 2007).

Leaving structure in clumps rather than scattered is also more efficient for logging with the consequence of reduced logging costs in cable-yarding harvest units. The recently completed logging system and transportation analysis (LSTA) for the Tongass indicates that only 35 percent of the remaining suitable old growth is planned for cable yarding (see Table 3.13-2 in the *Timber* section of the Final EIS). The remaining 65 percent is planned for ground-based logging systems, such as shovel logging, or helicopter. With ground-based or helicopter logging, there is substantial flexibility in terms of how retention trees could be left without significantly affecting logging costs. If only the normal operability ground is considered (excluding the difficult and isolated operability classes), the percentage of ground-based and helicopter yarding would still be 61 percent. Therefore, there is considerable flexibility available to project IDTs for the majority of future old-growth harvest units, to design retention spatial patterns in a way that is beneficial to wildlife and does not negatively affect timber sale economics.

The legacy standard and guideline addresses the high degree of endemism within the islands of the Tongass and a degree of uncertainty in managing for endemic species because of gaps in information about species distribution and habitat needs. While recent science addresses concerns regarding endemic mammals related to risks of extinction due to island factors and small population sizes and connectivity within islands, there remains a lack of a scientific basis to help managers develop species-specific conservation measures. Therefore, taking an ecological approach to leaving legacy that spans the entire Tongass and focuses on watersheds with a high degree of past timber harvest (harvest that occurred prior to the 1997 Forest Plan) is an approach that, in the absence of science to support other measures, will most likely help ensure connectivity for a wide range of species.

2. Providing an alternate method for retaining connectivity and prey base for marten and goshawk at the watershed scale.

The objectives of the 1997 Forest Plan goshawk foraging and marten standards and guidelines were to improve connectivity for marten by reducing fragmentation, improve habitat conditions to provide for dispersal for goshawks between OGRs and to maintain foraging habitat for both goshawks and marten in the matrix in biogeographic provinces with a high degree of past timber harvest. This was done through the retention of forest stand structure important to these species and their prey (large trees, snags, and down logs) through several standards and guidelines, including those specific to goshawk foraging and marten habitat.

The legacy standard and guideline would apply under Alternatives 1, 2, 3, and 6 for the 2008 Forest Plan Amendment Final EIS within seven high-risk biogeographic provinces, as compared to the 1997 goshawk foraging standard and guideline, which applied one biogeographic province on Prince of Wales Island, and the marten standards and guidelines, which applied in two high-risk biogeographic provinces and three additional moderate-risk biogeographic provinces (Table D-7).

One of the factors contributing to the high likelihood of maintaining sufficient habitat for viable populations of goshawks in the 1997 Forest Plan was the application of a 300-year ‘ecological’ rotation. While not a rotation as defined in traditional silvicultural terminology, the concept is applied at larger, landscape scale. Application of a 300-year ‘ecological’ rotation generally results in 1/3 of the productive forest landscape in 0-100 year-old stands (low value to goshawks or most of their prey), 1/3 in 100-200 year old stands (moderate value to goshawks and their prey), and 1/3 in 200-300 or older (old growth) stands (highest value to goshawks and their prey). These proportions of habitat within the scale of goshawk use areas (i.e., median home range of approximately 10,000 acres) across a large landscape would provide habitats with a high likelihood of sustaining well distributed populations. Both extended traditional rotations and the concept of a 300-year ‘ecological’ rotation were viewed favorably by members of the Goshawk Assessment Panel for sustaining long-term goshawk habitat (Iverson, 1996). Panel members, as did authors of the Goshawk Assessment, concluded that maintaining conifer stands in intermediate age stand structure from 100 to 200 years would, in part, supply stand structure for goshawk prey production, and thus, goshawk foraging opportunities.

Alternatives 1, 2, 3, and 6 for the 2008 Forest Plan Amendment FEIS include the Legacy standard, which requires 30 percent of a stand to be retained in higher risk VCUs for even-aged harvest units over 20 acres in size. Most (over 80 percent) of VCUs within the suitable land base are categorized as low or medium risk because these VCUs currently have more than 67 percent of their historical old growth remaining and will not have more than 67 percent harvested after 100 years of harvesting at the maximum ASQ level.. Because these VCUs will continue to be managed on at least an ecological 300-year rotation, these VCUs have a high probability of maintaining adequate wildlife habitat for many species, including marten and goshawk.

This approach addresses the potential cumulative effects from previous harvest and provides for the retention of a representation of old-growth components across all VCUs managed for timber production. In low and moderate risk VCUs, the representation of old-growth components is provided for by the mix of non-development LUDs, OGRs, and other standards and guidelines. In high risk VCUs, this is provided for by the legacy standard plus the mix of non-development LUDs, OGRs and other standards and guidelines.

Implementing the legacy standard and guideline in high risk VCUs will help ensure connectivity between OGRs within the matrix where connectivity may have been affected by past harvest practices. There is a high likelihood that VCUs with little past harvest will have a high degree of connectivity even after 100 years of implementing the Forest Plan because of the suite of protective measures that are in place under Alternatives 1, 2, 3, 5, and 6.

Table D-7 provides a summary of the number of VCUs where the legacy, goshawk, and marten standard and guidelines apply. There are two scenarios within which the legacy standard and guideline differs from the goshawk foraging and the marten standards and guidelines. First, there is no requirement to leave 30 percent legacy in harvest units 20 acres or smaller in size. Legacy would only be left in harvest units that are greater than 20 acres and this number was selected because it represents a typical harvest unit, based on analysis of the Logging System Transportation Analysis (LSTA). This typical harvest unit

Table D-7.
Number of VCUs where the Proposed Legacy Standard applies, compared with the number of VCUs where the Goshawk and Marten Standards apply, by Biogeographic Province

			Marten Standard & Guideline[1/]		
Biogeographic Province	**Legacy Standard & Guideline**	**Goshawk Standard & Guideline**	**Currently >33% Harvested[2/]**	**>33% Harvested in the Future**	**<33% Harvested Now & in the Future**
Yakutat Forelands	3	-	-	-	-
Yakutat/Glacier Bay Upland	-	-	-	-	-
East Chichagof Island	-	-	-	16	30
West Chichagof Island	-	-	-	-	-
East Baranof Island	1	-	-	-	-
West Baranof Island	4	-	-	-	-
Admiralty Island	-	-	-	-	-
Lynn Canal	-	-	-	-	-
Northern Coast Range	-	-	-	-	-
Kupreanof/ Mitkof Islands	-	-	-	22	13
Kuiu Island	-	-	-	-	-
Central Coast Range	-	-	-	-	-
Etolin Island and Vicinity	2	-	-	12	10
North Central Prince of Wales Island	31	22	9	30	31
Revilla Island/Cleveland Peninsula	3	-	3	23	19
Southern Outer Islands	5	-	-	-	-
Dall Island and Vicinity	-	-	-	-	-
South Prince of Wales Island	-	-	-	-	1
North Misty Fiords	-	-	-	-	-
South Misty Fiords	-	-	-	-	-
Ice Fields	-	-	-	-	-
TOTAL	49	22	12	103	104

[1/] Marten standards and guidelines include one level of retention in VCUs with >33 percent harvest and one level for VCUs with <33 percent harvest. The VCUs listed in the first column under marten will always follow the >33 percent harvest retention rules and the VCUs in the third column under marten will always follow the <33 percent harvest retention rules. The VCUs in the middle column start out under the <33 percent harvest retention rules and switch after the 33 percent harvest threshold is reached.
[2/] The VCUs listed in this column under marten are additional to VCUs that are counted under the Goshawk standard and guideline.

is what is available for harvest after considering landforms, land suitability, Tongass Timber Reform Act riparian buffers and other resource considerations mapped for the LSTA. For wildlife species sensitive to forest fragmentation, smaller clearcuts are better than larger clearcuts. Legacy was retained only in units greater than 20 acres in response to the challenge of providing economic timber sales while conserving wildlife habitat. This was chosen because of the lack a clear scientific basis for determining what sized clearcuts are absolute barriers to wildlife, because there is no clear scientific basis to support that 10 to 30 percent canopy cover retention mitigates the effects of clearcutting on wildlife and in order to address timber harvest logistical and economic considerations.

Because legacy only applies in openings greater than 20 acres in size, there is a risk of increased negative consequences for goshawks and marten at the stand scale than was anticipated in the 1997 Record of Decision (but not in the 1997 FEIS, see discussion in 3 below). However, considering that wildlife encounter both natural and human caused fragmentation on the Tongass, opening sizes from natural wind events range up to 1,000 acres, but are typically less than 40 acres, and there are few actual barriers (except saltwater) for many species on the Tongass, wildlife movements will continue to be facilitated through managed landscapes. While there would be openings as large as 20 acres without retention of legacy, a typical timber sale layout will have a mix of unit sizes and configurations. The combination of all the protective measures specific in the Forest Plan, including riparian buffers and implementation of other standards and guidelines, will result in timber sale layout that has significant more leave as compared to pre 1997 Forest Plan timber harvest practices.

The second scenario where legacy differs is that marten standards require two additional measures of retention that are not prescribed with the legacy standard and guideline. First, marten standards under the 2007 Forest Plan require 30 percent canopy cover retention in VCUs that would, in the future, have > 33 percent of the VCU harvested in what are considered high risk biogeographic provinces for marten. Alternatives that adopt the legacy standard and guideline would not require this additional measure; however, these VCUs are considered to be moderate risk overall, because a higher percentage of their harvest will have occurred under more protective standards and guidelines and a higher percentage of retention will be present, compared with VCUs that are rated as high risk by the legacy standard and guideline. Second, marten standards require a smaller level of retention (10-20 percent) in VCUs that would never exceed 33 percent harvest. Again, alternatives that adopt the legacy standard and guideline would not require this additional measure; these are considered to be low risk VCUs, which will have an even higher percentage of retention within the matrix due to the fact that the harvest percentage is low and/or a greater percentage of the harvest will have occurred under more protective standards and guidelines (which require more retention).

Observations from implementing the Forest Plan since 1997 indicates that there are multiple standards and guidelines that provide residual forest structure (trees, snags, down logs) that are retained within timber harvest units. Besides marten and goshawk standards, these include scenery, riparian buffers (including class III streams), soils, and karst standards. In addition, logging system limitations (such as blind leads) also result in portions of stands being retained that are often unreachable with cable logging systems. Partial harvest has also occurred more frequently than anticipated, due to a variety of factors, not just marten and goshawk standards and guidelines. These observations indicate that there is significant structure being retained within watersheds as a result of the Forest Plan standards and guidelines and this structure will provide habitat for many wildlife species, including marten and goshawk.

3. Overall, considered in combination with other improvements to the Conservation Strategy, including increased quality of small OGRs, increased old-growth protection in key areas, and increased quantity (acreage) of OGRs, habitat for viable populations of goshawk and marten across the Tongass would be maintained.

Under the 1997 Plan, the viability assessment for marten (with the assumption of the maximum timber harvest levels allowed over 100 years) of the selected Alternative indicated a moderate likelihood of maintaining viable and well distributed populations of marten across the Tongass. The viability assessment for goshawk indicated a high likelihood of maintaining viable and well distributed populations of goshawks across the Tongass. These determinations were made prior to additional conservation measures added in the Decision. The 1997 Forest Plan and the 2008 Forest Plan EIS both assume that matrix lands would be somewhat fragmented by timber harvest and recognized the risks to wildlife within a fragmented landscape. It was assumed that a consequence of implementation of timber harvest at maximum levels allowed in the Forest Plan over 100 years was that there would be a reduction in wildlife habitat capability in those watersheds that had significant amounts of fragmentation due to timber harvest, hence the importance of the reserve system. Research focused on the conservation strategy since 1997 has confirmed an assumption of the 1997 Forest Plan that for some species, the OGR system alone may not retain viable populations. This was why the Forest Plan approach of both a reserve system and matrix management was adopted in 1997. Under Alternative 6, total reserve area (non-development LUDs) has been increased by over 150,000 acres and protections are even greater under Alternatives 1, 2 and 3, when considering all additions to non-developments LUDs including small OGRs, increases to geologic special interest areas for karst and increases for other resources. A substantial portion of these additions is POG.

The potential effects to marten described for Alternative 6 in the Final EIS for the 2008 Tongass Forest Plan Amendment are within the range of effects predicted in 1997. These effects would be less under Alternatives 1, 2, and 3. The 1997 Tongass Forest Plan EIS estimated there would be a moderate likelihood that marten populations would remain viable with the selected Alternative throughout the Tongass, before the marten standard and guideline was added in the 1997 ROD to further reduce risk. Alternatives 1, 2, 3, and 6 also reduce risks to marten viability through increased protective measures for marten above and beyond what the viability panels assessed. These additional measures include increased old growth acres retained in both OGRs and other non-developments LUDs; retention of the marten road density and landscape connectivity standards and guidelines; and the addition of the legacy standard and guideline.

Furthermore, the level of risk to goshawk and marten viability described in the 1997 FEIS would be realized only under a certain set of conditions, as follows.

- Timber is harvested continually at the maximum level allowed under the Plan (the ASQ level annually) for 100 consecutive years, with no change in applicable standards and guidelines during that entire period. In essence, the panels did not assess the risks associated with a 10- to 15-year decision, but with a 100-year decision. This risk is relatively low because timber has not been harvested on the Tongass at or near the maximum ASQ level throughout a single planning cycle, let alone several. The first Tongass Forest Plan was adopted in 1979, and was in effect through May of 1997. It had an annual average ASQ of 549 MMBF of total volume. Total volume harvested from 1980 through 1996 averaged 327 MMBF annually, only 60 percent of the ASQ. Since adoption of the 1997 Forest Plan, total volume harvested has averaged 84 MMBF annually, only 32 percent of the annual average ASQ of 267 MMBF.
- If timber harvest rises to the ASQ annually over the next 10-15 years the planning process ensures that any issues that may emerge regarding sustaining viable populations of wildlife species on the Tongass will be addressed. Plans must be revisited through a public process every 10-15 years. Each time, the latest scientific information is examined to determine what changes may be needed. The Forest Service and other State and Federal agencies will continue to monitor implementation of the Forest Plan and its results. If a viability-related problem were to develop, it would be addressed.
- Standards currently in effect are far more protective than those of 20 or 40 years ago. It is highly likely that standards will continue to become more effective over the next several decades through adaptive management as the scientific understanding of how to minimize the adverse environmental effects of human activities continues to improve.

In addition, consideration of the increasing value of aging young-growth stands is crucial when assessing habitat values in the matrix. As young growth matures, habitat becomes more suitable for a variety of forest-dwelling prey. The matrix also increases in value for foraging goshawks, for providing nest sites for goshawks and to provide a variety of habitat conditions beneficial to marten. In addition, not all existing young growth will be managed in the future on an 80 to 100 year rotation. Of the approximately 440,000 acres of harvested lands on the Tongass, 45 percent is within non-developments LUDs and will be managed to enhance future old-growth habitat.

Overall, implementing the legacy standard and guideline increases the likelihood that the matrix will provide many more functions than just connectivity and will help ensure the persistence of all species on the Tongass. While adoption of this standard and guideline a degree of increased risk with respect of the conservation of goshawk and marten specifically because the legacy standard applies in less VCUs that the 1997 marten standards and guidelines applied and because it applies only in openings greater than 20 acres, this risk does not change the overall conclusion that there is a moderate to high degree of likelihood that sufficient habitat will be maintained to provide for viable populations of marten and goshawk.

4. The Legacy standard and guideline is simpler to implement and will likely have more consistent implementation Forest wide than the previous goshawk foraging and marten standards and guidelines.
The legacy standard and guideline is simpler and clearer than the goshawk and marten standards. The intent is similar – retain forest structure in units after timber harvest. The standard is clear that this structure is meant to be within the harvest units, not on the edge, though it does provide for exceptions when logging systems preclude this. The Forest Plan monitoring plan requires monitoring for a variety of wildlife questions. Adjustments can be made through this adaptive management process if it is determined that our objectives are not being met.

In addition, the goshawk foraging and marten standards and guidelines, with the TPIT clarifications, have often been implemented very similarly to how we expect the legacy standard and guideline to be implemented. Particularly in units harvested with cable yarding systems, patches of old growth have been left as a proportion of the unit, rather than as dispersed trees or as by retention of canopy cover. Observations indicate that canopy cover is difficult to measure and implement and, therefore, a portion of the stand has been left to meet the standards and guidelines. Therefore in high risk VCUs, implementation of the legacy standard and guideline will be the same on many Ranger Districts as was done using goshawk foraging and marten standards and guidelines.

2.5.2.3. Goshawk Nest Buffer Standard and Guideline – Alternatives 1, 2, 3, 4, & 6

Background

Under Alternatives 1, 2, 3, 4, and 6, the goshawk nest buffer standards and guidelines were modified to read as follows:

1. Preserve nesting habitat around all confirmed and probable goshawk nests. If, based on annual monitoring, a previously active nest is found to be inactive for 2 consecutive years, protection measures for the site may be removed.
2. When a new nest is located within an area that is under a timber sale or other contract, the activity may proceed if at least 300 acres of POG, including at least one contiguous block of 100 acres, will remain within a 0.75-mile circular radius of the nest. Timing restrictions on some activities will be applied to allow that year's brood to successfully fledge from the nest.

The purpose of change 1 was to allow for future tiimber harvest in areas if evidence indicates goshawks have discontinued use of the nest stand. Note that this considers active nest sites very conservatively and include sites that are occupied, whether or not there is actual nesting documented.

The purpose of change 2 was to allow a measure of flexibility when goshawk nests are found during implementation of a timber sale or other contract. This is of particular concern during timber sale contracts, but also could occur during implementation of other contracts. Goshawks predominately have alternate nests within a territory. When found, active nest sites are protected with a 100-acre nest buffer, but there is a high likelihood that the pair will move to an alternate nest site in subsequent years. Since timber sales are planned several years in advance of actual harvest, the likelihood of this happening before harvest, when a timber sale is under contract, is compounded. When goshawks move to an alternate nest, it is particularly problematic for management if they move into a timber sale unit or within a road location after a contract has been awarded. In this case, unless the purchaser and Forest Service can come to a mutual contract agreement, the government becomes liable to claims when the nest is buffered and the unit or portion of unit is dropped from the contract. Therefore, it is desirable to have flexibility to address these contract issues on a case-by-case basis.

New science relevant to goshawks and the conservation strategy is summarized in Section 2.4.2.1.

Rationale

The use of alternate nest sites within a territory coupled with the year-to-year variation in actual nesting makes it difficult to determine if goshawks are actively nesting within a nest stand or territory. Research indicates that goshawks commonly have multiple alternate nests within a territory. Alternate nests may occur within the 100 acre nest buffer or could elsewhere within the territory. Within one study in Southeast Alaska, only 54 percent of alternate nests occurred within 100 acres of known nests, indicating that goshawks commonly move nests outside known nest stands (USDA Forest Service 2007). This, coupled with the difficulty in finding nests in Southeast Alaska means there is some risk that observers will fail to detect an active nest within the territory. In addition, because goshawks do not necessarily nest every year and may go several years between successful nesting attempts, there is some risk that managers will not be absolutely certain a nest site is abandoned after inventorying for only 2 years. It is labor intensive to find goshawk nests and verify actual reproduction in a territory. This is even more costly in the remote, inaccessible terrain of Southeast Alaska. Since goshawks may not attempt to nest for 2 or more years and individual goshawks are highly variable in the number of years between successful nesting attempts, the only method for managers to be absolutely assured that goshawks are no longer using a territory would be cost prohibitive. Using 2 years allows some measure of assurance that managers will not inadvertently harvest an active nest stand, but this is not without risk. There is some risk that a once active nest stand will be logged because not all nesting goshawks are detected and because some goshawks pairs may return to nest in a stand after two or more years absence. In addition, there is some risk that the nest stand may become unsuitable for future nesting.

Standards and guidelines outline relatively conservative criteria for what constitutes confirmed and probable nests. Observers do not need to actually find the nest to confirm a stand as a nest stand requiring a 100 acre buffer. A confirmed stand is one where evidence suggests nesting is highly likely and mangers can be relatively assured that they have identified the actual nest tree. Characteristics of confirmed nests include goshawks observed on or near a nest; nestlings or branchers (young not able to fly) observed on or near a nest; goshawk feathers or eggs obtained from the nest or one or more nest structures indicative of goshawk were found with goshawk prey remains, but without positive identified goshawk on the nest and without positive identified feathers from nest. A probable nest is one where evidence suggests nesting is likely nearby, but there is less assurance that managers know where the actual nest tree is. Characteristics of probable nests include aggressive, territorial breeding season adults vocalizing or attacking an observer (without locating a nest); or adults observed during the breeding season in a territory and recently fledged young were observed (without locating a nest).

The fact that timber harvest occurs at all within a goshawk nest territory presents some risk that the goshawk pair will not successfully nest and may ultimately abandon the territory. However, most goshawk nesting habitat on the Tongass will not be affected by timber harvest. Assuming goshawks occupy suitable habitat across the entire the Tongass, most goshawk territories would be protected by virtue of the fact that the majority (71 to 72 percent) of existing POG is protected in reserves (Table D-8).

Providing protection for goshawk nest stands continues to be an important component of goshawk conservation measures in the Amended Forest Plan under Alternatives 1, 2, 3, 5 and 6. Goshawk nests and nest territories are protected in a variety of ways, including the implementation of 100-acre nest buffers within timber harvest areas. Within the matrix, an additional 17 to 18 percent of the existing POG would be protected within the matrix by a suite of buffers and standards and guidelines. Finally, at least an additional 1 percent of existing POG would not be scheduled and would not be harvested primarily because of economics; however, based on the recent history of harvest levels on the Tongass, this percentage could be substantially higher. In total, over 90 percent of the existing POG would be protected over the life of the Forest Plan under Alternatives 5 and 6.

Table D-8.
Summary of POG Protection under Alternatives 5 and 6.

	Alternative	Protected in Reserves (OGRs, Wilderness, Nat. Mon., LUD II, and other Natural Setting LUDs	Protected in Matrix (beach fringe, riparian and other areas protected from harvest by standards and guidelines)	Minimum POG Not Scheduled for Harvest	Total protected
% of 1954 POG *	Alternative 5	65.3%	16.9%	0.8%	83.0%
	Alternative 6	66.2%	15.9%	1.1%	83.2%
% of 2006 POG	Alternative 5	71.0%	18.4%	0.9%	90.3%
	Alternative 6	72.0%	17.3%	1.2%	90.5%

* The % of 1954 POG is the % of POG that was present in 2005 compared to the amount of POG that was estimated to be present prior at the onset of large-scale timber harvest.

It is not possible to estimate how many goshawk nests will be found in the future within units in active timber sales under contract. However, it is likely to be a relatively rare circumstance; since 1997, this issue of has occurred only once, where the nest moved multiple times within the timber sale contract area.

There is no scientific basis in Southeast Alaska to support a management strategy for goshawks that relies on retaining a prescribed threshold of suitable habitat in matrix lands instead of having perpetual nest buffer protections, as was done for management of goshawks in the southwest. While such a strategy would ideally provide flexibility to address timber harvest and goshawk nest conflicts, there are no studies that guide development of a habitat threshold. Science supports that the retention of old growth in matrix lands is an important component of goshawk conservation, especially within biogeographic provinces that are anticipated to be at higher risk for goshawks because they do not maintain a 300-year ecological rotation (Iverson et al.1996). But there are no known thresholds for how much old growth can be harvested before goshawks will abandon a territory. However, as described in Iverson et al. (1996), one estimate of the minimum proportion of old growth in breeding use areas in Southeast Alaska was 23 percent for males and 28 percent for females, respectively. It is instructive to assess the quality and protection status of habitat around known nest sites on the Tongass. Such information supports that known goshawk nests, many of which have been found during timber sale planning and thus are in matrix lands, have a high degree of habitat protection.

During the 1997 Forest Plan process, stand-level analysis was conducted to examine past timber harvest at various spatial scales around known goshawk nests. It also examined additional future risk to known goshawk nesting areas compared to land allocations and standards and guidelines in the Forest Plan. A sample of 36 known goshawk nest areas in Southeast Alaska was used for this analysis. This sample of nests is biased towards goshawks discovered in landscapes predominantly allocated to timber management and may not necessarily be representative of the entire goshawk population in Southeast Alaska. Within this sample, relatively little POG had been harvested around known goshawk nests. The proportion harvested increased with distance from the nest, with 3 percent (range: 0 to 50 percent) within the 0.25 mile radius (radius area = 140 acres), 12 percent (range: 0 to 57 percent) within a 1-mile radius (radius area = 2,040 acres), and 14 percent (range: 0 to 61 percent) within a 3-mile radius (radius area = 18,000 acres). Only 2 of 36 nests (6 percent) had any harvest within the 140-acre area around the nest and only 60 acres within the 0.25 mile radius had been harvested after the nest was discovered. Similarly, only 160 acres at three nests had been harvested within a 1-mile radius once the nest was located.

In addition, this analysis indicated that a total of 20 of 36 (56 percent) goshawk nest sites known at that time occurred in a protected natural setting LUD. Nearly 40 percent of the entire area of all three spatial analysis areas (0.25-, 1-, and 3-mile radii from the nest) would be protected in a reserve in the Forest Plan, despite potentially being a biased sample toward landscapes predominantly allocated to timber harvest. This reiterates the importance of the non-development LUDs in the overall protection of goshawk nest sites.

A summary of recent research given at the Conservation Strategy Review Workshop (US Forest Service 2007) looked at hypothetical post-fledging areas (PFAs) around 78 known goshawk nests, which indicated that these contained, on average, 39 percent medium- and high-volume old growth, 45 percent productive forest, 8 percent low-volume forest and 4 percent clearcuts. Results of this hypothetical PFA analysis indicated that an average of about 40 percent of the PFAs were medium- or high-volume POG, of which 55 percent was in the development LUDs or non-National Forest System lands.

More detailed analysis was done for the Forest Plan amendment looking at the same issue of protection of habitat around known goshawk nests but included an assessment of two different sized hypothetical PFAs. Both measurements have similar results and therefore, the issue of the actual size or shape of the circle is probably not biologically meaningful. For a 1-mile radius circle, 27 percent of circle was protected POG, 13 percent was POG mapped as suitable for harvest, 10 percent was young growth, 24 percent was unproductive forest, 5 percent was non-forest, non-NFS lands was 14 percent (this land contains POG, young growth, unproductive forest, and non forest), and saltwater was 9 percent. However, this analysis was done using the mapped suitable POG. If the difference between as the mapped suitable and what is actually suitable on the ground (due to a variety of factors, such as steep slopes, new streams, and other standards and guidelines) and scheduled for harvest, the acres of POG protected would increase to about 31 percent of the circle and the acreage of POG not protected would decrease to about 9 percent of the circle.

All of these analyses indicate that goshawk nests on the Tongass are afforded a relatively high level of protection, including both nests that occur within non-development LUDs and those in the matrix lands of development LUDs. In most cases there would be other potential nesting habitat within the goshawk's territory if nest stand was inadvertently logged. The analysis described above is a potential future monitoring tool to see whether newly found goshawk nests in the matrix have similar conditions.

There is the risk that timber harvest will occur within an occupied or historic goshawk nest stand, given that goshawks do not always respond during surveys and thus, there is some risk of overlooking goshawks during timber sale planning. This risk exists with or without changing this standard. However, the risk is reduced during the entire process from planning to layout to contract implementation since stands are visited multiple times and, therefore, it is less likely that a truly occupied stand would be overlooked. In addition, the Tongass will continue to do goshawk surveys for timber sale planning prior to NEPA decisions.

Overall, at least 90 percent of existing POG would be protected or not be scheduled for harvest under either Alternative 5 or 6 after 100 years (assuming the maximum timber harvest levels allowed in these Alternatives). While there is some uncertainty in how many nest stands would be affected by this change in standard and guideline, given the degree of POG retention within goshawk territories in the matrix that provide potential habitat for both alternate nest sites and foraging habitat and that the vast majority of nesting habitat is protected over the life of the Plan, implementation of this standard may affect nest occupation by individual pairs but not substantially affect goshawk populations across the Tongass.

Overall, nest protection within the matrix, while an important component of the conservation strategy, is a relatively small component of the overall conservation strategy because timber harvest will occur within a small portion of suitable goshawk habitat. The U.S. Fish and Wildlife Service, in their 2007 finding (Federal Register 2007. Vol. 72 no. 216 pp. 63123-63140) acknowledged this issue of goshawk nest protections and concluded the following, which confirms the value of the key components of the conservation strategy for goshawks:

> "Nest buffers of 100 ac (40 ha) of POG, as specified in the Forest Plan, are intended to protect individual nests from disturbance. Larger buffers would likely enhance goshawk conservation by providing better habitat for fledglings in the immediate vicinity of the nest, but lack of larger buffers is not expected to reduce fecundity or survival to an unsustainable level because OGRs, which typically protect much larger patches of old growth forest, and other retained forest patches are reserved in each watershed, and we expect goshawks to nest in these reserves as the forest

> around them is increasingly harvested. In some cases, suitable nesting habitat in nearby reserves may already be occupied by nesting pairs, but the territoriality of goshawks is likely to prevent this in most cases."

They also discuss concerns that have been raised about the adequacy of the conservation strategy to maintain goshawk populations and conclude that:

> "In spite of the shortcomings discussed above, we find that the full suite of standards, guidelines, and land designations contained in the 1997 Forest Plan are likely to provide adequate habitat protection to sustain goshawks in Southeast Alaska into the foreseeable future, largely because adequate amounts of old and mature productive forest will be protected in reserves, retention areas, and inoperable stands, in large and small patches, throughout the harvested matrix. "

2.5.2.4. Landscape Connectivity – Alternatives 1, 2, 3, 4 (partially), & 6

The Forest-wide Landscape Connectivity standard and guideline was changed to clarify when the issue of connectivity was important to assess during project implementation. It was also changed given that changes in the small OGR boundaries have improved connectivity between all medium and large OGRs and no areas will need specific consideration during project implementation (see *Biodiversity* and *Wildlife* sections of the Final EIS).

The conservation strategy did not assume that there was connectivity between small OGRs and the mediums and large OGRs. Connectivity would be provided for by beach fringe, riparian buffers, other standards and guidelines, other unsuitable POG, and unscheduled POG. While it may be desirable to consider local connectivity issues within a project area during NEPA analysis, this is not necessary in order to provide for viable and well distributed populations – this was provided by the Forest-wide reserve network of old growth in non-development LUDs.

The other portion of this standard that was added was to consider young-growth treatments that accelerate old growth conditions on unsuitable acres. There are significant acres of young growth in non-development LUDs that could provide connectivity quicker with active management.

Under Alternative 4, this standard and guideline would only apply within the four biogeographic provinces that include small OGRs (see *Biodiversity* and *Wildlife* sections of the Final EIS).

2.5.2.5. Endemic Mammals – Alternatives 1, 2, 3, 4, 6, and 7

The Forest-wide Endemic Terrestrial Mammal standard and guideline was changed to clarify what kinds of information should be used for assessing endemic mammals during NEPA analysis. The standard allows for use of existing information on endemic mammals to be used for project planning where available. The Forest has invested significant funds into numerous cooperative projects with several universities as well as with the Pacific Northwest Research Station. The result of this investment is a significantly better understanding about mammalian distribution in Southeast Alaska, than existed prior to the 1997 Forest Plan (for example, MacDonald and Cook 2007). This is not to imply that we have information on species distributions on all islands of Southeast Alaska. However, on many islands, particularly the larger islands, there is adequate presence/absence data for NEPA analysis. There is some inherent risk to endemic mammals under all alternatives because of their inherent endemism, their distribution amongst islands, and the lack of complete knowledge of their distribution and habitat relationships.

Other guidelines added to the 1997 Plan in response to the panel assessments would also benefit both the endemic and widely-distributed mammals. The connectivity guideline will provide additional measures to maintain connectivity of large and small reserves and other non-development LUDs in places where beach fringe and riparian habitat management areas do not provide adequate connectivity. Guidelines for structural retention for goshawk and marten habitat as well as the legacy standard and guideline will also benefit other mammal species. The increased quality and quantity of the OGR system under Alternatives 1, 2, 3, and 6 will also benefit many endemic mammals, particularly those as most risk, which includes the Prince of Wales flying squirrel.

2.5.2.6. Marten – Alternatives 1, 2, 3, 4, 6, and 7

The American marten Forest-wide standard and guideline was changed to clarify when to consider road density management. The standard clarifies that consideration of access as an issue for marten management should only occur when it is demonstrated that mortality is exceeding sustainable levels and that the most significant factor causing this human access on roads.

This change does not change the intent of the standard; however, it clarifies when it should be implemented. Other minor edits were also done to this standard and guideline that do not change the intent of the standard, but clarify it for more consistent implementation.

2.5.2.7. Wolf – Alternatives 1, 2, 3, 4, 6, and 7

The Alexander Archipelago Wolf Forest-wide standard and guideline was changed to clarify when to consider road density management. It also incorporated information from the Conservation Strategy Review that indicated that both open and total road density were important factors to consider when assessing road effects on wolves. The standard clarifies that consideration of access as an issue for wolf management should only occur when it is demonstrated that mortality is exceeding sustainable levels and that the most significant factor causing this human access is roads.

This change does not change the intent of the standard; however, it clarifies when it should be implemented. Other minor edits were also done to this standard and guideline that do not change the intent of the standard, but clarify it for more consistent implementation. It continues to outline the need for a cooperative interagency analysis to identify regions where wolf mortality is apparently excessive. In such areas we would attempt to determine if the mortality is unsustainable and identify the probable causal factors of the excessive mortality. If road access and specific roads are identified as contributing to excessive mortality, then road closures or access management recommendations can be made and actions taken. In addition, seasons, harvest methods and bag limits need to be considered as population management tools by the ADF&G and Federal Subsistence Board as a cooperative approach to managing wolf mortality at a sustainable level.

The 1997 Forest Plan did not prescribe a rigid open road density limit and one is not proposed in this amendment. The Wolf Assessment Panel recommended not using a specific road density "rule of thumb." This was contrary to recommendations in Suring et al (1993) where a road density limits from 1 to 1.25 mile of open road per square mile were recommended, depending on geographic location. Establishing a rigid road density level was not done because the resulting arbitrary closure roads to meet this density was determined to provide no management assurance that wolf conservation objectives would be achieved. Furthermore, it could unnecessarily limit overall public use of an established road system that may otherwise have no specific adverse impact on wolf mortality. Management recommendations for road and access management, if necessary, would result from the site-specific analysis discussed above that would identify a problem requiring a local and cooperative management resolution. Road densities above or indeed below these referenced densities may be appropriate to effectively manage road-access related wolf mortality. This approach is also taken by the amended Forest Plan.

Changing the standard and guideline to consider total rather than just open road density takes into account updated science supporting the relationship between wolf mortality and both open and closed roads. The standard and guideline also retains a range of road densities, based on research from several locations, including Alaska, Minnesota, and other states, that guide managers to determine the need to take action to address wolf mortality concerns. Based on research described in Section 2.4.2.3, the risk of unsustainable wolf mortality is higher on islands with roads that connect to communities than islands with no roads or roads that do not connect to a community. Given this variability in risk, adopting a range instead of one number allows better consideration of more site specific management that directly addresses actual human use.

2.5.2.8. Elimination of Legacy and Goshawk/Marten Standards and Guidelines – Alternatives 4 & 7

Alternatives 4 and 7 were developed because of the need to evaluate alternatives that satisfied higher timber volume demand levels than the 2007 Forest Plan. As such, methods of increasing timber volume levels were evaluated that caused the least impact to the conservation strategy. The elimination of the requirement to leave legacy or reserve trees within harvest units, as prescribed by the Legacy and the Goshawk and Marten standards and guidelines, was one of the key methods identified. As noted above and in Section 3, neither of these standards and guidelines were assumed for the viability panel ratings.

2.5.2.9. Minimum 33 Percent POG Retention – Alternative 4

Alternative 4 is different from the other alternatives in that it identifies Old-Growth Habitat LUDs in only four biogeographic provinces (North Prince of Wales Island, Kupreanof/Mitkof, Dall Island, and Northeast Chichagof), in addition to several individual reserves (Myers Chuck, Lake Eva, Wright Lake) in other provinces. This concept was first analyzed under Alternative 6 in the 1997 FEIS. Overall, Alternative 4 includes only 393,360 acres of Old-Growth Habitat LUDs, compared with 1,182,424 acres for Alternative 5. In order to provide for a minimum level of POG in VCUs outside of these four provinces, a new standard would require that a minimum of 33 percent of POG be retained in each VCU that occurs outside of the four biogeographic provinces. However, this requirement would not have a major effect on POG retention because few VCUs would result in less than 33 percent POG retention and the majority of those that would occur within the four biogeographic provinces.

2.5.2.10. Reduction of Beach Fringe – Alternative 7

Additional modifications were made to the standards and guidelines under Alternative 7 to respond to public comments so that this alternative could provide a higher level of timber volume and improve timber sale economics, while minimizing effects on the conservation strategy. This item and the next two items fall into this category; however, the reduction of the beach fringe is the most significant. Under Alternative 7, the beach fringe buffer would be reduced from 1,000 feet to 500 feet from the shoreline. This concept was first analyzed under Alternative 2 in the 1997 FEIS. Because this low-elevation band typically contains larger trees, is more easily accessible, and adds a substantial amount of suitable forest land, this modification has a large effect on available timber volume and average timber sale economics. On the other hand, it would negatively affect many wildlife and plant species that use or inhabit beach fringe habitats more extensively than most other Tongass habitats, and would negatively affect old-growth connectivity.

2.5.2.11. Elimination of Class III Stream Buffers – Alternative 7

As noted in Section 2.5.2.10, additional modifications were made to the standards and guidelines under Alternative 7 to respond to public comments so that this alternative could provide a higher level of timber volume and improve timber sale economics, while minimizing effects on the conservation strategy. The elimination of the requirement to leave riparian buffers along Class III streams is one of these modifications. It would not produce a substantial additional timber volume, but could result in more economic timber sales, since Class III stream buffers are thought, by many, to be a key factor in timber sale economics.

2.5.2.12. Elimination of Goshawk-Specific Nest Buffer Standard and Guideline – Alternative 7

As noted in Section 2.5.2.10, additional modifications were made to the standards and guidelines under Alternative 7 to respond to public comments so that this alternative could provide a higher level of timber volume and improve timber sale economics, while minimizing effects on the conservation strategy. Elimination of the goshawk-specific nest buffer standard and guideline is another modification that contributes to this goal. Only the general heron and raptor nest protection standard and guideline would apply to confirmed or probable goshawk nests. This means that active nests would receive forested 600-foot wind-firm buffers, where available, and that road construction through the buffer would be discouraged. Disturbance during the active nesting season would be prevented and protection measures could be removed if the nest is inactive after 2 consecutive years of monitoring.

3. WILDLIFE VIABILITY RATINGS

3.1. Historical Background for Tongass Viability Ratings

Direction under the National Forest Management Act (36 CFR 219.19:43048) states that “fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.” For planning purposes, a viable population is defined as “one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area.” Furthermore, “habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that individuals can interact with others in the planning area.”

To meet these requirements, decision-makers for the 1997 Forest Plan revision effort relied in part on the findings of structured risk assessment panels, consisting of subject matter experts. The panels were charged with the task of providing unbiased scientific information on the relative risk associated with implementing each plan alternative to the continued persistence across the landscape of selected species or species groups. These risk assessment panels consisted of four evaluators (drawn from various Federal agencies and Alaska state government), a local subject matter expert available as a resource person, a facilitator, a scribe, and a silent observer (Shaw 1999).

The approach of using professional judgment to assess viability risk had been used in the Pacific Northwest for the development of the Northwest Forest Plan (FEMAT 1993, Starkey 1998). In addition, this approach was selected for the Tongass because of the considerable uncertainty regarding the ecology and distribution of many wildlife species and there was generally inadequate information on which to base predictive models. In addition, the timeframe for the planning process was too short to facilitate the collection of additional data on which to base predictive models (Shaw 1999).

Thus, seven wildlife panel assessments were conducted: one for goshawk, marten, brown bear, wolf, marbled murrelet, "other terrestrial mammals," which included both endemics and widely distributed species, and black-tailed deer. These old-growth associated species and species groups were selected because collectively their ecologies incorporated the breadth of forest habitat features and other attributes of environmental variation represented across the Forest (Shaw 1999)., and because they were thought to be representative of a subset of species that are sensitive to disturbance and potentially at risk of either becoming locally extirpated or jeopardizing cultural or subsistence uses. Risk assessment panels were also conducted for sustainability of the fisheries resource, old-growth forest ecosystems, the social and economic values of forest resources to residents of southeast Alaska, and subsistence use of forest resources (e.g., black-tailed deer and salmon), but these are not discussed further in this appendix.

Panel assessments were initially conducted in fall 1995 and winter 1995-96 to evaluate the risks of nine draft Forest Plan alternatives. Following public comment, and taking into account results of these panel assessments, some plan alternatives were modified and additional plan alternatives were developed that were not subject to the panel assessment process. Consequently, a second set of risk assessment panels was convened in the spring of 1997, which evaluated seven alternatives including a modified version of Alternative 2 (equivalent to 2008 Alternative 7) and a new Alternative 11 (equivalent to 2008 Alternative 5); Alternative 6 (similar to 2008 Alternative 4) was not reevaluated. Evaluators were the same during both panel assessments for the marten and the other terrestrial mammals group, but one or more evaluators changed for the other panel assessments.

In the 1997 FEIS, which was developed before the second set of panels was conducted, Alternatives 10 and 11 were not subjected to risk assessment panels as were the full array of draft alternatives. In the description and analysis of panel results in the 1997 FEIS (Chapter 3, *Biodiversity* and *Wildlife* sections), there was a strong correlation between the acres of POG scheduled for harvest in an alternative and the mean outcome scores for that alternative. As the number of acres harvested increased among alternatives, the mean outcome scores also increased, resulting in greater risk that habitat may not be sufficient to maintain viable and well distributed populations.

Based upon this strong relationship that emerged, the likely effects of Alternatives 10 and 11 were inferred from the acres of old-growth forest scheduled for harvest in these two alternatives, the features of these alternatives as compared to the paneled alternatives, and the relative importance of these features as judged from panel discussions for individual species. Using this approach the likely effects of Alternatives 10 and 11 were discussed in the *Biodiversity* and *Wildlife* sections of the FEIS. Because this strong relationship facilitated development of an effects analysis and time and expense of reconvening all panels was a consideration, alternatives 10 and 11 were not originally subjected to panel risk assessment.

To examine if these inferences were appropriate and presented an accurate analysis of likely effects of implementing Alternatives 10 and 11. This second set of six risk assessment panels included the northern goshawk, Alexander Archipelago wolf, brown bear, American marten, fisheries resources, and other terrestrial mammals. These panels followed the same process as the panels conducted in late 1995 and early 1996. The conclusions from this second set of panels were consistent with the inferences made based on the strong relationship between acres harvested and viability scores (see Appendix N to the 1997 FEIS).

Therefore, this same approach for making inferences is being used in the 2008 Forest Plan Amendment FEIS. Additional factors which solidify the accuracy and reasonableness of this approach are that all of the 2008 alternative harvest levels are within the range of harvest levels analyzed by the panels and four of the seven 2008 alternatives are similar to alternatives directly evaluated by the panel assessments.

Section 3.2 describes the 1995/1996 and 1997 panel assessment process and Section 3.3 summarizes the wildlife panel assessment results. Section 3.3 reviews recent science related to viability analysis and Section 3.4 describes the application of the 1995/1996 and 1997 panel assessments to the 2008 alternatives. Finally, Section 3.5 presents an alternative approach to addressing viability.

3.2. Description of the 1995/1996 and 1997 Panel Assessment Process

3.2.1. Panel Process

The panel assessments evaluated alternatives in terms of their ability to maintain habitat sufficient to support the continued existence of well-distributed, viable wildlife populations across the Tongass over a 100-year planning horizon (10 decades of implementation). The panels were conducted with a modification of the Delphi process that was used, tested, and judged effective in the President's Northwest Forest Plan.

To assess relative levels of risk to wildlife species or species groups, a likelihood approach was used where evaluators individually assigned 100 "likelihood" points by alternative to five potential outcomes, based on the available scientific information. Outcomes included:

- Outcome I: Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain well-distributed breeding populations across the Tongass. The concept of well distributed must be based on knowledge of the species' distributional range and life history.
- Outcome II: Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Tongass. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.
- Outcome III: Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain some breeding populations, but with significant gaps in the historic distribution in the Forest. These gaps are likely permanent and will result in some limitation of interactions among local populations. The significance of gaps must be judged relative to the species' distributional range and life history.

- Outcome IV: Habitat only allows continued species existence in refugia, with strong limitations on interactions among local populations. The significance of extirpations across islands or regional landscapes must be evaluated relative to the species' distribution, range, and life history.
- Outcome V: Habitat conditions result in species extirpation from Federal land.

Likelihood points assigned to these outcomes do not represent absolute probabilities per se, rather they represent a relative measure of how likely future outcomes are, based on reasoned professional judgment (Shaw 1999). Thus they can be used to compare alternatives, and serve as a measure of the evaluators' certainty about a particular outcome, but by themselves do not represent the percent probability of a given outcome.

For each species, evaluators independently assigned outcome scores to each alternative. For the endemic and widely distributed groups, evaluators selected what they determined to be the most vulnerable species or group of species, which varied by alternative due to the location of activities proposed under each alternative and the geographic distribution of many island endemics (Shaw 1999). However, like the single-species panels, each group was assigned only 100 points per alternative. The only species for which likelihood ratings were not used was the Sitka black-tailed deer, for which the panel assessment relied on the deer habitat capability model to predict potential outcomes (See *Wildlife* section in Chapter 3 for a description).

Panel evaluators were instructed to evaluate the effect that implementation of the alternatives for 100 years would have on the abundance and distribution of habitats suitable to support well distributed and persistent populations of species assessed. One hundred likelihood outcome points were distributed among five possible outcomes. In addition, panel evaluators were asked to appraise features used to construct alternatives (e.g., reserves, beach buffers) as to their contribution to maintaining habitat for species assessed. These qualitative appraisals of specific features and the panel discussions were used by the authors of the written summaries prepared for each panel, to interpret the quantitative evaluation of alternatives as indicated by the assignment of likelihood points by outcome and to identify important ecological considerations. (Summary reports for each panel were developed and are included in the planning record and at http://www.fs.fed.us/pnw/tlmp_app/.)

In the presentation of panel assignment of likelihood outcome points in each table below, the 'after' likelihood outcome ratings are used to compare among alternatives since these second ratings benefit from professional interaction and a likely greater understanding of differences among features in alternatives. The 'before' ratings occurred following presentations on alternatives and local information on each species, but before the merits of individual alternatives were discussed among panel evaluators. The average rating for all panelists also is used, rather than focusing on differences among individual evaluators.

3.2.2. Concepts of Viable and Well Distributed Populations

In the discussion and analysis of the first set of panel results in the 1997 FEIS, Outcomes I and II were often combined as an expression of likelihood of sustaining habitat sufficient to support viable and well distributed populations. Conversely, Outcomes III, IV, and V were often combined in effects analysis as representing increased risks of not maintaining the habitat necessary to sustain viable and well distributed populations. By virtue of its description, Outcome III was difficult to interpret due to the statement that "significant gaps" would be created and the "significance of gaps must be judged relative to the species distributional range, and life history." There was considerable variability in the interpretation of this concept by individual panelists. The original panelists convened in late 1995 and early 1996 were not specifically queried about the relationship between outcomes and the maintenance of viable well-distributed populations. These conclusions were generally inferred, based largely upon whatever discussion occurred during panel deliberations. In general, the IDT inferred that Outcome III represented a condition where gaps were significant enough to substantially preclude interaction among populations of the species. In this condition, a species would not be well distributed, and continued existence of the species across the planning area would be at risk.

Because of the difficulty the IDT encountered in interpreting the first set of panel results relative to the maintenance of well distributed and viable populations, the second set of panelists were provided an opportunity to directly and explicitly discuss these issues. The same five outcomes were used in the second panels conducted in 1997. However, focused discussion provided additional information relative to Outcome III and the panelists' interpretation of gaps in distribution, well distributed populations, and viability.

Outcome III, defined as providing habitat to maintain breeding populations but with significant gaps in historic distribution, was interpreted as an array of conditions. For some of the panels, one end of this array was any condition where gaps in habitat existed as small as the territory of a single animal or single pair of animals of the species being assessed. At the other end, this array could include conditions with broad gaps in habitat distribution and significant limitations on population interactions. The panelists considered some part of this array of conditions as meeting their concept of viable and well distributed. They indicated that the concepts of well distributed and viable, as they used them for the purposes of assessing risk, were not necessarily synonymous. Their views on well distributed habitat dealt primarily with the likelihood that modified habitat would, because of gaps, no longer be able to support a continuous territory-to-territory distribution of resident individuals or groups. That is, some previously occupied territories might become permanently vacant within a 100-year timeframe.

The panelists interpreted viability as a condition in which populations could continue to interact and interbreed within their historic distribution across the Tongass National Forest. They felt that a distribution that included some gaps could still be considered viable as long as there was still interaction among the population segments on the forest and those population segments were distributed across the species range. For example, the marten panel understood that their concept of a habitat gap being as wide as a previously occupied home range likely had little if any effect on species interaction or interbreeding. Thus, in the panelists' interpretation, the criterion of well distributed was more restrictive than the criterion of viable.

The panelists were not providing a legal interpretation of the requirement in the National Forest Management Act of 1976 (NFMA) regulations to provide for viable populations. In the discussion of population viability in the NFMA regulations, the concept of "well-distributed" is tied to the ability to continue interactions among individuals of a species, not necessarily to the maintenance of a territory-to-territory distribution of the species. The interpretation of well distributed is expressed most clearly in the stipulation that maintenance of a viable population requires providing habitat to support "at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area" (36 CFR 219.19). This has been interpreted to mean that the condition of viable and well distributed allows for gaps within a species distribution as long as the population segments of the species continue to interact and are distributed throughout the planning area. Thus, the concept of well distributed used by the panelists was more stringent than the concept as applied in the NFMA regulations.

It is difficult to determine how many likelihood points were assigned to the outcome of a viable population since the panelists considered that only some part of the array of conditions under Outcome III met their definition of viable. Thus, the likelihood of maintaining habitat sufficient to support well distributed and viable populations is appropriately presented as being within the span of scores that bracket Outcome III. Consequently, in some of the tables in the following discussions, ratings are expressed as being greater than the sum of likelihood scores for Outcomes I and II, but less than the sum of likelihood scores for Outcomes I, II and III. Expression of data as a range also illustrates the uncertainty in the process and the variability in the professional judgments regarding the concepts of viable and well distributed populations. Use of a range also avoids presenting a single absolute value that might suggest a level of precision that does not exist in this assessment process.

Finally, in some of the following tables, 1995/1996 panel outcome scores are expressed in the same manner of bracketing scores as for the 1997 scores discussed above. Expression of the first panel information in this manner is for comparative purposes only. These combinations do not infer any conclusions on behalf of the 1995/1996 panels because they did not specifically discuss viable and well distributed populations relative to the specific outcomes.

3.3. Summary of 1995/96 and 1997 Panel Assessment Results for Wildlife

3.3.1. Northern Goshawk

3.3.1.1. General Observations on the Goshawk Panels

Panelists noted the apparent low relative density of nesting goshawks in Southeast Alaska. Less than 40 total nest sites had been identified by the time of the assessments after nearly 5 years of inventory effort across the Forest (Iverson 1996a). Low prey diversity compared to other goshawk populations across North America was considered a principle factor, resulting in a higher sensitivity to habitat modifications which may reduce prey diversity and abundance.

The primary factor used by panelists in rating the likelihood of alternatives to support a viable and well-distributed goshawk population was net proportion of all old growth on the Tongass that would be harvested in 100 years (Iverson 1996a, 1997a). This was based on science current at the time of the panel assessments that indicated the strong selection by goshawks for POG forest and the avoidance of all other habitat types (especially early and mid seral conifer forests), though panelists noted that the reliance on this factor was somewhat general due to the lack of more specific information on goshawks in Southeast Alaska and what specific old-growth acres would be harvested.

The 1995 panel assessment used 20 percent of the POG harvested as a threshold level beyond which local persistence and viability were concerns (Iverson 1996a). Most notable was north Prince of Wales Island where in excess of 20 percent of the POG had been harvested. Significant concern arose over this and increased proportions of unsuitable early seral forest on the landscape. This concern was generated from the relatively low density of nesting goshawks discovered relative to the inventory effort in those landscapes. In addition, potential signs of ecological stress was indicated by large home ranges, nonbreeding, and differential winter and breeding use areas. Thus, qualitative judgments concluded that alternatives resulting in this or a greater percentage of the net POG harvested could result in negative overall landscape consequences to sustaining resilient, adaptable, and well distributed goshawk populations in Southeast Alaska. While such thresholds were considered by the 1997 panel, they did not make any conclusions regarding harvest thresholds due to the lack of information and other uncertainty (Iverson 1997a). They suggested that to draw conclusions relative to harvest thresholds, further information was needed on the demographic performance of goshawks under different situations.

In addition, alternatives that proposed standards and guidelines to maintain important landscape components such as riparian, beach and estuary buffers were rated as having higher likelihoods of supporting well-distributed goshawk populations. These habitats are used by goshawks when old-growth forest is present and they also generally support greater prey diversity and net prey productivity. The ability of stands to provide structure adequate to support prey populations and goshawk foraging opportunities was also considered important and related to the length of rotation and harvest method proposed under the alternatives.

The concept of habitat reserves was seen as a less important landscape design feature, since management of the landscape matrix as a whole was felt to have a greater net influence on goshawk habitat suitability, distribution and persistence. Large (40,000 acre) and medium (10,000 acre) habitat reserves as proposed were generally considered too small to sustain more than one or two pairs of goshawks. Roads were not considered an adverse element, thus roadless features of reserves did not generally contribute to overall habitat suitability.

Panelists concluded that at some, albeit low, minimum level, forest management was not considered adverse to overall goshawk habitat suitability and likely contributed to stand diversity.

Given the wide ranging nature of goshawks, the panels emphasized the importance of matrix management to providing habitat capable of supporting viable and well-distributed goshawk populations. However, elements of the reserve system (i.e., large and medium habitat reserves and legislated conservation areas) were deemed important because by default they reduced the net acreage of old-growth harvested.

3.3.1.2. Goshawk Panel Results

The final average panel ratings for northern goshawk are displayed in Table D-9. Alternative 1 in 1997 essentially represents a no-harvest alternative. Nearly two-thirds of all likelihood points were assigned to Outcome I, which indicates that well distributed goshawk breeding populations would be maintained across the Tongass. However, Outcome II received nearly a third of likelihood scores, suggesting that even with no further reduction in old-growth forest, goshawk populations would likely experience reductions and local persistence may be more ephemeral or irregular as a result of the local concentration of habitat loss from past timber harvest. Implied in this conclusion is that additional harvest would be additive to an existing effect.

Because of the significant amount of legislatively reserved lands and the net amount of POG that would likely remain under even the most aggressive timber harvest alternatives, panelists believed there was little chance for total extirpation of the goshawk population from Southeast Alaska. The highest rating for Outcome V (extirpation) was only 8 (for 1997 Alternative 7). Moderately high net scores for Outcomes I and II occurred for 1997 Alternatives 4 and 5 (65 and 74-85, respectively). These alternatives had in common the use of extended 200-year rotations. Panelists generally believed that forest structure resulting from mid-seral mature forest developmental stages (100 to 200 years old) was more beneficial to goshawks and their prey than a combination of reserves and shorter, 100-year rotations.

The 1997 panel assigned 71 likelihood points to 1997 Alternative 11 for the sum of Outcomes I and II, and 97 likelihood points to the sum of Outcomes I, II and III. Even though this alternative was based on a 100-year rotation, its ratings were second highest of all alternatives that proposed to continue timber harvest, only slightly lower than the rating given to Alternative 5. In addition, Alternative 11 was rated as having very low likelihood of goshawks existing in refugia or being extirpated from the Tongass after 100 years of Forest Plan implementation with a combined Outcome IV and V score of 3.

Alternatives 3, 6, and 10 (1997) had intermediate combined Outcome I and II scores of 52, 50, and 48, respectively. In spite of partial or complete application of habitat reserves, the higher overall old-growth harvest levels, coupled with the 100-year rotation perpetuated a less suitable early seral forest stand structure and was a drawback for these alternatives. Conversely, panelists attributed moderate uncertainty that either of these two alternatives would maintain well distributed populations, with a combined score of Outcomes III, IV and V of 48 (1997 Alternative 3), 50 (1997 Alternative 6), and 53 (1997 Alternative 10). This suggested there was a nearly even chance that either permanent gaps in the distribution would occur or goshawks may exist only in refugia under these three alternatives in 100 years; and in either case interaction between individuals would likely diminish. The forest-wide system of old-growth habitat reserves proposed in 1997 Alternatives 3 and 10 alone imbedded in a matrix of early seral forest structure managed on a 100-year rotation were rated by the panelists to be of insufficient size to support goshawk populations without gaps in distribution or refugia populations occurring.

Alternatives 2, 7 and 9’ (1997) were rated by panelists as having a relatively high likelihood (76-80, 88, and 77-92, respectively) that in 100 years gaps in distribution would be likely to occur or populations would exist only in isolated refugia or be extirpated (Outcomes III, IV, or V). When Alternative 9 was analyzed in 1997 with a lower harvest, results were nearly the same producing a likelihood of 90.

Variation in ratings for alternatives assessed in both 1995 and 1997 ranged up to 18 points based on the sum of likelihood points assigned to Outcomes I, II and III (Table D-9). Of those alternatives reviewed in both 1995 and 1997, 1997 Alternatives 1, 5, 2, and 9' were ranked in order (based on average weighted outcomes) from least to highest risk to goshawk habitat in both of the assessments. The 1997 panels also confirmed the judgment in Chapter 3 of the 1997 FEIS, based on a detailed analysis of VCUs, that 1997 Alternatives 5 and 11 had the highest likelihood of sustaining goshawk habitat across the forest of all alternatives that proposed to continue timber harvest. However, the analysis in Chapter 3 resulted in a conclusion that 1997 Alternative 11 had a slightly higher likelihood of maintaining goshawk habitat than 1997 Alternative 5.

Table D-9.
Northern Goshawk Panel Results[1]

	1997 Forest Plan Revision FEIS Alternatives												
Outcomes	**Pre 1954**	**1**	**5**	**11**	**4**	**10**	**3**	**6**	**8**	**2**	**9**	**9'**	**7**
1997 Panel													
I	89	63	35	23		8				1	0	0	
II	11	38	50	48		40				19	10	8	
III	0	0	15	28		48				61	61	61	
IV	0	0	0	3		5				16	26	29	
V	0	0	0	0		0				5	3	3	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		66	23		23		17	6	0	0		0	0
II		31	51		42		35	44	27	24		23	12
III		3	25		29		34	33	41	40		42	40
IV		0	1		6		14	17	29	33		32	40
V		0	0		0		0	0	3	4		3	8
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	100	100	85-100	71-97	--	48-96	--	--	--	20-61	10-61	8-61	--
1995 Panel	--	97-100	74-99	--	65-94	--	52-86	50-83	27-68	24-64	--	23-66	12-52

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9'. Alternatives 1 and 9' are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only 'after' scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

3.3.1.3. Effects of Added Habitat Management Measures

Even though 1997 Alternative 11 was rated second highest in terms of viability among all alternatives that proposed to continue timber harvest and had a very low likelihood of goshawks existing in refugia or being extirpated from the Tongass after 100 years of Forest Plan implementation, because it was the selected alternative and because the goshawk had been considered for listing under the Endangered Species Act, 1997 Alternative 11 was reviewed to determine if features of the alternative could be modified to improve the projected outcome.

The conservation assessment for northern goshawk (Iverson et al. 1996) evaluated the effect of various management practices on goshawk nesting and foraging habitat, and also identified specific geographic locations where goshawk habitat had been highly fragmented. Based on this information, an additional measure for goshawk habitat was prescribed for Prince of Wales Island where POG had been fragmented by past management actions. This measure applied in VCUs where over 33 percent of POG had been converted to young stands by past management. In those VCUs, any additional management of POG was to be either restricted to 2-acre clearcuts or be managed to leave significant structure in harvested stands.

This standard and guideline applied to management activities in VCUs on Prince of Wales Island with a high percentage of past harvest. Approximately 55 percent of the total original POG had been converted to young forest in these VCUs. For any additional harvest of POG in these VCUs, the standard and guideline had the effect of either implementing a 200-year uneven-aged management regime or leaving structure equivalent to 30 percent of the cover of the original stand. Neither of these practices was expected to produce high-value nesting habitat, but they were expected to result in moderate to high value foraging habitat (Iverson et al. 1996). This structure, in combination with matrix management provisions for beach fringe and riparian management areas, was believed to facilitate goshawk dispersal among large and medium reserves on Prince of Wales Island. Goshawks were also considered to benefit in other provinces by the measures put in place for marten and for connectivity. Again, these had the effect of facilitating dispersal among goshawk populations in reserves. Taken in combination with other measures already in place in 1997 Alternative 11, these increased the already high likelihood of providing habitat sufficient to maintain viable and well-distributed goshawk populations and, had they been added prior to the panel assessments, may have increased the likelihood points.

3.3.2. American Marten

3.3.2.1. General Observations on the Marten Panels

Forest structure at the stand scale and integrated across the landscape was the most important factor in panel ratings and discussion due to the close association of marten with lower elevation and higher volume old growth and because these stands have also received a disproportionate amount of timber harvest (Iverson 1996b, 1997b). Structural complexity, associated with older forest stands, was also deemed important for providing habitat to support adequate prey populations of small mammals. The ability of alternatives to provide structural complexity was related to the proposed harvest rotation, which was a primary factor in the panel ratings. The panels considered 100 years an inadequate amount of time to produce structural elements such as large trees, snags, and downed logs that are used by marten and provide prey habitat. Maintaining the old-growth forest within the beach and riparian habitat zones was considered important by panelists, particularly for landscape connectivity and prey habitat diversity.

Both marten panels agreed that large and medium reserves as designated by the VPOP provide important habitat features for marten (Iverson 1996b, 1997b). Both panels indicated, however, that the VPOP approach to establishing a system of well distributed OGRs was only minimally acceptable for marten. The approach was judged to be minimal primarily because its spatial distribution of reserves could allow for the creation of "gaps" in marten distribution within harvested matrix lands.

Roads were a minor consideration in panel ratings in relation to their impact on human access. As with wolves, it was not the direct effect of the number of road miles or road density proposed under the alternatives, but rather increased trapping pressure and related mortality resulting from increased access which could be mitigated through appropriate road management, seasons, and bag limits.

3.3.2.2. Marten Panel Results

The final average panel ratings for American marten are displayed in Table D-10. Alternative 1 (1997) provided the greatest likelihood of maintaining well distributed marten populations across their current range on the Tongass. It had a mean likelihood rating of 54 (in 1995) to 84 (in 1997) for Outcome I. The 1995 panelists indicated that even with no further timber harvest and road construction, there was still a reasonable likelihood that local populations would be reduced or gaps that limit populations would be created with little interaction within the species range, as indicated by a combined score of 46 for Outcomes II and III. Concentration of past timber harvest in specific provinces and past harvest primarily in the high-volume classes which were concentrated at lower elevations contributed to this conclusion. In contrast, however, the much higher ratings given by the 1997 panel indicated they thought that past timber harvest would create few gaps in marten distribution (combined score of only 17 for Outcomes II and III).

Panelists concluded that there was no likelihood of extirpation of marten from the entire Tongass National Forest under all alternatives in 1997 and under most alternatives in 1995. In 1995, Alternatives 2, 9, and 7 were considered to have some chance of extirpation (likelihood scores of 15-25 for Outcome V). Anticipated timber harvest, especially in the remaining high-volume class stands at lower elevation, and road construction, contributed to this conclusion.

The likelihood that in 100 years an alternative would result in either significant gaps in distribution, populations existing in relatively isolated refugia, or local extirpations, may be an indication that marten populations would not remain well distributed across the forest. This cumulative likelihood is the sum of Outcomes III, IV, and V. From this perspective, 1995-1997 Alternatives 2, 7, 8, 9 and 9' were given cumulative ratings of 80 to 91, depending on the panel and the alternative. Alternative 6 (1995) also had a relatively high cumulative likelihood outcome of 72. Extensive planned roading, continued fragmentation of habitat, and most importantly, a significant reduction in the important high-volume old-growth forest component were factors cited by panelists that contributed to these conclusions. Even (1995-1997) Alternatives 3, 10, and 11, with their significant reserve components had combined Outcome III, VI, and V ratings of 56 to 70, suggesting a better-than-even chance that well distributed populations may not be maintained across the Tongass in 100 years. All of these alternatives had in common a 100-year timber harvest rotation.

Alternatives 4 and 5 (1995-1997) were rated intermediate by the panelists in their likelihood of maintaining persistent and well distributed marten breeding populations, with combined scores for Outcome I and II of 60 and 66-70, respectively. Extended 200-year timber harvest rotations was the most important design feature for sustainable approaches to providing marten habitat.

Alternative 10 (1997) was intermediate between 1997 Alternatives 2 and 3 in both design features and acres of old growth harvested; thus risks to maintaining viable marten populations were considered intermediate between these two alternatives. In spite of having a system of large, medium and unmapped small reserves that would reduce risks relative to 1997 Alternative 2, the 100 year rotation, only a 500-foot beach fringe, and smaller riparian buffers in 1997 Alternative 10 was considered as possible long-term risks to marten.

Table D-10.
American Marten Panel Results[1]

		1997 Forest Plan Revision FEIS Alternatives											
Outcomes	**Pre 1954**	**1**	**5**	**11**	**4**	**10**	**3**	**6**	**8**	**2**	**9**	**9'**	**7**
1997 Panel													
I	90	84	1	0		0				0	0	0	
II	9	9	65	36		30				19	13	11	
III	1	8	29	55		59				64	53	50	
IV	0	0	5	9		11				18	35	39	
V	0	0	0	0		0				0	0	0	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		54	17		15		4	3	3	3		3	3
II		25	53		45		40	25	17	6		6	6
III		21	24		37		41	42	42	55		46	27
IV		0	6		3		15	30	35	21		24	39
V		0	0		0		0	0	3	15		21	25
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	99-100	93-100	66-95	36-91	--	30-89	--	--	--	19-83	13-66	11-61	--
1995 Panel	--	79-100	71-95	--	60-97	--	44-85	28-70	20-62	8-64	--	9-55	9-36

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9'. Alternatives 1 and 9' are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only 'after' scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

Alternative 11 (1997) had additional features that further increased the likelihood of maintaining viable goshawk populations relative to 1997 Alternative 3, such as mapped small reserves in all watersheds, and allocation of four additional medium and small reserves. The 1,000-foot beach and riparian protection were similar among 1997 Alternatives 11 and 3, but 1997 Alternative 11 had substantially fewer old growth acres scheduled for harvest (475,000) and thus lower risk than 1997 Alternative 3 (571,440). Total acres harvested in 1997 Alternative 11 was even fewer than 1997 Alternative 4 (495,000), in spite of the 200-year rotation. Alternative 11 (1997) did not have a two-aged silvicultural prescription that maintained forest structure considered important by panelists, but the net acres old growth disturbed might have offset either the potential advantage of two-aged management in 1997 Alternative 3 or two-aged management and a 200-year rotation in 1997 Alternative 4.

Of those alternatives reviewed in both 1995 and 1997, Alternatives 1, 5, 2, and 9' were ranked in order from least to highest risk to marten habitat in both assessments (Table D-10). The 1997 panel results also were consistent with conclusions drawn concerning the relative ranking of all alternatives based on other evidence in Chapter 3 of the 1997 FEIS and other information in the planning record. This includes the conclusion that outcomes of 1997 Alternative 11 would be similar to those of 1997 Alternative 3.

3.3.2.3. Effects of Added Habitat Management Measures

American martens were one of the primary species considered in the design of the original VPOP strategy. By design, each large HCA was intended to support at least 25 female martens, medium HCAs to support at least 5 female martens, and small HCAs at least 1 female. Each large HCA was designed to support a population with high likelihood of at least short-term persistence. The design distance between large HCAs was 25 miles, approximating the maximum dispersal distance recorded for marten, and medium and small HCAs were spaced more closely. Forested corridors were to provide for dispersal among HCAs. All corridors were to be at least 330 feet wide, and riparian and beach fringe habitats were considered appropriate corridors where they provided connections among the HCAs. This network of interconnected HCAs was intended to support a number of local populations that could interact as a metapopulation, thus providing for long-term viability.

Three of the scientists involved in the Kiester and Eckhardt (1994) review identified limitations in this strategy for marten. Benkman, Lidicker, and Powell questioned the use of the maximum marten dispersal distance to establish spacing among HCAs. Benkman cautioned that this strategy would only work if the medium and small HCAs provided connections among the large HCAs. Lidicker added that the condition of the matrix ought to be considered when establishing distances among HCAs. Powell indicated that marten would generally not travel directly between HCAs, so the actual distances they would have to cover would exceed the design distance. None of these reviewers commented directly on the size of large or medium HCAs, but both Benkman and Powell noted that the small HCAs would be unlikely to support even one pair of marten by themselves. A number of the reviewers in Kiester and Eckhardt (1994) commented in general that the utility of corridors for wildlife dispersal had not been demonstrated. None of these comments were specific to marten, possibly because marten are known to make extensive use of riparian zones (Bissonette et al. 1989, Clark et al. 1987).

The VPOP strategy is most fully represented in 1995-1997 Alternative 3. The risk assessment panel convened in 1995 rated this alternative intermediate between 1995 Alternative 1 (no further harvest) and 1995 Alternative 9 (continuation of the existing plan). They indicated that there was a better than equal likelihood that implementation of this alternative for 100 years would result in significant gaps in marten habitat distribution on the Tongass. They projected no likelihood that marten would be extirpated from the entire forest under this alternative.

The risk assessment panel convened in 1997 gave Alternative 11 a similar risk rating to that given to Alternative 3 in 1995. Alternative 11 (1997), as rated by the panel, provides for a wider beach fringe buffer than 1997 Alternative 3, but it also relies more heavily on even-aged management in the matrix. Panelists noted that the projected matrix conditions had a significant influence on their ratings. The panelists convened in 1997 also clarified their interpretation of the outcomes that were used as the basis for risk assessment. Outcome III, defined as providing habitat to maintain breeding populations but with significant gaps in historic distribution, was interpreted as an array of conditions. At one end of this array was any condition where gaps in habitat existed as small as the territory of a single marten. At the other end, this array could include conditions with broad gaps in habitat distribution and significant limitations on population interactions. The panelists considered some part of this array of conditions as meeting the definition of viable and well-distributed. The panelists assigned a total of 91 likelihood outcome points to the sum of Outcomes 1 + II + III. This included 36 likelihood points in Outcomes I and II, which they considered to represent a viable and well distributed condition. It also included 55 likelihood points in Outcome III, some portion of which represents a viable and well distributed condition. The panelists indicated there was a very low likelihood that marten would exist only in refugia or be extirpated from the Tongass after 100 years of Forest Plan implementation with a combined Outcome IV and V score of 9. The panelists indicated that matrix management was the feature of 1997 Alternative 11, as rated, that contributed to the assignment of likelihood points to outcomes that were not well-distributed. They indicated that clearcut silviculture on a 100-year rotation would result in further fragmentation of marten habitat.

Alternative 11 (1997) was strengthened subsequent to the panel assessment because that assessment indicated a level of concern about the likelihood of marten populations remaining well-distributed across the Tongass for at least 100 years. The measures used to strengthen the alternative were based on comments provided by the panelists, information drawn from past studies on marten, and information on existing habitat conditions on the Tongass. Three different measures were applied to 1997 Alternative 11 to improve the likelihood of maintaining habitat to support well-distributed populations of marten.

The first directs the management of high quality marten habitat in five biogeographic provinces where marten habitat was considered to be at higher risk. These five biogeographic provinces were identified by the VPOP risk assessment as the highest risk provinces of the 21 provinces across the Tongass National Forest (Suring et al. 1993). High value habitat is defined in the Interagency Marten Habitat Capability Model (Suring et al. 1993) as consisting of high-volume old-growth stands at elevations below 1,500 feet. Within the high-risk provinces, these stands were to be managed under practices other than clearcutting. In VCUs where 33 percent or more of the POG had been or was projected to be harvested, further harvest in any high-value marten habitat would retain at least 30 percent canopy closure, 8 large live trees per acre, 3 large decadent trees per acre and 3 logs per acre. Where less than 33 percent of POG had been harvested, further harvest in high-value marten habitat would retain 10-20 percent canopy closure, 4 large live trees per acre, 3 large decadent trees per acre, and 3 logs per acre. These habitat management measures were based on studies showing marten use higher in partially logged areas than clearcut areas (Soutiere 1979); a study reported by Hargis and Bissonette (1997) and Hargis et al. (1999) indicating that the proportion of clearcut harvesting at a landscape scale is a key determinant of marten success; and numerous studies showing the importance of large wood structure to marten (Baker 1992, Buskirk et al. 1989, Corn and Raphael 1992, Raphael and Jones (1997).

The second measure provided for access management to reduce marten mortality in areas where mortality rates due to trapping/hunting had been identified as a serious risk to marten populations. The third measure provides additional assurance of maintaining connections between habitat blocks throughout the Tongass. It required an analysis of the effectiveness of features such as small reserves, beach fringe and riparian buffers in providing for connection between old-growth blocks in medium and large reserves and other natural setting LUDs. Where these measures do not provide for full connectivity, additional habitat was to be allocated to provide for connectivity of old-growth habitats.

With all measures in place, 1997 Alternative 11 was modified to provide for a network of large and medium-sized HCAs, capable of supporting 25 and 5 female marten each, respectively. Connection between HCAs was provided by protected habitats in riparian and beach fringes, small HCAs, and additional old-growth habitat designated for connectivity where these protected habitats were not adequate. Connections through the riparian and beach fringe were believed to be effective for marten based on studies that have shown preferential use by marten of riparian zones (Buskirk et al. 1989, Raphael and Jones (1997), Spencer and Zielinski 1983). The matrix between the reserves also contained significant, although fragmented, old-growth habitat. An average of 57 percent of the pre-1954 POG was estimated to remain unharvested in the matrix areas through the planning horizon of 100 years. The percent of old growth remaining in the matrix varies by province, but in those provinces considered at highest risk the additional habitat measures described above were to be applied in the matrix. In addition to all of the above habitat measures, road access was to be managed to reduce marten mortality where mortality had been identified as a significant risk.

Full implementation of the above strategy was believed to increase the likelihood of maintaining habitat that would support well-distributed marten populations. While there would likely be gaps in this distribution, it was estimated that there was low likelihood that there would be significant isolation among marten populations resulting from implementation of 1997 Alternative 11.

3.3.3. Alexander Archipelago Wolf

3.3.3.1. General Observations on the Wolf Panels

Important assessment factors for wolves were deer habitat capability, wolf mortality, and wolf dispersal capabilities; genetic information indicating the existence of the Alexander Archipelago subspecies was new at the time of the panel assessments and was also considered, though not as a major factor. Deer habitat capability was ranked as the most important factor influencing panel evaluators' ratings because of the close link between wolf persistence and deer habitat capability (Iverson 1996c, 1997c). Thus, alternatives that contributed to greater deer habitat capability, as determined by the deer habitat capability model (see *Wildlife* section of Chapter 3 for a description), and thus greater numbers of deer, were ranked as more likely to sustain viable and well-distributed wolf populations. Deer habitat capability can be reduced directly by timber harvest, which may increase deer vulnerability to predators, especially in winters of heavy snowfall.

Roads were a primary factor associated with wolf mortality identified by the panels; however, the panels agreed that the main issues were related to human access and attitudes (i.e., issues of season and bag limits, proper access management, and human education), rather than the miles of road or road densities proposed by the alternatives. It was recognized that increased road densities contributed to increased legal and illegal mortality. Thus, the value of maintaining roadless refugia was identified as a means of providing deer habitat capability and controlling human access, and alternatives that maintained such areas were ranked as more likely to sustain viable and well-distributed wolf populations.

Wolf population distribution and the interaction of populations with respect to gaps was also an issue discussed by the panel, given the dispersal capabilities of wolves. A gap in wolf distribution was defined as approximately 100 square miles between populations, or the estimated size of a wolf pack territory on Prince of Wales Island. The most current genetic information available at the time suggested that interchange among wolf populations was occurring across major island groups in Southeast Alaska. However, there was disagreement on this point between local experts and evaluators since direct ecological evidence suggested the existence of dispersal barriers or at least severe limitations to such dispersal, especially between Prince of Wales Island and neighboring islands and the mainland, as demonstrated by available radio-telemetry data (Iverson 1996c). The panel did highlight the potential ecological concerns associated with insular populations of wolves.

3.3.3.2. Wolf Panel Results

The final average panel ratings for Alexander Archipelago wolf are displayed in Table D-11. For all 1997 alternatives, it was concluded that there was virtually no chance of extirpation of the wolf from the Tongass National Forest (Outcome V). All alternatives had only 1 of a possible 100 points assigned to this outcome, with the exception of Alternatives 9 and 9' in the 1997 panel, which had 3 points assigned. This likely represents a chance catastrophic event that, in combination with normal Forest Service activity, would result in the complete extirpation of wolves.

Alternative 1 (1997) provided the greatest relative likelihood of maintaining stable well distributed wolf populations across their current range on the Tongass. However, panelists indicated that even with no action, past management activity that reduced deer habitat capability on some portions of the forest (north and central Prince of Wales Island were specifically identified) would at least result in some likelihood of locally reduced population levels (the sums of Outcomes II, III, and IV were 12 – 19, depending on the panel). Outcome II for Alternative 1 was explained as the likely result of natural fluctuations in wolf populations in response to prey availability and other environmental factors.

Table D-11.
Alexander Archipelago Wolf Panel Results[1]

	1997 Forest Plan Revision FEIS Alternatives												
Outcomes	**Pre 1954**	**1**	**5**	**11**	**4**	**10**	**3**	**6**	**8**	**2**	**9**	**9'**	**7**
1997 Panel													
I	89	88	55	58		54				20	18	18	
II	8	6	29	25		26				43	30	30	
III	1	3	13	14		16				34	44	44	
IV	1	3	3	3		3				3	6	6	
V	1	1	1	1		1				1	3	3	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		80	48		34		59	26	7	35		3	3
II		14	34		39		25	38	43	25		31	26
III		3	16		24		14	31	40	30		48	51
IV		2	1		2		1	4	9	9		18	19
V		1	1		1		1	1	1	1		1	1
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	97-98	94-97	84-97	83-97	--	80-96	--	--	--	63-97	48-92	48-92	--
1995 Panel	--	94-97	82-98	--	73-97	--	84-98	64-95	50-90	60-90	--	34-82	29-80

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9'. Alternatives 1 and 9' are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only 'after' scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

Because of the intensity of proposed harvest activity and anticipated significant regional reductions in deer habitat capability, Alternatives 2, 7 and 9 were rated by the 1995 panel to have some likelihood (range 9-19) of creating populations that would exist in refugia with severely restricted interaction between them (Outcome IV) (Iverson 1996c); the points for this outcome were dropped considerably by the 1997 panel, ranging from 3 to 6 for Alternatives 2, 9, and 9’ (Iverson 1997c).

The likelihood of an alternative resulting in a situation in 100 years where either gaps in distribution occur, populations exist in refugia, or total extirpation may be a general indication that wolf populations would not remain well distributed across the Tongass compared to historical distributions. This cumulative likelihood is considered the sum of Outcomes III, IV, and V. The 1995 and 1997 versions of Alternatives 7, 8, 9, and 9’ all had relatively high cumulative likelihood outcomes, ranging from 50 to 71. Moderate likelihoods existed for Alternatives 2 (40) and 6 (36). These cumulative outcomes are generally directly related to the total harvest levels and associated reductions in deer habitat capability and all have in common a 100-year timber harvest rotation timber management regime.

Overall, the results of the 1995 and 1997 evaluations were consistent. Of those alternatives reviewed in both 1995 and 1997, Alternatives 1, 5, 2, and 9' were ranked in order from least to highest risk to wolf habitat in both assessments (Table D-11). In the 1997 evaluation, Alternatives 11, 10, and 5 were all given relatively high ratings, and these were similar to ratings given to Alternative 3 in 1995. These results are consistent with the discussion of alternatives in Chapter 3 of the 1997 FEIS, except that the analysis in Chapter 3 clearly distinguished Alternative 11 as the most favorable for wolves among the alternatives that propose to continue timber harvest, primarily due to the more extensive reserve system in Alternative 11.

3.3.4. Brown Bear

3.3.4.1. General Observations on the Brown Bear Panels

Important assessment factors identified by the brown bear panel included acres harvested, roads and access management, large reserves and legislated conservation areas, and riparian habitat management. Alternatives that harvested more acres were given a lower likelihood of maintaining habitat sufficient to support a viable and well distributed brown bear population. The driving force behind this relationship were the cumulative effects of timber harvest (i.e., the combination of clearcuts, road construction, and risks to salmon populations on bears), though direct effects, such as the temporary displacement of bears due to their tendency to avoid recently clearcut areas, were also taken into account (Iverson 1996d, Meade 1997). Likewise, alternatives that did not include effective access management or proposed a greater number or road miles were rated as having a lower likelihood of supporting viable and well-distributed brown bear populations. This was related to the potential for direct effects such as the increased potential for brown bear mortality due to legal hunting, illegal killing, and defense of life and property, as well as the creation of either temporary or permanent gaps in the distribution of the brown bear population. Indirect effects associated with the extent of proposed road construction related to the risks posed to anadromous salmon, the primary food source of brown bears (the panels relied on the 1996 fish and riparian panel results to assess this).

Large OGRs and legislated conservation areas where timber harvest is not permitted were considered a critical factor in the rating of these alternatives due to their function in providing roadless refugia for brown bears. Thus, alternative that allocated a greater number of acres to these reserves were rated as having a higher likelihood of supporting viable and well-distributed brown bear populations. The spatial distribution of these areas was also taken into account, as was the likelihood that they would persist in a roadless state over time.

Two aspects of riparian habitat management were identified as being important to brown bears: the maintenance of riparian habitat capable of sustaining salmon habitat and populations over time and providing sufficient forest cover to maintain important brown bear feeding and loafing areas. Alternatives that provided greater protection to riparian areas were considered more likely to provide adequate travel corridors to foraging areas, loafing areas, and vegetative cover capable of reducing adverse encounters among brown bears (i.e., sows with cubs) and between bears and humans.

3.3.4.2. Brown Bear Panel Results

Average panel ratings are shown in Table D-12. Panelists unanimously agreed that brown bears were not likely to be extirpated in 100 years from the Tongass National Forest under any alternative. All panelists rated Outcome V as 0 for all alternatives; wilderness and LUD II (legislated) areas essentially assured brown bear persistence somewhere in Southeast Alaska in 100 years. Alternative 1 was rated highest in total likelihood of maintaining brown bears in their current distribution, with combined scores of Outcomes I and II of 93, although certain populations would experience some reduction in overall density (a 76 score for Outcome II). The likelihood rating of 6 for Outcome III was due to the extent of past roading and an anticipated future growth in human use of existing roads, in spite of little or no additional timber harvest.

Due to the planned extensive timber harvest and associated road construction, Alternatives 7 and 9' had the highest likelihoods of limiting distribution of brown bears such that they might exist only in isolated refugia, with Outcome IV scores of 40 and 25-41, respectively.

Panelists generally agreed that either Outcomes III, IV, or V would not represent well distributed populations based upon the assessment criteria they were provided. Alternatives 2, 7, 8, 9, and 9' all had scores over 50 for Outcomes III, IV, and V combined. All of these alternatives had in common relatively extensive planned timber harvest and all were managed with a 100-year rotation. The panelists believed that these five alternatives presented the greatest relative long-term risk to the maintenance of well distributed brown bear populations in 100 years.

Alternative 3 ratings did not appear to reflect the panelists' conclusion that riparian habitat protection was a significant feature in brown bear management. Alternative 3 hds the widest riparian buffers on most channel types, yet was rated similarly to Alternatives 4, 5, 6, 10, and 11 with combined Outcome I and II scores of 60, 55, 65-67, 51, 56, and 68, respectively. The extended rotations in Alternatives 4 and 5 inferred greater dispersion of future timber harvest into roadless watersheds and were rated similar to Alternatives 3 and 6 in spite of much less total planned harvest of old growth. Alternative 11 had the highest likelihood of maintaining viable long-term brown bear populations due the extensive reserve system that should significantly address the road issue that is adverse to bears. It also has strong riparian protection. Nonetheless, all these alternatives had a reasonable likelihood of maintaining brown bear populations at least in their current distribution in spite of the potential for development of temporary gaps in distribution.

Subpopulations in Southeast Alaska were rated separately. Panelists generally had greater concerns for the mainland bear populations than the populations on Chichagof/Baranof and Admiralty Islands. The mainland population was rated consistently lower than Chichagof/Baranof for all alternatives in combined Outcomes I and II. These ratings supported discussion that focused significant concern on the low density population that may already exist in relatively isolated regions. Anticipated future roading and human access development would exacerbate this natural situation and place these populations at additional risk.

Overall, the results of the 1995 and 1997 evaluations were consistent. Of those alternatives reviewed in both 1995 and 1997, Alternatives 1, 5, 2, and 9 were ranked in order from least to highest risk to brown bear habitat in both assessments (Table D-12). However, the panel results suggested that Alternatives 5 and 11 would produce similar outcomes for brown bears, while analysis based on the components of the alternatives (Chapter 3 of the 1997 FEIS) indicated that Alternative 11 was more effective than Alternative 5 in reducing risk to bears. Alternative 11 has a much greater reserve system than Alternative 5, including additional large reserves on Northeast Chichagof Island in a landscape that was identified as high risk by the 1995 panels. In addition, Alternative 11 provides more substantial riparian protection than Alternative 5, and this feature was identified as important for bears.

Table D-12.
Brown Bear Panel Results[1]

		1997 Forest Plan Revision FEIS Alternatives											
Outcomes	**Pre 1954**	**1**	**5**	**11**	**4**	**10**	**3**	**6**	**8**	**2**	**9**	**9'**	**7**
1997 Panel													
I	81	16	0	0		0				0	0	0	
II	19	76	65	68		56				49	16	16	
III	0	6	33	25		33				41	63	59	
IV	0	0	3	8		11				10	21	25	
V	0	0	0	0		0				0	0	0	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		40	8		8		10	6	1	4		0	0
II		53	59		47		50	45	28	35		14	16
III		8	34		37		36	38	50	38		45	44
IV		0	0		8		4	11	21	24		41	40
V		0	0		0		0	0	0	0		0	0
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	100	93-100	65-98	68-93	--	56-89	--	--	--	49-90	16-79	16-75	--
1995 Panel	--	94-100	67-100	--	55-92	--	60-96	51-89	29-79	39-77	--	14-59	16-60

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9'. Alternatives 1 and 9' are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only 'after' scores are shown. The -414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

3.3.5. Other Terrestrial Mammals

3.3.5.1. General Observations on the Other Terrestrial Mammals Panels

This panel identified two groups of mammals associated with POG for evaluation: widely distributed taxa (widely distributed group), and endemic taxa (endemic group).

Widely distributed group included:

- black bear (Ursus americanus)
- Canada lynx (Lynx canadensis canadensis)
- wolverine (Gulo gulo luscus)
- fisher (Martes pennanti)
- northern flying squirrel (Glaucomys sabrinus zaphaeus)
- river otter (Lutra canadensis mira)
- mountain goat (Oreamnos americanus columbiae)
- silver-haired bat (Lasionycteris noctivagans)
- California Myotis (Myotis californicus caurinus)
- Keen's Myotis (Myotis keenii keenii)
- little brown Myotis (Myotis lucifugus alascensis)
- long-legged Myotis (Myotis volans longicrus).

The endemic group included:

- Prince of Wales Island flying squirrel (*Glaucomys sabrinus griseifrons*)
- beaver (Castor canadensis phaeus)
- Keen's mouse (Peromyscus keeni sitkensis)
- red-backed vole (Clethrionomys gapperi stikinensis)
- red-backed vole (Clethrionomys gapperi solus)
- red-backed vole (Clethrionomys gapperi wrangeli)
- red-backed vole (Clethrionomys gapperi phaeus)
- Admiralty Island meadow vole (Microtus pennsylvanicus admiraltiae)
- Sitka meadow vole (Microtus oeconomus sitkensis)
- ermine (Mustela erminea aiascensis)
- ermine (Mustela erminea initis)
- ermine (Mustela erminea celenda)
- Admiralty Island ermine (*Mustela erminea salva*)
- Suemez Island ermine (*Mustela erminea seclusa*)

Because multiple species were considered by the panel, likelihood scores given to the most vulnerable or sensitive taxon within a group were applied to the entire group in 1995, thus these panel ratings result in conservative scores. The 1997 panel assessment rated the species as a group due to the underlying uncertainty level for the ratings of the endemic group due to the lack of ecological knowledge for many of the species.

The panel recognized that certain endemics may yet be discovered while other endemics may be more common than originally thought. The panel identified that the greatest concern for endemic species was their restricted ranges, which naturally increased their risk of extinction, and that being an endemic species equated to increased risk. Thus the panel predicted that all of the proposed alternatives had some likelihood of causing extirpation within the endemic group and likelihood increased with higher levels of timber harvest proposed. For the endemic group, Alternative 2 was determined to have a low likelihood of maintaining viable and well-distributed populations due to the absence of a reserve network and the amount of timber harvest proposed. Alternative 6 and 11 were both determined to have a moderate likelihood of maintaining viable and well-distributed endemic mammal populations, with Alternative 11 being the best, due to proposed harvest levels and rotation length (100 versus 200 years).

3.3.5.2. Other Terrestrial Mammals Panel Results

Average panel ratings are shown in Tables D-13 and D-14. Alternative 1 was generally considered by the panels as the alternative least likely to negatively impact taxa under consideration. The panels predicted a higher likelihood that the *widely distributed group* would experience ephemeral range distribution gaps (Outcome II) in both 1995 and 1997; the *endemic group* was predicted to occur more frequently in refugia (Outcome IV) in 1995, but the 1997 panel predicted a higher likelihood for Outcome II, as for the widely distributed group. Panelists assigned these outcomes based upon historical levels of timber-related activities. The panels suggested that Alternative 1 could be improved by restoring old growth in extensively harvested areas (northern Prince of Wales Island for example).

Alternatives 5 and 11 were regarded by panelists as the second and third least likely alternatives to negatively impact taxa under consideration. The panels offered higher likelihoods that the *widely distributed group* would experience both ephemeral and permanent range distribution gaps (Outcomes II and III) that could affect viable populations well-distributed across the planning area. Little brown Myotis was cited as one animal whose local populations would be more ephemeral under this alternative; it was predicted that fisher could experience significant gaps in its historic range. The *endemic group* would more likely have range distribution gaps or be restricted to refugia under Alternatives 5 and 11 (Outcomes III and IV). These circumstances would increase the risk of extirpation as a result of isolation. Prince of Wales Island flying squirrel was noted as one animal that would likely only exist in refugia. Panelists stressed that reserves should be carefully located within the ranges of vulnerable wildlife and that corridors be truly functional.

Panelists ranked Alternatives 3, 4, 6, and 10 as intermediate among the alternatives in terms of likelihood of negatively impacting taxa under consideration. For the *widely distributed group*, likelihood scores were fairly evenly distributed among Outcomes II, III, and IV; scores for outcome extremes (I and V) were consistently lower for these alternatives. Likelihood scores were similarly distributed for the *endemic group*, except scores were higher for Outcome V, particularly for Alternatives 3 and 6 in 1995. For most of these alternatives, local populations of Sitka mouse could become more ephemeral (Outcome II); northern flying squirrel could experience permanent gaps in its historic range or exist only in refugia (Outcome III or IV); fisher could exist only in refugia (Outcome IV).

The panel considered Alternatives 2, 7, 8, 9, and 9’ to be most likely among alternatives to create wildlife viability problems. The panel predicted that implementation of these alternatives would result in high likelihoods that both the *widely distributed and endemic groups* would exist only in refugia (northern flying squirrel for example) or would become extirpated (Keen’s Myotis for example). It was suggested that these alternatives could be improved by incorporating longer rotations, uneven-aged management, and higher levels of riparian habitat protection.

For the widely distributed group, it was determined that Alternative 2 had a very high likelihood of resulting in conditions of either refugia or extirpation in 100 years (not viable; combining Outcomes IV and V). Conversely Alternative 11 was rated as having a relatively high likelihood of not resulting in conditions of refugia or extirpation in 100 years because of its forest-wide reserve system. Alternative 6 was rated as being in between Alternatives 2 and 11 (Table D-13).

There was general consistency in the 1995 and 1997 evaluations of other terrestrial mammals, although there was variation in the ratings assigned to alternatives by the two panels. Of those alternatives

Table D-13.
Widely Distributed Mammals Panel Results[1]

Outcomes	Pre 1954	1	5	11	4	10	3	6	8	2	9	9’	7
						1997 Forest Plan Revision FEIS Alternatives							
1997 Panel													
I	75	24	3	10		3				0	0	0	
II	17	45	36	28		23				3	0	0	
III	7	28	53	44		53				15	9	4	
IV	1	4	6	16		19				68	68	70	
V	0	0	3	3		4				15	24	26	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		23	3		1		5	5	5	0		0	0
II		44	38		34		31	19	10	9		3	3
III		25	49		41		34	25	20	18		9	8
IV		9	9		21		19	36	33	29		35	31
V		0	3		3		11	15	33	45		54	59
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	92-99	69-97	39-92	38-82	--	26-79	--	--	--	3-18	0-9	0-4	--
1995 Panel	--	67-92	41-90	--	35-76	--	36-70	24-49	15-35	9-27	--	3-12	3-11

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9’. Alternatives 1 and 9’ are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only ‘after’ scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

Table D-14.
Endemic Mammals Panel Results[1]

Outcomes	Pre 1954	1	5	11	4	10	3	6	8	2	9	9’	7
	1997 Forest Plan Revision FEIS Alternatives												
1997 Panel													
I	59	6	1	3		1				0	0	0	
II	26	34	9	16		13				0	0	0	
III	13	31	45	36		34				8	8	4	
IV	2	28	41	41		46				70	71	73	
V	0	1	4	4		6				23	21	24	
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		13	5		4		8	8	6	0		0	0
II		20	18		14		15	18	11	5		3	3
III		18	16		19		21	18	16	11		9	8
IV		43	51		50		36	28	28	30		29	26
V		8	10		14		20	30	39	54		60	64
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	85-98	40-71	10-55	19-55	--	14-48	--	--	--	0-8	0-8	0-4	--
1995 Panel	--	33-51	23-39	--	18-37	--	23-44	26-44	17-33	5-16	--	3-12	3-11

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9’. Alternatives 1 and 9’ are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only ‘after’ scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

reviewed in both 1995 and 1997, Alternatives 1, 5, 2, and 9' were ranked in order from least to highest risk to habitat of the widely-distributed group in both assessments (Table D-13). Differences between Alternatives 2 and 9' were slight in both assessments. Additionally, ratings of all these alternatives improved substantially from the 1995 to the 1997 assessment. The same pattern held true for the

endemic mammal group (Table D-14). Relative rankings of the four alternatives reviewed by both panels remained constant, but the ratings for each of the alternatives improved from the first to the second panel. These results also generally support the conclusion drawn in Chapter 3 of the 1997 FEIS that, of the alternatives that propose to continue harvesting timber, Alternative 11 poses the least risk to these species groups. However, the difference for these species between Alternative 11, as evaluated by the panelists, and Alternative 5 is small. Subsequent to the assessment by the panelists, additional measures were added to Alternative 11 to benefit these species groups.

3.3.5.3. Effects of Added Habitat Management Measures

As noted above, the other terrestrial mammals associated with POG were broadly divided into two groups: widely-distributed species and endemic species. A total of 26 taxa within these two groups were explicitly considered by the panels asked to provide judgments for the other terrestrial mammals. Two of these 26 taxa, northern flying squirrel and river otter, were the focus of specific measures in the original VPOP strategy. Small HCAs were adopted by the VPOP committee to provide for distribution of northern flying squirrels in every major watershed (i.e., every 10,000 acres). The size of these HCAs was intended to allow them to support 20 to 40 squirrels. VPOP also recommended that travel corridors be maintained between patches of flying squirrel habitat. They considered beach fringe and riparian zone to be suitable corridors, and recommended that additional corridors be designated in areas where these did not provide adequate connectivity.

The Prince of Wales river otter is strongly associated with saltwater beach fringe and freshwater riparian habitats (Larsen 1983, Noll 1988, Woolington 1984). VPOP's conservation recommendation for river otter was maintenance of beach fringe, estuary fringe, and riparian habitat associated with streams and lakes.

The review of Kiester and Eckhardt (1994) provided little comment on this aspect of the VPOP strategy. However, one of the common themes of many of the reviews was the lack of knowledge of all the taxa present on the Tongass and the distribution of species among islands. Kiester and Eckhardt (1994) recommended a thorough biological survey of the Tongass, and an evolutionary analysis of small mammals. Lidicker (in Kiester and Eckhardt 1994) recommended that no timber harvest take place on islands less than 1,000 acres or those that could be considered unique because of their isolation or known presence of endemics.

In the 1995 evaluation, the VPOP strategy, most fully embodied in Alternative 3, was assessed as having the third highest likelihood, for those alternatives that propose continuing timber harvest, of maintaining both the widely-distributed and the endemic groups of mammals. In this assessment, substantial likelihoods of not maintaining species well-distributed were projected for all alternatives, including Alternative 1 which called for no further timber harvest. These results were based, at least in part, on effects of past harvest, lack of knowledge of many of the mammal species, and risks inherent to endemic species. Alternative 11, as evaluated in the 1997 panel assessments, differed in several important ways from Alternative 3. It eliminated all islands less than 1,000 acres from the timber base as recommended by Lidicker (in Kiester and Eckhardt 1994). It extended the beach fringe to 1,000 feet, but also relied more heavily on short-rotation clearcutting than did Alternative 3. Of the alternatives evaluated in 1997 that propose continued timber harvest, it ranked second highest in likelihood of maintaining viable populations of the widely-distributed and endemic mammals. Despite its favorable ranking relative to the other alternatives, it still was projected to have substantial likelihood of not maintaining well-distributed populations. Alternative components that were viewed favorably by this panel included the presence of a reserve system, the amount of old growth that would be retained in the matrix, and a process for site-specific analysis particularly related to endemic mammals.

In response to the 1997 panel assessment, additional guidelines were added to Alternative 11 to increase the likelihood that viable populations of endemic mammals would be maintained. These guidelines require that surveys for endemic mammals be completed prior to projects that would substantially alter vegetation on islands of 50,000 acres or less. Surveys were also to be conducted on larger islands if an initial assessment indicates high likelihood that endemic mammals are present on the site. Where endemic taxa are detected by the surveys, projects were to be designed to provide for continued persistence of the taxa. As an additional measure, ongoing research of endemic taxa on the Tongass was to be accelerated.

Other guidelines added to Alternative 11 in response to the panel assessments also benefited both the endemic and widely-distributed mammals. The connectivity guideline provided additional measures to maintain connectivity of large and small reserves and other non-development LUDs in places where beach fringe and riparian habitat management areas do not provide adequate connectivity. Guidelines for structural retention for goshawk and marten habitat also benefited other mammal species.

The Prince of Wales flying squirrel may be considered the greatest viability concern among the endemic mammals that were specifically considered by the panels, and the northern flying squirrel may be of greatest concern among the widely-distributed mammals. According to Carey (1991), habitat factors important to northern flying squirrels include large, live trees; large snags; fallen trees; multilayered canopies; and connectedness of habitat either through large contiguous areas of habitat or through corridors of suitable habitat. Alternative 11 provided these features through its system of large and medium HCAs interconnected with small reserves and matrix habitats. Each large HCA should have the capability to support 100 or more northern flying squirrels, medium HCAs to support more than 50 squirrels, and small HCAs to support 20 to 40 squirrels. These individual populations should have the capability to persist over short to intermediate periods of time. Interactions among these populations through the matrix would allow them to function as a metapopulation conferring high probability of long-term persistence. Dispersal through the matrix was facilitated by the beach fringe and riparian habitat management areas, by the overall amount of old forest remaining in the matrix, and by additional measures prescribed under Alternative 11 to provide for connectivity. These additional measures could include relocating small reserves to better serve a role as connectors, thus providing for small squirrel populations at locations intermediate between the larger populations.

These same components of Alternative 11 also reduced risks to the endemic species and the Prince of Wales flying squirrel. In addition, the 200,000-acre reserve designated on Prince of Wales Island, by itself, was expected to support a moderately large population of squirrels. Another feature of Alternative 11 that was to further reduce risk to Prince of Wales flying squirrels was the requirement to survey for endemic mammals on islands of 50,000 acres or less, or in other areas where there is a high likelihood of species presence. Application of this measure to Prince of Wales Island was expected to result in additional project-specific measures reducing risk to the squirrels. Finally, implementation of mitigation measures for goshawk and marten on Prince of Wales Island was expected to result in the retention of structural features important to flying squirrels such as snags, logs, and large live trees.

Implementation of the survey requirement was expected to substantially reduce risks to other endemic species. This requirement, in combination with the ongoing research on endemic taxa, is responsive to Kiester and Eckhardt's (1994) recommendation to conduct a biological survey on the Tongass.

3.3.6. Marbled Murrelet

3.3.6.1. General Observations on the Marbled Murrelet Panel

Only one panel was conducted for the marbled murrelet (Smith 1996). The panel noted the lack of distributional and ecological information about marbled murrelets, especially in Southeast Alaska. They appeared to make the following general assumptions about harvest practices and other components of the alternatives relative to marbled murrelets and in particular to nesting habitat.

1. The best or most important habitat is found within large contiguous blocks of high-volume, low-elevation old-growth forest. In Yakutat and Glacier Bay this may include stands of large mature Sitka spruce.

2. The main concern with fragmenting or reducing such habitat is an increase in predation rates (more edge and less interior).
3. Canopy cover above the nest (highest in the high-volume stands) is another critical factor in keeping predation rates lower.
4. The maintenance of old-growth forest reserves, and extended rotations, are both seen as ways to retain suitable nesting habitat. Large reserves, and rotations greater than 200 years, are favored; an alternative that would provide both Forest-wide would be ideal (assuming timber harvesting is to continue). Rotations averaging 100 years are not long enough to provide suitable habitat.
5. Riparian and beach fringe old growth, due to its linear nature (more edge, less interior), is considered less suitable nesting habitat than interior old growth. Alternatives with higher amounts of riparian and beach fringe protection may work against murrelets by pushing harvest into critical nesting habitat. Conversely, higher riparian protection could lead to improved habitats overall through a synergistic effect resulting from more interconnectivity.
6. The retention of spatially-explicit small OGRs (as in the one/watershed in Alternatives 3) is favored over the "33 percent residual" concept of Alternatives 5 and 6.

3.3.6.2. Marbled Murrelet Panel Results

Average panel ratings are shown in Table D-15. Based on these ratings, the nine alternatives rated fell roughly into four groups. Alternative 1 was by itself with all of its outcome points assigned to Outcomes I or II. The very low level of timber harvest, all of it under a 200-year rotation, resulted in a rating considerably higher (in terms of ensuring viability) than the other alternatives. The assignment of points to Outcome II was primarily a result of the amount of low-elevation, high-volume old growth already harvested.

Alternatives 3, 4 and 5 all rated fairly high, with at least 74 percent of the points in Outcomes I or II. Alternative 5, offering extended rotations and reserves in critical areas, had the highest viability scores of this group, although the panel would have preferred spatially-identified small reserves rather than the 33 percent residual old growth concept. The full reserve system and greater riparian protection, combined with two-aged management, of Alternative 3 was favored somewhat over the Forest-wide uneven-aged management, but no reserves, of Alternative 4.

Alternatives 2, 6, and 9 each had most of their points (67-74 percent) assigned to Outcomes II or III, and except for Alternative 9 have over 90 percent in Outcomes I-III, providing moderate to high viability ratings (although not all panelists felt Outcome III would meet viability requirements). The rationale for these scores varied by alternative. Alternatives 6 rated highest of this group due largely to their reserve systems, two-aged rather than even-aged timber harvesting, and watershed-specific residual old growth requirements. The 100-year rotations in each were a drawback. Alternatives 2 and 9 rated somewhat lower than Alternatives 6, neither of the former having a reserve system and both using even-aged harvest with 100-year rotations.

Finally, Alternative 7, similar to Alternatives 2 and 9 and with a higher timber harvest level, had the lowest viability rating, assigning 2/3 of its points to Outcomes III or IV.

Table D-15.
Marbled Murrelet Panel Results[1]

		1997 Forest Plan Revision FEIS Alternatives											
Outcomes	**Pre 1954**	**1**	**5**	**11**	**4**	**10**	**3**	**6**	**8**	**2**	**9**	**9'**	**7**
1997 Panel													
I													
II													
III													
IV													
V													
Potential POG Harvest (1,000s of acres)	- 414	0	463	475	495	670	571	732	--	853	1,042	1,403	1,200
1995 Panel													
I		85	45		36		41	26	25	18		16	10
II		15	46		38		40	33	38	34		29	20
III		0	6		24		19	36	31	40		38	45
IV		0	3		3		0	5	6	9		18	23
V		0	0		0		0	0	0	0		0	3
Potential POG Harvest (1,000s of acres)	--	0	572	--	618	--	736	954	955	1,107	--	1,403	1,557
Range Between Outcomes I + II and I + II + III													
1997 Panel	--	--	--	--	--	--	--	--	--	--	--	--	--
1995 Panel	--	100	91-97	--	74-97	--	81-100	59-95	63-94	52-91	--	45-83	30-75

[1] Mean likelihood outcome scores by evaluators in 1997 are shown at the top of the table. Scores from the 1995 panel are shown in the middle of the table. Scores were assigned by both panels for Alternatives 1, 2, 5, and 9'. Alternatives 1 and 9' are identical between panels in both features and acres of POG harvested. Alternatives 2 and 5 are identical in features but with fewer acres of POG harvested in 1997 relative to 1995. A range for all alternatives is shown at the bottom of the table for the likelihood of maintaining habitat to support viable and well distributed goshawk populations. Only 'after' scores are shown. The - 414,000 value for POG harvest under Historic represents the acreage harvested since 1954.

Marbled murrelet likelihood outcome ratings were also highly correlated (0.98) with acres of POG planned for harvest over a 100 year rotation. Alternative 10 was very similar in design to Alternative 3, but did not have the extended beach nor option 1 and 2 riparian buffers, both features considered important by panelists, thus presented greater relative risks than Alternative 3. The system of large and medium and unmapped small old-growth habitat reserves in Alternative 10 was also an important feature, thus superior in design with lower relative risk that Alternative 2.

Alternative 11 harvested almost the lowest amount of old growth (Table D-15), had the most extensive forest-wide reserve system with very large reserves in heavily harvested provinces, and had an extended beach and significant riparian protection. The only possible drawback of Alternative 11 was the 100-year timber harvest rotation in the matrix, viewed as unfavorable by panelists. However, an average of nearly 57 percent of the original 1954 POG would remain in all watersheds under timber management contributing to a diversity of stands and habitat mosaics, clearly superior to extensive even-aged stands. Thus, Alternatives 1 and 11 were believed likely offer the highest likelihood of maintaining well distributed viable murrelet populations.

Commentary on the Panel Ratings. The marbled murrelet is second only to the Other Terrestrial Mammals panel with respect to the lack of local information available to assess long-term viability. Viability concerns for the marbled murrelet in southeast Alaska intensified due to listing of this species as threatened under ESA in California, Oregon, and Washington and the very close habitat affinity with coastal old growth forests (Ralph et al. 1995). Information to substantiate this concern in southeast Alaska is only indirect relative to the loss of nearly one million acres of POG coastal temperate rainforests throughout southeast Alaska (including all ownerships). These are generally the more productive sites at low elevation, presumably some of the best murrelet nesting habitat (DeGange 1996). However the strength of the association between murrelet nesting habitat and highly POG forest has not been established; indeed two of the six nests located in Southeast Alaska to date have been on the ground.

Short term (10-15 years) risks to murrelet viability are difficult to assess but are likely minor especially given the magnitude of recent conservative population estimates of over 365,000 marbled murrelets in southeast Alaska (DeGange 1996). Further, murrelets appear to be highly mobile traveling up to 50-60 miles per day on foraging flights (DeGange 1996) suggesting at least the possibility of relatively high population interaction throughout southeast Alaska. Short term risks are likely proportional to the amount of additional old growth planned for harvest among alternatives (1, 11, 5, 4, 3, 10, 6, 2, 9 and 7 in order of increasing risk) within the planning period covered by the Forest Plan Revision. While large block reserves in general may be a preferable conservation strategy, the small (1,600 acre) block reserves (Alternatives 3, 10, 11 and parts of 5 and 6) in each watershed may significantly contribute to maintenance of nesting habitat and well distributed populations in the absence of additional information on nesting habitat relationships. Forest-wide Standards and Guidelines protect nesting habitat around any identified murrelet nests. However, only six murrelet nests have been found so this standard is not considered as a viable conservation strategy in itself. Rather it serves to protect habitat surrounding the few nests that may be located for long term monitoring and studies to understand murrelet habitat relationships.

Under the assumption that POG habitat is the preferred murrelet nesting habitat, then the loss of an additional 1.5 million acres in some alternatives, in addition to the million acres already lost, could contribute to a long-term viability concern. This concern may become greater if future research reveals a significant murrelet selection for high volume low elevation forests that are sought for timber production, similar to the situation documented in the Pacific Northwest (Ralph et al. 1995). DeGange (1996) suggested that long rotations may be beneficial components to a murrelet conservation strategy, he concluded that a reserve system was more likely to present a viable conservation strategy for murrelets given significant unknowns about this elusive specie; protecting intact landscapes/ecosystems is a better hedge against uncertainty.

The significant reserve system in Alternative 11, especially in at-risk landscapes with significant past timber harvest (reserves partially discussed under Wolf) may make this alternative superior to all others (except Alternative 1). The reserve system in additional to significant matrix protection should provide a reasonably high likelihood of sustaining well-distributed viable murrelet populations throughout southeast Alaska.

Even over long time periods, there is less relative concern for the marbled murrelet compared to other old growth associated vertebrates assessed by panels. Average murrelet scores for Outcome I and II rated higher than all other species in all alternatives except for the wolf in Alternatives 2 and 3.

3.4. New Science Relevant to Wildlife Viability Assessment Since 1997

The process of assessing wildlife risk through a structured panel assessment process is one of a variety of methods for conducting a viability assessment. Beissinger and McCullough (2002) compiled a reference which consists of a set of review papers on population viability analysis. This section presents a summary of the science that is relevant to wildlife viability assessment since 1997. It is largely based on a review of recent science relative to population and species viability assessment conducted by Haufler (2006).

Numerous factors influence the viability of any species. However, habitat is the greatest overall factor affecting viability of a species (Wilcove et al. 1998). Reed et al. (2006) identified four broad classes of factors influencing viability of a species; population size and structure, habitat, demography, and relationships between demographic rates and habitat and between demographic rates and population size. In addition, many other minor factors can play a role. Given this myriad of potential influences on the viability of a species, it is not surprising that quantification of species viability has been a difficult task. Consequently, most assessments of species viability in a planning or impact assessment context have been conducted qualitatively, usually with the use of expert opinion in relation to projected future conditions.

Species viability assessment based on habitat has ranged from expert assessments of future population status based on projected habitat conditions to more complex analyses of individual home ranges and their contributions to species persistence in spatially-explicit individually-based population viability models (Noon et al. 1999). Individually-based spatially explicit models may be the most realistic (Breininger et al. 2002), but these approaches also require many model parameters that may not be known with any accuracy, and include various assumptions that may be difficult to test. The spatial description of habitat quality produced from this approach can be used for a variety of habitat-based population viability assessments (Akcakaya and Atwood 1997, Akcakaya 2000). Lawler and Schumaker (2004) evaluated habitat surrogates for population parameters of red-shouldered hawks and goshawks, and found poor relationships between predicted habitat quality and observed habitat quality.

Various models for population viability assessment (PVA) have been proposed and developed (see review by Akcakaya and Sjogren-Gulve 2000), most involving theoretical relationships of demographic data. The idea behind PVA has been to determine an estimate of the extinction risk to a species based on current demographic conditions and alternative future conditions. Given the complexities of species viability described above, it is not surprising that sufficient data generally do not exist to conduct a thorough population viability analysis. For example, Green and Hirons (1991) reported that data suitable for population modeling were available for only 2 percent of threatened bird species, taxa about which we know the greatest amount, while Samson (2002) reported that suitable data existed to conduct a PVA for only 3 of 119 species at risk in the Northern Great Plains. Beissinger and Westphall (1998) discussed use of PVAs in endangered species management. They suggested caution in use of predictions produced from such analyses because of the unreliability of data available for such models as well as the lack of understanding of both periodic fluctuations and density dependent factors, and varying model assumptions that can cause changes in results. They suggested that PVAs consider relative rather than absolute rates of extinction, be limited to short projections, and use models compatible with the available data.

A number of different demographic-based approaches have been proposed for assessing species viability. As with habitat-based approaches, these range from relatively simple approaches to much more complex approaches (Haufler 2006). Incidence function models are relatively simple models designed to provide an estimate of the risk of extinction (Hanski 1999). This approach requires the presence or absence of species of interest to be determined for various habitat patches in a landscape over a time. Appropriate time frames are difficult to estimate, as different populations have different generation times and vulnerability to extinction events. This approach assumes relatively static habitat conditions (Ralls et al. 2002), an unlikely condition for management planning or impact assessments.

A second demographic-based approach is the use of population trend information (Morris et al. 1999). This approach requires the population of a species to be consistently monitored over time to determine any changes in the population size. Morris et al. (1999) recommended a minimum of 7 years of trend data for accurate analysis. Even with this information, the population trend applies only to that time interval and landscape studied.

A number of population simulation models have been developed that address questions of productivity and survival rates of a population (Haufler 2006). These models require detailed information on the demographics of the population under evaluation, data that are seldom available (Bessinger and Westphal 1998).

Certain populations may be limited by the spatial distribution of their habitat, where dispersal among patches is a relatively rare event, so that population demographics within a patch are largely independent of other habitat patches within the landscape. When this arrangement occurs, it is known as a metapopulation (McCullough 1996, Hanski and Gilpin 1997). A number of metapopulation models have been developed that attempt to address population persistence in patches as balanced by dispersal rates among patches. Such models, to be accurate, require information on the status of a population within a habitat patch, including the habitat quality, population size, and internal-patch demographic parameters. In addition, the distribution, and size of other patches in the landscape and rates of successful dispersal among the patches must be known. Dispersal data are one of the least known and most difficult parameters to assess for a population, and small errors in assessment of dispersal can cause large errors in projections of metapopulation models (Reed et al. 2002). In addition, even if these population parameters are collected, as with other demographic parameters, they are usually not transferable to other conditions than those in which they were collected.

Concerns over habitat fragmentation have led many to assume that populations are regularly being converted to metapopulations, and to view any system with a patchy distribution as a metapopulation (Hanski and Simberloff 1997, Harrison and Taylor 1997). However, this is generally not correct, as actual metapopulations are rare (Harrison and Taylor 1997). Hanski (1999) discussed the basic parameters that need to be considered to conduct a metapopulation analysis.

Smith and Zollner (2005) argue that using the most vulnerable species, or evaluating single species without reference to others, to assess impacts of land management likely underestimates the probability of extinction of wildlife species across the planning area because the risk of local extirpation increases with the number of extinction prone species considered. Additionally, the management alternative that poses the greatest risk to the most vulnerable wildlife species may not pose the greatest risk to the wildlife community as a whole (Smith and Zollner 2005). The authors present an alternative method for assessing risk to wildlife viability that considers the risk of “any” extinction among species at risk in the planning area. To accomplish this, an equation is used which calculates the joint probability of at least one extinction among the set of selected species (derived from panel assessment ratings or population viability analysis), which can then be used to conduct a relative comparison of alternatives. That is, it takes into account the marginal, or individual, extinction probability of each species. This approach is used here as an alternate method for comparing the effects of the alternatives on wildlife viability (see Section 3.6 and the *Wildlife* section of Chapter 3 for further discussion).

Global climate change has been a subject of increasing interest and focus in the past 10 years. A number of publications have discussed biodiversity conservation in the face of global warming. Saxon (2003) presented a good discussion of this topic. He recommended that conservation planning occur across ecoregions, and that these ecoregions be identified based on abiotic factors including climate, but also based on other abiotic factors than climate as this factor is likely to change. With climate change expected to have a greater effect on more polar regions, incorporating the potential consequences of global warming relative to conservation planning in Alaska is warranted.

3.5. Application of Panel Assessments to the 2008 FEIS Alternatives

The 1997 Forest Plan Revision Final EIS wildlife analysis relied in part on the expert panel evaluations of alternatives in terms of the estimated relative risks to a species or habitat of concern, as described in Sections 3.2 and 3.3. The 2008 Forest Plan Amendment FEIS also relies in part on these panel evaluations. Of the seven alternatives analyzed in the 2008 FEIS, four of them are very similar to or based on alternatives analyzed during the panel assessments. In addition, the harvest levels of all 2008 alternatives are within the range of the 1997 alternative harvest levels, given that a no-harvest alternative was analyzed in 1997. As described in Section 3.1, there was a strong correlation between the acres of POG scheduled for harvest in an alternative and the mean outcome scores for that alternative resulting from the panel assessments (Section 3.3). As the number of acres harvested increased among alternatives, the mean outcome scores also increased, resulting in greater risk that habitat may not be sufficient to maintain viable and well distributed populations. Therefore, the panel evaluations can be used to make inferences about the 2008 alternatives.

The accuracy of this approach was tested in 1997 (Section 3.1). The 1997 FEIS, which was developed prior to the 1997 panel assessments, evaluated two alternatives, which had not been assessed by the panels, by making inferences based on harvest acres; these inferences and the resulting alternative evaluations were generally confirmed based on the 1997 panel assessments (see Appendix N to the 1997 FEIS).

The relationship between the 2008 alternatives and the 1997 alternatives in terms of equivalency of features, land base, and acreage of POG potentially harvested is summarized in Table D-16, for use in rating the 2008 alternatives in terms of the panel assessments.

Based on the equivalencies given in Table D-16 and supplemental information, viability ratings for the 2008 alternatives were developed and are summarized in Table D-17. The ratings were based on the midpoint of the range between the sum of Outcomes I+II and the sum of Outcomes I+II+III for each alternative. The midpoint of the range between these sums was used as the index of viability because viability was generally assumed by panelists to lie between the sum of Outcomes I+II and the sum of Outcomes I+II+III (USDA Forest Service 1997(Appendix N, p.N-3). The 2008 alternatives were evaluated by applying the equivalencies or rankings in Table D-17 to the panel assessment midpoint values as shown in the tables in Section 3.3. The midpoint values were then transferred to ratings using the key provided in the footnote to Table D-17. Further explanation for these ratings is provided in the following subsections.

3.5.1. Northern Goshawk

Alternatives 1, 2, and 3 in 2008 would both have midpoint values above 91, based on applying Table D-16 equivalencies and rankings to Table D-9. Therefore, they are expected to have very high viability ratings for goshawks. Alternatives 5 and 6 in 2008 are both similar to 1997 Alternative 11, which had a midpoint value of 84. In addition, 2008 Alternatives 5 and 6 both include supplemental measures, which may have a positive effect on viability; 2008 Alternative 5 includes the goshawk and marten standards and guidelines and 2008 Alternative 6 includes the legacy forest structure standards and guidelines. Neither of these measures were evaluated by either of the panels, so their value for goshawks was not considered. As a result of this and the 84 midpoint value for 1997 Alternative 11, 2008 Alternatives 5 and 6 are rated in the high category for goshawks. Alternative 4 in 2008 is rated as moderately high, because the midpoint value for 1997 Alternatives 10, 3, and 6, ranges from 66.5 to 74. Alternative 7 in 2008 is equivalent to 1997 Alternative 2, which had a midpoint value of 40.5. This value falls within the moderate range.

Table D-16.
Relationship of 2008 Alternatives to 1997 Alternatives for Use in Rating 2008 Alternatives in Terms of Panel Assessments

2008 Alternatives	Equivalency or Ranking in terms of 1997 Alternatives*
Alternative 1 84,000 acres of potential POG harvest	2008 Alternative 1 has a lower POG harvest than any of the 1997 alternatives with POG harvest. Ratings for this alternative should be between 1997 Alternative 1 with 0 harvest and 1997 Alternative 5 (with 463,000 acres of harvest) or 1997 Alternative 11 (with 475,000 acres of harvest). Based on the low POG harvest levels, ratings would be closest to (but greater than) Alternative 1.
Alternative 2 223,000 acres of potential POG harvest	2008 Alternative 2 has a lower POG harvest than any of the 1997 alternatives with POG harvest. Ratings for this alternative should be between 1997 Alternative 1 with 0 harvest and 1997 Alternative 5 (with 463,000 acres of harvest) or 1997 Alternative 11 (with 475,000 acres of harvest). Based on harvest levels, ratings would be in the middle of the range between Alternative 1 and Alternatives 5 or 11.
Alternative 3 325,000 acres of potential POG harvest	2008 Alternative 3 has a lower POG harvest than any of the 1997 alternatives with POG harvest. Ratings for this alternative should be between 1997 Alternative 1 with 0 harvest and 1997 Alternative 5 (with 463,000 acres of harvest) or 1997 Alternative 11 (with 475,000 acres of harvest). Based on harvest levels, ratings would be closer to (but less than) Alternatives 5 or 11.
Alternative 4 644,000 acres of potential POG harvest	2008 Alternative 4 is similar to 1997 Alternative 6 in terms of features and land base. The acres of POG harvest are lower for the 2008 Alternative 4 at 644,000 compared with the 1997 Alternative 6 at 732,000. However, only the 1995 version of Alternative 6 was evaluated by the viability panels, and the acres of POG harvest are considerably lower in 2008 vs. 1995 (644,000 vs. 954,000, respectively). The alternative that was reviewed by the viability panels and is the closest to the 2008 Alternative 4 is the 1997 Alternative 10 (670,000 acres of harvest). So ratings for 2008 Alternative 4 are expected to be between 1995 Alternative 6 and 1997 Alternative 10; being closer to the latter alternative.
Alternative 5 479,000 acres of potential POG harvest	2008 Alternative 5 is similar to 1997 Alternative 11 in terms of features, land base, and POG harvest (481,000 vs. 463,000 acres of harvest, respectively). Therefore, the ratings for this alternative would be similar to the ratings for 1997 Alternative 11.
Alternative 6 472,000 acres of potential POG harvest	2008 Alternative 6 is similar to 1997 Alternative 11 in terms of features, land base, and POG harvest (472,000 vs. 463,000 acres of harvest, respectively). Therefore, the ratings for this alternative would be similar to the ratings for 1997 Alternative 11.
Alternative 7 826,000 acres of potential POG harvest	2008 Alternative 7 is similar to 1997 Alternative 2 in terms of features, land base, and POG harvest (826,000 vs. 853,000 acres of harvest, respectively). Therefore, the ratings for this alternative would be similar to the ratings for 1997 Alternative 2.

* POG harvest levels in 1997 are based on values given to the panels, which were different, in some cases from the final scheduled acres given in the 1997 FEIS.

Table D-17.
Viability Ratings (likelihood of maintaining habitat to support viable and well distributed populations) assigned to the 2008 Alternatives based on the Equivalent Panel Assessment Ratings from the 1995/1997 Panel Assessments

Species	Alternatives						
	1	2	3	4	5	6	7
Goshawk	Very High	Very High	Very High	Moderately High	High	High	Moderate
Marten	Very High	High	High	Moderate	Moderate	Moderate	Moderate
Wolf	Very High	Very High	High	High	High	High	Moderately High
Brown Bear	Very High	High	High	Moderately High	High	High	Moderately High
Widely Distributed Mammals	High	Moderately High	Moderately High	Moderate	Moderate	Moderate	Moderately Low
Endemic Mammals	Moderate	Moderate	Moderate	Moderately Low	Moderate	Moderate	Very Low
Marbled Murrelet	Very High	Very High	Very High	High	Very High	Very High	Moderately High

[1] Ratings were based on the midpoint of the range between Outcomes I+II and Outcomes I+II+III for each alternative, as determined by applying the equivalencies or rankings in Table D-17 to the panel assessment results tables in Section 3.3. The midpoint values were then transferred to ratings using the following key:
Very High: 91-100, High: 81-90, Moderately High: 66-80, Moderate: 35-65, Moderately Low: 20-34, Low: 10-19, Very Low: 0-9.

In addition, these ratings may be conservatively low. Information from recent studies indicates that goshawks may make more use of second growth and other forest types than was assumed during the panel assessments (Bosakowski et al. 1999; McClaren 2003, 2004; Boyce et al. 2006, Reynolds et al. 2006). As noted in Section 3.3.1.1, the primary factor used by panelists in their ratings was the proportion of POG that would be harvested in 100 years. The panels assumed a strong selection by goshawks for POG and the avoidance of all other habitat types. In addition, the level of old-growth harvest that was envisioned by the panels over the past 10 years has not materialized. As a result, nearly the same amount of old growth still exists on the Tongass and the large quantities of older second growth are now 10 years closer to becoming useful goshawk habitat. Therefore, if the panels were repeated today, the ratings could be slightly higher.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than 1997 Alternative 11, and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher ratings. These higher ratings are because of a smaller managed land base, the addition of goshawk/marten (in the case of 2008 Alternative 5) or legacy (in the case of 2008 Alternatives 1, 2, 3, and 6) standards and guidelines, and new science about goshawk habitat use in Southeast Alaska. The slight change in the goshawk nest standard and guideline (see Section XX), is not expected to affect viability.

The same relative ratings are also expected to hold for the 1997 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 1997 Forest Plan). These conclusions follow the same reasoning as given in the above paragraph for most of the alternatives. Table D-18 summarizes this reasoning.

Table D-18.
Goshawk Viability Ratings for the 2008 Alternatives Relative to the 2007 Forest Plan[1/]

Alternatives	Comparison with 2007 Forest Plan1/	Viability for Alternative relative to 2007 Forest Plan1/
Alternative 1	Acreage in protected POG is considerably higher in Alt 1 due to expanded OGRs (i.e., more acreage in Old Growth Habitat, Special Interest Areas, Semi-Remote Recreation, and other non-development LUDs). 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 1 has legacy S&G.	Alt. 1 has higher viability rating
Alternative 2	Acreage in protected POG is considerably higher in Alt 2 due to expanded OGRs (i.e., more acreage in Old Growth Habitat, Special Interest Areas, Semi-Remote Recreation, and other non-development LUDs). 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 2 has legacy S&G.	Alt. 2 has higher viability rating
Alternative 3	Acreage in protected POG is considerably higher in Alt 3 due to expanded OGRs (i.e., more acreage in Old Growth Habitat, Special Interest Areas, Semi-Remote Recreation, and other non-development LUDs). 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 3 has legacy S&G.	Alt. 3 has higher viability rating
Alternative 4	Acreage in protected POG is considerably lower in Alt 4 due to OGRs in only four provinces and less acreage in non-development LUDs in general. 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 4 does not have goshawk/marten S&Gs or legacy S&Gs.	Alt 4 has lower viability rating
Alternative 5	Same as the 2007 Forest Plan	Alt 5 has the same viability rating
Alternative 6	Acreage in protected POG is higher in Alt 6 due to expanded OGRs (i.e., more acreage in Old Growth Habitat, Special Interest Areas, and Semi-Remote Recreation). 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 6 has legacy S&G.	Alt. 6 has a similar viability rating
Alternative 7	Acreage in protected POG is considerably lower in Alt 7 due to OGRs in only four provinces and less acreage in non-development LUDs in general. 2007 Forest Plan has goshawk S&G, marten S&G, and unmodified goshawk nest S&G, while Alt 7 does not have goshawk/marten S&Gs or legacy S&Gs.	Alt 7 has substantially lower viability rating

1/ The 2007 Forest Plan is defined as the 1997 Forest Plan, as amended through 2007. It is represented by Alternative 5.

3.5.2. American Marten

Alternative 1 in 2008 would have a midpoint value suggesting a very high viability rating for marten, based on applying Table D-16 equivalencies and rankings to Table D-10. Based on the level of POG harvest, 2008 Alternatives 2 and 3 are expected to have a high rating. Alternatives 5 and 6 in 2008 are both similar to 1997 Alternative 11, which had a midpoint value of 64. In addition, 2008 Alternatives 5 and 6 both include supplemental measures, which were not considered in the panel assessments and these measures may have a positive effect on viability; 2008 Alternative 5 includes the goshawk and marten standards and guidelines and 2008 Alternative 6 includes the legacy forest structure standards and guidelines. As a result of this and the 64 midpoint value for 1997 Alternative 11, 2008 Alternatives 5 and 6 are rated at the upper end of the moderate category for marten. Alternative 4 in 2008 is also rated as moderate, because the midpoint value for 1997 Alternatives 10, 3, and 6, ranges from 49 to 64.5. Alternative 7 in 2008 is equivalent to 1997 Alternative 2 with a midpoint value of 51, which is also in the moderate range.

Information from recent studies indicates that the marten in Southeast Alaska may represent two species, or at least, two different genetic lineages of one species. If there are actually two species, it could indicate a greater viability concern for some islands on the Tongass (e.g., Kuiu - the endemic lineage of marten is currently only documented on Kuiu and Admiralty Islands). However, there is no information indicating that there are ecologically meaningful differences (e.g., differences in habitat use) between the two lineages.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than 1997 Alternative 11, and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher ratings. These higher ratings are because of a smaller managed land base, the addition of goshawk/marten (in the case of 2008 Alternative 5) or legacy (in the case of 2008 Alternatives 1, 2, 3, and 6) standards and guidelines.

The same relative ratings are also expected to hold for the 2007 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 2007 Forest Plan). The moderate viability rating for marten in the 2007 Forest Plan was based on the 1997 plan without the additional conservation measures for marten added in the Decision. With those additional measures, the likelihood of maintaining habitat for viable populations of marten was strengthened. Similarly, Alternative 6 strengthens this likelihood by retaining the additional measures that were added for the 1997 Decision except for the replacement of the Legacy standard for one of the marten measures. This, plus the other additions described in Chapter 2, is why both Alternatives 5 and 6 would have higher viability ratings than the 1997 Forest Plan These conclusions follow the same reasoning as given in the above paragraph for most of the alternatives and are similar to those given in Table D-18 for goshawks.

3.5.3. Alexander Archipelago Wolf

Alternatives 1 and 2 in 2008 would have midpoint values suggesting a very high viability rating for the wolf and Alternative 3 would have a high rating, based on applying Table D-16 equivalencies and rankings to Table D-11. Alternatives 5 and 6 in 2008 are both similar to 1997 Alternative 11, which had a midpoint value of 90. As a result, 2008 Alternatives 5 and 6 are rated at the high end of the high category. Alternative 4 in 2008 is also rated as high, because the midpoint value for 1997 Alternatives 10, 3, and 6, ranges from 79.5 to 91. Alternative 7 in 2008 is equivalent to 1997 Alternative 2 with a midpoint value of 80, which is in the moderately high range.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than 1997 Alternative 11, and 2008 Alternatives 1, 2, and 3 would have higher ratings. Alternatives 5 and 6 in 2008 would have similar ratings, albeit slightly higher. The same relative ratings are also expected to hold for the 2007 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 2007 Forest Plan).

3.5.4. Brown Bear

Alternative 1 in 2008 would have a midpoint value suggesting a very high viability rating for the brown bear, based on applying Table D-16 equivalencies and rankings to Table D-12. Based on the level of POG harvest, 2008 Alternatives 2, 3, 5, and 6 are expected to have high ratings. Alternative 4 in 2008 would be rated as moderately high, because the midpoint value for 1997 Alternatives 10, 3, and 6, ranges from 70 to 78 and averages below 76. Alternative 7 in 2008 is equivalent to 1997 Alternative 2 with a midpoint value of 69.5, which is also in the moderately high range.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than

1997 Alternative 11, and 2008 Alternatives 1, 2, and 3 would have higher ratings. Alternatives 5 and 6 in 2008 would have similar ratings, albeit slightly higher. The same relative ratings are also expected to hold for the 2007 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 2007 Forest Plan).

3.5.5. Other Terrestrial Mammals

Alternative 1 in 2008 would have a midpoint value suggesting a high viability rating for widely distributed mammals and a moderate rating for endemic mammals, based on applying Table D-16 equivalencies and rankings to Tables D-13 and D-14. Based on the level of POG harvest, 2008 Alternatives 2 and 3 are expected to have moderately high ratings for widely distributed mammals and moderate ratings for endemic mammals, respectively. Alternatives 5 and 6 in 2008 are both similar to 1997 Alternative 11, which had a midpoint value of 60 for the widely distributed group and 37 for the endemic group. In addition, 2008 Alternatives 5 and 6 both include supplemental measures (see Section 3.3.2.3), which were not considered in the panel assessments and these measures may have a positive effect on viability; these measures include the survey requirement, connectivity guideline, and goshawk and marten standards and guidelines for 2008 Alternative 5 and the survey requirement, connectivity guideline, and legacy standards and guidelines for 2008 Alternative 6. As a result of this and the midpoint values for 1997 Alternative 11, 2008 Alternatives 5 and 6 are rated at the high end of the moderate category for the widely distributed group and at the low end of the moderate category for endemics. Alternative 4 in 2008 is also rated as moderate for the widely distributed group because the midpoint value for 1997 Alternatives 10, 3, and 6, ranges from 36.5 to 54. This alternative is rated as moderately low for endemics (midpoint ranges from 31 to 35). Alternative 7 in 2008 is equivalent to 1997 Alternative 2 with midpoint values of 10.5 and 4 for the widely distributed and endemic groups, respectively. This places it in the moderately low and very low categories for the widely distributed and the endemic groups, respectively.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than 1997 Alternative 11, and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher ratings. The same relative ratings are also expected to hold for the 2007 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 1997 Forest Plan).

3.5.6. Marbled Murrelet

Alternatives 1, 2, and 3 in 2008 would have midpoint values suggesting a very high viability rating for the marbled murrelet, based on applying Table D-16 equivalencies and rankings to Table D-15. Alternatives 5 and 6 in 2008 are both similar to 1997 Alternative 11, which was not rated by the panel; however, based on the values assigned to the 1995 versions of Alternatives 3, 4, and 5, the 2008 Alternatives 5 and 6 would also fall into the very high viability category. Alternative 4 in 2008 is rated as high, because the midpoint value for the 1995 versions of Alternatives 3 and 6 range from 77 to 90.5. Alternative 7 in 2008 is equivalent to the 1995 version of Alternative 2, but with less harvest. It is given a moderately high viability rating for the marbled murrelet because the midpoint value for the 1995 version of Alternative 2 was 71.5.

Given these factors, the rankings of the 2008 alternatives relative to the 1997 selected alternative (Alternative 11) would be as follows: Alternatives 4 and 7 in 2008 would have lower viability ratings than 1997 Alternative 11, and 2008 Alternatives 1, 2, and 3 would have higher ratings. Alternatives 5 and 6 in 2008 would have similar ratings, albeit slightly higher. The same relative ratings are also expected to hold for the 2007 Forest Plan versus the 2008 alternatives (i.e., 2008 Alternatives 4 and 7 would have lower viability ratings and 2008 Alternatives 1, 2, 3, 5, and 6 would have higher viability ratings than the 2007 Forest Plan).

3.6. Alternative Approach to Viability Evaluation for Alternative Comparison

To determine whether the alternatives provided sufficient habitat to sustain all indigenous wildlife across the planning area, and as a means to compare the alternatives, the 1997 Forest Plan FEIS relied, in part, on the findings of structured panel assessments. As described above, these panel assessments provided estimates of the relative risk, in the form likelihood points or scores for a certain outcome. Results from this assignment of likelihood points do not represent probabilities in the classic sense of frequencies; rather, they represent degrees of belief in future outcomes that are based on reasoned professional judgment and expressed in a probability-like scale (Shaw 1999). Scores from individual panel members were averaged to produce a likelihood score for five possible outcomes related to population distribution for each species: occupancy of historic range (Outcome I), temporary gaps in distribution (Outcome II), permanent gaps in distribution (Outcome III), existence in refugia (Outcome IV), and extirpation from Federal lands (Outcome V).

Other considerations to assess viability were presented in Section 3.4. In order to increase the confidence in our viability assessment, an alternate method for alternative comparisons to address viability was used, The tool with the most applicability to the Tongass, given the lack of level of information required for most other tools, is the analysis presented by Smith and Zollner (2005). They argued that using the most vulnerable species to assess impacts of land management likely underestimates the probability of extinction of wildlife species across the planning area because the risk of local extirpation increases with the number of extinction prone species considered. Since the Tongass is an island archipelago with natural inherent risks of species extripation, this method presents a conservative method to further assess viability risks. The authors present an alternative method for assessing risk to wildlife viability that considers the risk of “any” extinction among species at risk in the planning area. To accomplish this, an equation is used which calculates the joint probability of at least one extinction among the set of selected species. That is, it takes into account the marginal, or individual, extinction probability of each species, as determined by population viability analysis or panel assessment, to compare the relative, rather than absolute, risk of extinction among land management alternatives (see Smith and Zollner (2005) for the equation and for statistical details).

This method was used to rank the 2008 FEIS alternatives in terms of relative level of risk of any of the evaluated species existing in refugia or being extirpated using the 1997 FEIS panel assessment ratings. It is important to note that, since the panel scores for outcomes do not represent probabilities, this approach simply produces risk indices. Two risk indices were calculated: one is based on the likelihood that any species will exist in refugia or be extirpated after 100 years of Forest Plan implementation and the other is based on the likelihood that any species will be extirpated.

This method (which applies the binomial theorem) requires that responses of species at risk to management alternatives be independent (i.e., they cannot respond identically to the management scenario or be ecologically dependent on each other as in predator/prey interactions; Smith and Zollner 2005). The individual species and groups selected for risk assessment panel evaluation were chosen because their ecologies likely incorporate the breadth of forest habitat features and other attributes of environmental variation represented across the Forest (Shaw 1999) and are, therefore, assumed to be independent for this analysis; however, it is recognized that some degree of correlation between components is inherent in all ecological communities.

Table D-19 presents the risk indices for 2008 Alternatives 4, 5/6, and 7, which are equivalent or similar to 1997 Forest Plan FEIS Alternatives 6, 11, and 2 (which were evaluated by the panels), respectively. Applying this risk assessment method indicates that, when all evaluated species are considered jointly, Alternatives 4 and 7 would have the greatest risks. This difference is driven primarily by potential risks to the endemic and widely distributed mammals groups, which have the highest risks of any species or group evaluated (Table D-19). The risk index for extirpation was near 40 percent for both Alternatives 4 and 7, but only 8 percent for Alternatives 5 and 6. The risk index for any species existing in refugia or

Table D-19.
Risk Indices associated with the joint probability that any (i.e., at least one) wildlife species among those evaluated would become restricted to refugia or be extirpated

Species	Risk Index for	Outcome Scores and Risk Index[1/]		
		Alt 4*	Alt 5 or 6	Alt 7
Goshawk	Species existence in refugia or extirpation	17	3	21
	Species extirpation from NFS lands	0	0	5
Marten	Species existence in refugia or extirpation	30	9	18
	Species extirpation from NFS lands	0	0	0
Wolf	Species existence in refugia or extirpation	5	4	4
	Species extirpation from NFS lands	1	1	1
Brown bear	Species existence in refugia or extirpation	11	8	10
	Species extirpation from NFS lands	0	0	0
Murrelet***	Species existence in refugia or extirpation	5	1	9
	Species extirpation from NFS lands	0	0	0
Endemics[2/, 3/]	Species existence in refugia or extirpation	58	45	93
	Species extirpation from NFS lands	30	4	23
Widely distributed[2/, 3/.]	Species existence in refugia or extirpation	51	19	83
	Species extirpation from NFS lands	15	3	15
Combined Risk Index for a Species Being Restricted to Refugia or Being Extirpated[2/]		90	66	>99
Combined Risk Index for a Species Being Extirpated[2/]		41	8	38

1/ Derived from the 1995 (Alternative 4) and 1997 (Alternatives 7 and 11) panel assessment ratings for Outcomes IV and V; Alternatives 4, 5, and 7 are equivalent to the 1997 Forest Plan FEIS Alternatives 6, 11, and 2, respectively. See Smith and Zollner (2005) for equation and further statistical discussion. Values are relative.

2. Endemic group includes small mammals whose known distribution in southeast Alaska (beaver, ermine, voles, etc); wide ranging group includes

3/ Within each guild, evaluators selected what they considered to be the most sensitive species or group of species to evaluate the effect of each alternative on the guild, sometimes consisting of a few or even one species, depending on geographic distribution of species or management actions (Shaw 1999). For the risk assessment these groups were treated similarly to the single species panels.

being extirpated was greater than 99 percent for Alternative 7, 90 percent for Alternative 4, and 66 percent for Alternatives 5 or 6. Again, it is important to understand that these numbers represent an index of relative risk that any species may exist in refugia or be extripated after 100 years of maximum levels of timber harvest allowed in each Alternative. This relative risk is used to compare alternatives and therefore, it is not accurate to consider these as absolute indicators of a degree of risk.

Because 2008 Alternatives 1, 2, and 3 would harvest less timber than Alternative 5 or 6, but maintain equivalent or more protective conservation measures, it can be assumed that their risk indices would be lower than the corresponding indices for Alternatives 5 and 6. The lowest risk indices would be associated with Alternative 1.

The fact that Alternative 4 had an overall probability of extirpation that was slightly higher than Alternative 7, despite proposing less harvest, is likely due to the fact that risk assessment panels convened twice, once in 1995 and once in 1997, evaluating different alternatives each time. The 1997 FEIS Alternative 2 (equivalent to the 2008 Alternative 7) was assessed both times, whereas 1997 FEIS Alternative 6 (equivalent to the 2008 Alternative 4) was only assessed in 1995. In 1997, there was a consistent shift in outcome ratings for Outcome V, or local extirpation (points shifted to higher outcomes, generally IV), across all alternatives due to a clarification of the interpretation of extirpation within the 100-year evaluation period (Iverson 1997). Also, the acreage potentially harvested under the version of Alternative 6 reviewed by the 1995 panel was higher than the level of harvest for the 1997 Alternative 6 and for the 2008 Alternative 4. Thus, it is likely that if the 1995 version of Alternative 6 had been reevaluated in 1997, its score for Outcome V would also have shifted down, lower than the 1997 version of Alternative 2 (re-ordering the results to show that Alternative 7 considered here would in fact pose the greatest risk to the ecological community). Taking this factor into account, the overall outcomes confirm the relative rankings of the alternatives based on other comparisons.

4. CONCLUSIONS REGARDING THE 2008 FOREST PLAN AMENDMENT

4.1. Introduction

The conservation strategy provides the scientific basis for an ecological approach to the Tongass Forest Plan. The strategy consists of a system of OGRs and matrix lands that are a mix of retention and active forest management. The Forest-wide reserve network provided by the non-development LUDs provides the backbone framework to ensure maintenance of habitat for species viability while the matrix provides a variety of functions and activities. Both are critical for the conservation strategy and to ensure species viability; however, they have different functions.

The reserve network protects the integrity of the old-growth forest ecosystem by protecting the largest blocks of contiguous old growth, as well medium and smaller-sized blocks. These reserves are distributed across the Forest and serve as core areas for functioning old-growth ecological communities.

The forests in the matrix provide a variety of functions, including connectivity between old growth in reserve areas and providing habitat for a variety of organisms associated with forests of a variety of successional stages, including old growth. Standards and guidelines within the matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next and maintenance of ecologically valuable structural components such as down logs, snags and large trees. The expected condition for the matrix over time, given all Forest Plan expectations, is a mosaic of successional stages – from early seral to second growth forests to old-growth forests. The suite of ecological functions provided by the matrix, including connectivity and old-growth representation, is achieved through the combination of old growth retention in beach fringe, riparian and floodplain buffers, karst, soil, other no-harvest areas; aging young-growth stands; uneven-aged managed stands; and patches of forest left in managed stands. Matrix functions are enhanced, both in the short term and as the stand ages, by leaving individual reserve trees, snags and clumps of reserve trees within harvested units.

4.2. Forest-wide Reserve Changes

Changes to the conservation strategy under the alternatives fall into two broad categories (as described in Sections 2.5.1 and 2.5.2): changes to the Forest-wide reserve network and changes to standards and guidelines that affect management of the matrix. The overall effects of these changes need to be examined in combination to determine the net effects of the changes relative to the 2007 Forest Plan (modeled by Alternative 5). This section summarizes these overall effects.

As noted in Section 2.5.1, the Forest-wide reserve network was modified in two ways: changes were made to the areas identified as Old-Growth Habitat LUDs and changes were made to other non-development LUDs. Under Alternatives 1, 2, 3, and 6, the boundaries of a large portion of the Old-Growth Habitat LUDs that represent the small OGRs were modified using a process that started with an interagency biological proposal and ended with a refinement of that proposal in consideration of multiple-use objectives. The net result of these modifications was an increase in OGR acres by 39,000 relative to Alternative 5 (the 2007 Forest Plan). In contrast, Alternative 4 reduces the acreage in Old-Growth Habitat LUDs by 789,000 or 67 percent and Alterative 7 totally eliminates the Old-Growth Habitat LUD.

The second way that the Forest-wide reserve network was modified was through the modification of other non-development LUDs, which also represent an important part of the network. Overall, the acreage in these other non-development LUDs was also enlarged under Alternatives 1, 2, 3, and 6 relative to Alternative 5, and reduced under Alternatives 4 and 7.

Table D-5 provides a summary of these changes in reserve area relative to Alternative 5. This table demonstrates that the land area in reserves under Alternative 6 (proposed action) has increased by 149,000 acres relative to Alternative 5. This represents an increase of approximately 1 percent of the Forest land area (i.e., reserve acreage represents 79.4 percent of the Forest under Alternative 6 and 78.5

percent under Alternative 5). An increasingly greater percentage of the Forest would be in reserves under Alternatives 3, 2, and 1 (83.3, 88.5, 95.0 percent, respectively). Under Alternatives 4 and 7, the acreage in reserves would be reduced to 71.8 and 69.9 percent of the Forest, respectively.

Table D-6 summarizes these changes relative to POG. Under Alternative 6, the acreage of POG in reserves would be 45,000 acres greater than under Alternative 5, while the acreage of POG that is protected in the matrix would be 28,000 acres less than under Alternative 5, resulting in a net increase of 17,000 acres. In addition, the percentage of high-volume and large-tree POG that is protected in reserves would increase under Alternative 6, relative to Alternative 5, primarily because of the changes made to OGRs and other LUDs; these changes resulted in a greater portion of the forest types consisting of larger trees being included within reserves. Under Alternative 6, for example, 72.6 percent of the high-volume POG and 69.9 percent of the large-tree POG would be included within reserves compared with 71.3 and 67.8 percent under Alternative 5, respectively. Overall, 90.1 percent of the existing high-volume POG and 89.0 percent of the large-tree POG would not be harvested under Alternative 6, compared with 88.9 and 88.6 percent under Alternative 5. Again, an increasingly greater percentage of total POG and the larger tree POG types would be protected in reserves and in overall under Alternatives 3, 2, and 1, in that order. In contrast, a significantly smaller percentage of total POG and the larger tree POG types would be protected in reserves and overall in Alternatives 4 and 7, in decreasing order.

4.3. Standards and Guidelines Changes

The other major factors to be considered in comparing the overall effects of changes to the conservation strategy are the changes to standards and guidelines. Most changes to the standards and guidelines under Alternatives 1, 2, 3, and 6 are minor and it was concluded in the previous subsections that they would not affect the strategy. The one change to the standards and guidelines that is more far-reaching and needs to be considered in combination with the LUD changes is the replacement of the goshawk and marten standards and guidelines with the legacy standard and guideline. The legacy standard provides an alternative, more ecological approach to conserving wildlife habitat at the project scale as compared to the more species-specific marten and goshawk standards. This approach simplifies the standard, allows equal to greater flexibility, and leaves representative components of old growth in high risk VCUs outside of the biogeographic provinces covered by the marten and goshawk standards.

For marten, ADF&G harvest reports continue to indicate stable or increasing marten populations across the Tongass and trapping continues to occur across the entire Tongass under both State regulations and federal subsistence regulations. While there is increased knowledge regarding the distribution of two marten lineages (*caurina* and *americana*), there is no indication of differential life history requirements or habitat use between lineages. Therefore, maintaining one set of marten standards is still appropriate. The legacy standard would continue to retain additional forest structure in VCUs with the highest level of harvest in high risk marten provinces and this is still valid, based on concerns about the ability of marten to travel through landscapes that have large openings due to past timber harvest.

No barriers to movement other than open salt water have been identified and marten travel through a variety of habitats including clearcuts, muskeg openings and roads. Marten will continue to move through the matrix using riparian and beach buffer routes, as well as crossing the mix of natural and human-caused openings. Since trapping access and trapping success can increase where there are roads, the standard requiring road management considerations is maintained, where marten mortality is directly attributed to road access.

Considering the combination of the OGR network, non-development LUDs and retention of old growth via various standards and guidelines, there is significantly more high value marten habitat retained than just in OGRs. Recent studies indicating that OGRs may not be of sufficient sizes to maintain marten do not adequately take into account the amount of other old growth retained in the Forest Plan and, thus, do not reflect how much actual marten habitat would remain. Slightly more than two-thirds (68 percent) of all existing old growth within the matrix would remain unharvested after 100 years of Forest Plan implementation (at the maximum allowable harvest rate) under either Alternative 5 or Alternative 6. Thus, lands outside of the reserves will provide more than just connectivity for marten. Given timber harvest trends (smaller-sized openings coupled with decreased harvest levels), the continued succession of young growth to mature forest, and the value and amount of old growth retained outside of OGRs, it appears that the assumptions of these studies were very conservative and do not reflect available marten habitat under actual Forest Plan implementation. Based upon this analysis, implementation of Alternatives 1, 2, 3, or 6 with the legacy standard would not reduce the likelihood of maintaining habitat that supports well-distributed marten populations, relative to Alternative 5. Based on the viability panel analysis (Section 3), there is at least a moderate likelihood that sufficient habitat would be maintained to support a viable and well distributed marten populations across the Tongass under these alternatives. While it is anticipated that there could be gaps in this distribution, there is a low likelihood that there would be significant isolation among marten populations resulting from implementation of the amended Forest Plan.

For goshawks, based upon these analyses, Alternatives 1, 2, 3, and 6 would provide a sufficient amount and distribution of habitat to maintain viable and well distributed populations across the Tongass after 100 years of Forest Plan implementation. The legacy standard and guideline would continue to retain additional forest structure in harvest units greater than 20 acres in all VCUs on Prince of Wales Island that were identified as concerns for goshawk, and this is still valid, based on concerns about goshawks specific to this island. In addition, the legacy standard would also retain forest structure in other VCUs forest-wide, which provides an additional measure of protection for goshawk habitat outside of Prince of Wales Island.

These analyses assumed maximum allowable timber harvest every decade for 100 years of implementation of the Forest Plan. The interagency assessment called *The Conservation Assessment for the Northern Goshawk in Southeast Alaska* (Iverson et al. 1996) defined three categories of VCU harvest and related those categories to the likelihood of the VCU continuing to support goshawks. These categories were based on the concept of a 300-year ecological rotation. The three categories were: 1) <33 percent POG harvest = high likelihood that VCU supports goshawks; 2) 33-47 percent POG harvest = slightly increased risk that VCU will not support goshawks; and 3) >47 percent = increased risk that VCU will not support goshawks.

The proportion of the Tongass acreage that falls into these categories was estimated for those VCUs that originally contained a significant amount of goshawk habitat (defined as a minimum of 2,300 acres of POG). For this appendix, the three categories were applied to Alternative 6 and the results are summarized below:

- An estimated 95 percent of the goshawk range on the Tongass currently has a high likelihood of sustaining goshawk habitat (< 33 percent of old-growth harvested).
- An estimated 95 percent of the goshawk range on the Tongass would have 47 percent or less of the POG harvested after 100 years of Forest Plan implementation, and would maintain a relatively high likelihood of sustaining goshawks.
- An estimated 12 percent of the goshawk range on the Tongass would have a slightly elevated risk of not sustaining goshawks, with between 33 and 47 percent of the old growth harvested after 100 years.
- Most elevated risk landscapes (> 47 percent harvested) would be aggregated on North and Central Prince of Wales Island. This province only represents 9 percent of the acreage comprising goshawk range on the Tongass.
- Where risks would be elevated by matrix management intensity, remaining very high quality goshawk habitats would be protected by forest-wide standards and guidelines

These results, together with the viability panel analysis described in Section 3 and the other related analyses presented in Section 2.5, lead to the conclusion that implementation of Alternatives 1, 2, 3, or 6 with the legacy standard would not reduce the likelihood of maintaining habitat that supports viable and well-distributed goshawk populations relative to Alternative 5. Based on the viability panel analysis (Section 3) there is at least a high likelihood that sufficient habitat would be maintained to support viable and well distributed goshawk populations across the Tongass under these alternatives.

In contrast, the modifications to the standards and guidelines under Alternatives 4 and 7 (e.g., no legacy or goshawk/marten standards and guidelines under either alternative and reduced beach fringe and elimination of Class III stream buffers under Alternative 7), coupled with their significantly lower acreages of protected POG, particularly in reserves, leads to the conclusion that the likelihood of maintaining habitat that supports well-distributed marten and goshawk populations could be compromised. The potential effect would be substantially greater under Alternative 7. However, based on the viability panel analysis (Section 3) there is a moderate likelihood for marten and a moderate to moderately high likelihood for goshawks, that sufficient habitat would be maintained to support viable and well distributed populations across the Tongass under these alternatives. In addition, even under Alternative 4 or 7, the potential effect would not be realized unless harvest levels occurred and were maintained at a much higher rate than has occurred in the past 10 years. Given this, and given the 10 to 15-year timeframe until the Forest Plan is revised again, it is highly unlikely that these levels of harvest would occur before the next Forest Plan revision.

4.4. Summary and Conclusions

In summary, the numbers reviewed in Section 2.5 reflect the changes in reserves as well as the changes in standards and guidelines (including the replacement of the goshawk and marten standards and guidelines with the legacy standard and guideline). Although there is some shift of POG from the matrix to POG in reserves, the net effect of all LUD and standard and guideline changes is an increase in protected POG (including the larger tree POG types) under Alternatives 1, 2, 3, and 6, relative to Alternative 5. The 1997 Forest Plan FEIS analysis of Alternative 11 (without consideration of specific additional goshawk and marten standards and guidelines) stated that the 1997 Alternative 11 was explicitly designed to address issues related to wildlife viability conservation planning. It was projected to have a moderately high likelihood of maintaining viable, well distributed populations of old-growth associated species across the Tongass National Forest (USDA Forest Service 1997c). Alternatives 1, 2, 3, and 6 of the 2008 Forest Plan Amendment FEIS do not negatively affect the conservation strategy that this conclusion was based on; in fact, the acreage in reserves and the acreage of old growth in reserves would be higher and the total protected POG would be slightly higher. These positive effects would occur under Alternatives 6, 3, 2, and 1, in increasing order. Alternatives 4 and 7, on the other hand, would negatively affect the conservation strategy and would reduce the likelihood of maintaining viable, well-distributed populations. Alternative 7 would have the greatest potential to negatively affect the strategy. Under any alternative, however, the maximum effects that these conclusions are based on depend on actual harvest levels occurring at a rate significantly higher than under the recent past.

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