Southeast Conference TLMP Comments
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Appendix 4.

Biological Review

Tongass National Forest
Land Use and Resource Management Plan

Technical review and comment on the 2007 Tongass National Forest DEIS and Conservation Strategy
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Introduction. This review was conducted at the request of the timber coordinators of the Southeast Conference in support of their efforts to establish a predictable, reliable timber supply from federal lands sufficient to sustain the region's timber economy and communities. I comment from the perspective and experience gained over the last 39 years as a biologist working with the technical relationships between forest management and fish and wildlife in the Pacific Northwest. My comments focus on the biodiversity and wildlife elements of the plan, and consider the degree to which they are placed at increased risk in relation to proposed timber harvest levels.

A review of the literature and documentation associated with the wildlife elements of the forest plan, information on forestry and wildlife relationships in Alaska, British Columbia and the Pacific Northwest, and observations over the course of my career suggest this level of habitat protection is well beyond that required for the maintenance of well-distributed populations of wildlife on the TNF. Further, without assuming additional risk, or a minimal level of risk to wildlife, the opportunity exists to more equitably balance conservation of wildlife with forest harvest at levels consistent with the timber needs of the forest industry and dependent communities.. My rationale and the scientific evidence supporting this position are discussed below in relation to individual elements of the Plan and Conservation Strategy.

Summary

The principal observations from my review are listed in summary form below. A discussion of individual elements of the plan follows this summary.

- The DEIS, TLMP, conservation strategy and associated documents are well-written and reflect substantial effort on the part of many individuals in their preparation.

- The plan is extremely conservative relative to the importance assigned to productive old-growth forest habitats. The influence of amount of old-growth habitat seems to be "more is better" as a way to minimize risk, rather than considering effects, risks and overall biodiversity conditions associated with retention at various levels.

- Effects of changed amounts of productive old-growth forest on wildlife are presumed to be worst-case, and are based on concepts and assumptions that in some cases lack scientific validity or supporting data. The result is that the approach taken in the plan is precautionary to the extent of overemphasizing perceived negative influences of forest harvesting.

- The TLMP doesn't directly consider the levels of existing reserves both inside and adjacent to the Tongass, in combination with those designated in plan alternatives, thus is overly-cautious with regard to risks to maintenance of wildlife and biodiversity. Even without considering other habitat contributions, overall productive old-growth levels are well above reported thresholds for maintenance of ecological integrity.

- While not quantitatively addressed in the conservation strategy, restrictions on timber harvest on high hazard soils and karst lands will reserve an additional, unspecified amount of productive old-growth forest.

- Other factors (legal and illegal hunting, trapping) are as important as habitat quality in determining populations levels for some species; while considered in the plan, the potential value of harvest regulation and access control in helping to ensure viability of a number of species, in concert with habitat management, is not fully addressed .

- Habitat changes associated with forest harvest are temporary, with rapid recovery for variables such as amounts of edge and cover for hiding and dispersal; the plan contains limited recognition of these relationships or their contribution to habitat quality.

- Silvicultural treatments have been shown to be effective on the Tongass in increasing amount of understory shrubs important as deer forage and habitat for small mammals and shrub-nesting birds and should be recognized for their current and future contributions to habitat.

- Although geographic differences are not factored in, some species (goshawk, marten, wolf, brown bear) populations occur at viable levels in habitats containing substantially less old growth forest and greater levels of development than the Tongass. This suggests that habitat associations of species considered in the plan are in some instances less linked to old-growth than assumed in the plan.

- Several assumptions relative to species - habitat associations which affect the adequacy of alternatives are incorrect; for example: non-federal lands in SE Alaska lands have zero habitat capability and there is a direct relationship between the amount of productive old-growth and marbled murrelet and flying squirrel abundance.

- Large trees (>21"dbh) are considered to be important habitat elements for a number of wildlife species considered in the TLMP, particularly in low elevation stands. Forest inventory plot data indicate comparable densities of large trees occur in productive timberlands both below and above 800 feet elevation. (USDA Forest Service, 1995-2000 FIA Inventory for SE Alaska).

- The focus on retention of the highest volume timber stands in the TLMP is based on the assumption that past forest harvesting targeted these stands (DEIS 3-133). However, for purposes of operational and economic efficiency, harvests prior to 1976 more typically involved all or portions of entire watersheds and the range of volumes associated with stands occurring there. After 1976 green-up strips were retained as a means of reducing harvest unit size as required by NFMA and a conforming USFS policy.

- The ecological rationale for expanding the beach fringe to 1000 feet in width is not clear.

- An adaptive management approach which assesses results of management actions as a means of adjusting practices through time would allow evaluation of alternatives that increase timber supply at low levels of risk to wildlife and biodiversity.

Review of specific features of the DEIS and Conservation Strategy

Current forest conditions - In assessing the potential impact of timber harvesting as proposed in the various alternatives of the forest plan, it is important to define the setting to which the proposals apply. The Tongass National Forest (TNF) is the largest of the U.S. National Forests, containing 16.8 million acres, and makes up over 90% of the forested land base in SE Alaska. Approximately 6.9 million acres (41%) of the TNF are classified non-forested, 4.5 million acres are non-productive old-growth forest (27%), 5.0 million acres are productive old-growth (30%) and 0.4 million acres (2%) are second growth. Remaining private, state and tribal ownerships constitute less than 10% of the forested land base in SE Alaska. (USDA Forest Service 2007)

Under the 1997 Forest Plan, 676,000 acres (4% of the area in the forest and 13% of the productive old-growth forest) of the TNF are deemed suitable for timber harvest with rotations averaging 100 years. With a proposed annual allowable sale quality (ASQ) of 267 million board feet , 83% of the productive old growth present prior to large scale timber harvest (pre-1954) would have remained in 2100. This level is further modified by the proposed Conservation Strategy, which was developed in the revision of the 1997 forest plan, and intended to maintain viable, well-distributed old-growth associated wildlife populations. This strategy sets aside reserves containing 3.6 million acres of productive old–growth and an additional 1 million acres are protected through the various standards and guidelines prescribed for management of the matrix. **Thus, under these proposals, of the 5 million acres of productive old growth present in 1997, about 4.6 million acres, or 92% will remain 1n 2105, the end of the planning period.** In conjunction with the non-forested (6.9 million) and non-productive old-growth (4.5 million) acres, the land in reserve status totals approximately 16 million acres, or about 95% of the land in the TNF. In addition there are about 750,000 acres of productive old-growth remaining on non-NFS lands including private, state, BLM and other, resulting in about 88% of 1954 levels remaining in all of SE Alaska.

In addition to the reserved lands specified in the plan, a number of additional areas of reserved lands, some of which contain old-growth forests, are present in SE Alaska and adjacent British Columbia. There are 9.1 million acres in National Park and Wilderness status in SE Alaska, while in Coastal British Columbia over 24 million acres are designated as reserves. Collectively these areas, while containing variable ecosystems, also provide habitat for a number of the wildlife species that are the focus of the forest plan.

Development of the Plan and Conservation Strategy. Clearly the proposed plan and its conservation strategy as described above, if implemented, present a very low risk to biodiversity and the wildlife of SE Alaska. It is apparent that the individuals developing the strategy took an extremely conservative approach in evaluating the importance of productive old-growth forests. This is illustrated by the fact that **if alternative 7, which allows the most timber harvest, were to be implemented, 76% percent of the productive old-growth present on the TNF in 1954 would still remain in 2105.** Other alternatives result in up to 88% of the productive old-growth remaining. With this focus on productive old-growth, limited attention was given to the wildlife habitat values of other habitats including non-productive old-growth forest and second growth, and the potential role of silviculture in providing desired habitat conditions for some species.

It was recognized early in the planning process that **information on a number of the key habitat relationships involved was inadequate**, requiring the use of "best professional judgment" on the part of plan developers in formulating many of the habitat protection measures. These limitations on knowledge were further addressed through the use of "expert" panels of scientists and managers from Alaska and elsewhere who considered available scientific information and their experience in evaluating risks from forest management to individual species. Recognizing these limitations, the developers of the conservation strategy indicated that their **assessments should be considered a series of hypotheses based on available information and which require additional testing and evaluation.** (Appendix M, Viability assessment, 1991 TLMP)

Wildlife conservation concepts underlying Forest Plan development A number of ecological concepts were employed in the Viable Population (VPOP) analysis done for the 1997 plan, and subsequently served as underpinnings of the current Conservation Strategy. The authors of these documents recognized that some of these concepts had not been scientifically validated. While recent and ongoing research has contributed to an improved understanding of some of these concepts, substantial information gaps, and differing interpretations of existing information, remain. Since these concepts formed the basis of a significant part of the conservation strategy it is important to understand the extent to which they do or do not reflect scientific consensus.

Habitat amounts required for maintenance of biodiversity. The high levels of productive old-growth forest reserve recommended in the conservation strategy are justified by the need to maintain viable, well-distributed populations of old-growth species. (DEIS 2007, 3-135). This designation was made without reference to whether or not thresholds of old-growth forest might exist below which populations would decline or species or ecological function would be put at risk. Several recent reviews (Dykstra 2004; Price et al 2007), conducted in support of the ecosystem-based management planning process in place for the Central Coast of British Columbia, a forest area with a number of ecological similarities to the TNF, shed some scientific light on that relationship. While the relationships are complex, these authors concluded that maintaining habitat at greater than **60% of *total* habitat equates to low risk to biodiversity (i.e. a high probability that ecological integrity will be maintained)** and that maintaining habitat at equal or less than 30% of *total* habitat equates to high risk (i.e. a high probability that ecological integrity will not be maintained). The relationship between these 2 points was seen as linear in most studies, and it was noted that the literature shows high variability among species. It is important to note that these thresholds are for *total* habitat and since natural ecosystems may contain greater or lesser amounts of old-growth, e.g. 70 percent under the natural disturbance regime for BC coastal hemlock-balsam stands, Price et al (2007) suggest **a threshold of 70% natural old forest as a low risk approach.** To illustrate, an ecosystem type of 1000 acres, for example, which due to natural disturbance history, contained 70% or 700 acres of old-growth, would have a low-risk threshold of 490 acres (70% x 700 acres). These authors also suggest that because of the variability between ecosystems, differing targets may be appropriate for different areas

Applying the low-risk threshold to the 5.4 million acres of productive old-growth forest present on the TNF in 1954, and assuming their composition was 100% old-growth, this suggests **retention of 3.8 million acres (70%) would be a low risk strategy**, i.e. it presents a high probability that ecological integrity will be maintained. This is probably a conservative number, as the historic, largely wind-driven disturbance regimes on the Tongass, while variable by location, result in 30% of the forest not reaching late seral conditions (Haufler 2006 Conservation Strategy - Review of Conservation Planning and Science).

Under the current range of alternatives, acreage of productive old-growth remaining in 2105 ranges from 4.7 (alternative 1) to 4.1 (alternative 7) million acres (EIS table 3.9-13). Recognizing that habitat requirements for most old-growth associates cannot be precisely defined and exhibit some variability as discussed below, and that factors other than habitat influence populations**, risks to ecological integrity appear to be low, even at the highest level of timber harvest**. Further, the linear relationship between amount of habitat and population response suggests that minor departures from 70% probably do not confer major increments of risk. While it may not provide habitat quality at the same level as productive old-growth, the approximately 4.5 million acres of non-productive old-growth contributes habitat for old-growth associates as well.

Adaptive management to provide management direction . In the face of the uncertainty commonly associated with complex ecological systems like forests, management decisions are often not made because of concerns over the outcomes. In the

TLMP, the low-risk approach taken in the plan limits forest management activity at the same time it requires an extensive program of monitoring for other resources. Since it is a 100-year plan, changes on the ground occur slowly. **An adaptive management approach (Walters and Holling, 1990 in Simberloff 1998) which assesses results of a broader range of management actions as a means of adjusting practices through time would allow evaluation of alternatives that increase timber supply at low levels of risk to non-timber resources.** The need for this kind of approach, involving both managers and scientists to achieve large scale studies was noted by Kessler et al (1992) in a discussion of changing approaches to sustainable natural resources management on U.S. National Forests.

Fragmentation . Fragmentation and creation of edge from timber harvest are identified in the Tongass plan as concerns for interior forest species. Concerns focus on edge effects and reductions in connectivity. Agreement on what constitutes fragmentation has been hindered by a lack of distinction between habitat fragmentation, or change in landscape configuration, and habitat loss (Fahrig 1999, Bunnell et al 1998). Research on the effects of conversion of forest land to agriculture or urban development, i.e. habitat loss, has demonstrated negative effects on bird populations, largely through increased predation and nest parasitism in the remaining forest patches. Most of these findings come from studies in eastern North America. Conversely, research to date has not demonstrated these effects with forest fragmentation in which forest land is modified through harvest or silvicultural practices, but remains in forest use as would be the case on the Tongass. Bunnell et al (1998) concluded that the current emphasis on habitat spatial pattern as opposed to amount of habitat is misplaced as reported by Fahrig (1997) and if conservation efforts involve a choice between amounts and distribution of habitat, the amount is more important. Fahrig (1997) conducted simulations from which she observed that “when breeding habitat covers more than 20% of the landscape, survival is virtually ensured no matter how fragmented the habitat is.”

One of the only studies addressing the independent effects of habitat area and configuration is that of McGarigal and McComb (1995) working with forest birds, including some late-successional forest associates, in 30 landscapes in the Oregon coast range. These investigators noted that the total amount of habitat available is of greater significance to survival and reproduction than its configuration, but that both are important. They suggest that land managers focus first on maintaining sufficient late-seral forest area and secondarily consider the details of how late-seral forest is arranged. Since roughly an equal number of species demonstrated positive and negative effects, an intermediate level of late seral area at the landscape level is likely to sustain highest levels of bird diversity. Likewise, Dykstra’s (2004) review of the literature indicated habitat loss has the greatest influence on habitat thresholds and that fragmenting habitat results in more habitat required for persistence; however, the evidence is weak for ubiquitous fragmentation thresholds in forests.

With regard to increased predation, Marzluff and Restani (1999), reviewed the literature on the effects of fragmentation / creation of edge on predation rates within forest stands. They noted that two thirds of earlier studies failed to find a significant decrease in nest predation and parasitism from the forest edge to the forest interior. They predict that forest fragments in western United States landscapes will rarely show edge or fragmentation effects related to nest predation. In studies conducted entirely within a forested landscape, Schmiegelow and Hannon (1999) found in three nest predation experiments that fragmentation did not increase predation and there did not appear to be an increase in predation at the forest /clearcut edge.

Why are fragmentation effects not seen? In their review of the literature on fragmentation, Bunnell et al (1998) noted several reasons why fragmentation effects are not evident in western forests, including: 1) differences between forest age classes are insufficient to create distinctly different forest patches uniquely providing necessary resources, Second, even though distinctive and desired resources are provided in older stands, there is sufficient of these stands(enough area) and the intervening matrix does not provide an impediment to movement among them and third, as a result of the natural heterogeneity of western forests - particularly in the mountainous coastal area - species habitat requirements are relatively plastic. Diverse physiography, the great range of natural disturbance sizes, recent glaciation, and large historical ranges of most species may mean species are more able to accommodate habitat change. Other likely explanations for a lack of fragmentation being observed in western managed forests include the fact that changes in certain habitat features, e.g. hiding / dispersal cover, are temporary, and structural habitat features (down logs, snags, green trees) reduce the hostility of the matrix by providing habitat and stepping stones for animal movement. **The relatively stable population status of the old-growth associated wildlife community of the Tongass, despite the high levels of natural fragmentation characteristic of the productive old growth forests due to muskeg, forested wetlands and alpine areas (2007 DEIS 3-130) likely reflects several of these relationships.**

Given these relationships, the extensive amount of old forest remaining and the rapid reestablishment of young forest on harvested sites suggest the occurrence of classical fragmentation / habitat loss effects (increased predation, nest parasitism, loss of species) in the TNF is unlikely at the range of proposed levels of timber harvest.

Habitat connectivity / corridors. A goal of the conservation strategy is to maintain connectivity between the various types of old-growth reserves [large, medium and small Habitat Conservation Areas (HCAs)] , riparian corridors and the beach fringe. While some species will probably use these corridors as travel routes, their degree to which they are required is unclear. In their review, Beier and Noss (1998) noted that the importance of corridors has not been conclusively demonstrated, in large part due to study design flaws, and suggest several approaches to better assess their value. Keister and Eckardt (1994) in their review of the viability assessment for the 1997 plan noted that corridors were virtually untested in practice. With (1999) noted that connectivity of the landscape is not uniformly important to forest vertebrates; its importance is determined by the degree to which the land surrounding a forest patch is “hostile”, and a species’ ability to cross a low quality habitat. Forest vertebrates vary widely in their “gap-crossing” ability. With also noted that habitat patches may be functionally connected by dispersal for species with gap-crossing abilities and suggested the provision of “stepping stones” rather than continuous strips of habitat (corridors). Similarly Bunnell (1999) noted that management for connectivity in the matrix could be accomplished with no more difficulty, more operational flexibility and probably less cost than designing effective corridors. McComb (1999) noted that quality of retained patches and ease through which wildlife can travel (permeability) of the matrix may be more important to animal movement and survival than the presence or absence of corridors. In their review of research to date Bunnell et al (1998) found no evidence that lack of connectivity is a threat to wildlife in Northwest forests.

Corridors probably are of greatest value for species with low capacity to move around or disperse(vagility). Price et al (2007) noted that hydroriparian corridors prescribed for the forests in the central coast and Queen Charlotte Islands have value in connecting headwaters, valley bottoms and estuaries. Species closely associated with streams (e.g. river otter, amphibians) will benefit from the riparian corridors recommended in the Tongass plan; for others like wolves and brown bears the value of corridors may be primarily in reducing human-caused mortality while dispersing, a concern that should be possible to address through hunting regulations and road management. While a number of the Management Indicator Species (MIS) will likely use these connections among their travel routes, their importance, and the degree to which they are required, will vary among species. Beach fringe and riparian zones provide a substantial level of landscape connectivity, as do legacy structures retained in harvest units and, in a relatively short time, the post-logging regenerating forest itself. **These plan features, coupled with the fact that greater than 50% of the forested area of the TNF is already in reserves, suggest the likelihood of insufficient connectivity is low, raising a question regarding the need for extensive HCAs for this purpose.**

Habitat Conservation Areas The biological complexity associated with the forest renders a species-by-species approach to conservation of limited application except for individual species of particular concern i.e., threatened or endangered, important to subsistence, invasive, etc.,. An additional consideration in conservation planning is to strive for representation of the various habitats present. The Tongass plan’s incorporation of both coarse and fine filter approaches is a logical strategy for this purpose. However in the implementation of the coarse filter strategies through the designation of large, medium and small Habitat Conservation Areas (HCAs) there is an inordinate level of emphasis placed on productive old-growth forest. Habitat capability models based on current information and current knowledge of biologists (best professional judgment) were used in the viability assessment of the 1991 Tongass plan and were the basis for the HCA approach currently proposed. It was noted that habitat capability and population numbers are not linked, since factors other than habitat affect populations, and it is not possible to determine whether an observed population reflects habitat change, prey densities or hunting / trapping effects (Appendix M – 1991 TLMP). The status of the 11 MIS considered for the viability analysis was relatively good, i.e. none were threatened or endangered. The six MIS chosen (Canada goose, wolf, brown bear, marten, Prince of Wales river otter and mountain goat) appeared to have healthy populations because they support sport and subsistence harvest. And the assumption used in the viability analyses that forest harvest effects were always negative and that they could not be avoided or mitigated through project level planning efforts overstates the influence of timber harvest and ignores potential unit design and silvicultural interventions known to improve habitat for many species.

Given the observations above regarding fragmentation, corridors and connectivity, and particularly in light of the fact that even alternative 7, which allows most timber harvest results in productive old-growth retention at levels considered highly likely to maintain biodiversity, **the need for additional old-growth reserves in HCAs can be questioned**. At the same time, the habitat values and contributions to biodiversity of managed forests are essentially ignored. From an overall wildlife diversity standpoint, is is well accepted that there are forest specialists associated with a particular seral stage or structural class of the forest, and others that are generalists occurring over a range of stages. Thus when harvest changes the seral stage there will be “winners and losers” with respect to habitat suitability. As a result of this relationship there will be a higher level of wildlife diversity associated with the habitats found in a forest of a variety of developmental stages. In the TLMP old-growth forest will continue to be the dominant seral stage, with timber harvesting creating younger stages of forest development contributing different habitats suitable for a different suite of species.

The emphasis on retention of old-growth in the plan also minimizes the role of disturbance and the resilience of the forest and wildlife in responding to it and largely ignores the other forested habitats including non-productive and low-volume old-growth. And, as pointed out above, the proposed coarse filter approach fails to recognize the contributions of the major areas of reserved lands outside the TNF to habitat for the management indicator and sensitive species that are the focus of the plan. From a distribution and representation perspective, a greater range of habitat features thought to be important to wildlife would likely be achieved if HCAs incorporated the range of forest conditions existing on the ground rather than a focus on high volume productive old-growth stands.

Implementation of the HCA strategy is intended to result in large and medium old-growth reserves (OGRs) distributed across the planning landscape. HCAs were designed based on the most restrictive requirements of species with large home ranges and for which there were some viability and distribution concerns. They were designed to provide for source populations of brown bear, northern goshawk, marten and wolf, and to provide refugia for dispersing animals.

The Forest plan designated 38 large, 112 medium and 237 small HCAs. About 3.5 million acres of productive old-growth are contained in OGRs, established by biogeographic province across the TNF and linked to areas of non-development. This distribution results in limitations to timber management over essentially all parts of the TNF. The need for this much forest reserve is questionable as discussed above, and in relation to individual wildlife species needs as discussed below, as its magnitude greatly exceeds what would be considered a low-risk strategy. The research reviewed in the fragmentation section above indicates that distribution on the landscape is secondary to the amount of habitat present, bringing in the question the values of HCAs in the context of the large amounts of old-growth habitat reserved. The wide distribution of OGRs has the effect of spreading the limited amount of timber harvest in the proposals across the productive old-growth portion of the TNF as well. Levels of timber harvest vary by alternative, ranging from a maximum of 30 to less than 10 % of the TNF supporting intensive or moderate development. Thus the area affected by timber harvest likely to occur is small, and would seem to present little risk to maintenance of viable wildlife populations.

The presence of pre-established HCAs has a large influence on where timber harvests will occur. Their wide distribution across the forest ensures widely distributed harvest units as well. As the features, including surrounding habitat conditions, of individual harvest units will vary, defining HCAs, particularly small ones, might more effectively address local habitat needs if done on a project-level basis.

Zoning as an option? Given the low level of risk, even at the highest level of timber harvest, **an approach which focuses this activity would better serve both the timber and wildlife interests**. Designating specific areas of productive old-growth, along with second-growth, for intensive forest management would add efficiency from both a resource extraction / economic perspective and an ecological one. (Bunnell 1996, Binkley 1997) Emphasis areas could be selected based on timber type, historic harvesting patterns, adjacency to existing reserves, habitat values, or other factors. On the timber side, harvesting would be facilitated, transportation costs reduced and silvicultural investments would be more likely to be effective. On the wildlife side, the disturbance and habitat change associated with timber harvesting would be confined to a smaller portion of the overall area. Appropriate protection requirements in these areas would include riparian buffers on fish-bearing streams, protection of habitat of threatened and endangered species if present, beach and estuary fringe retention. Retention of legacy structures (snags, down logs, green replacement trees) at levels and in locations compatible with timber harvest economics and worker safety could add habitat value in timber emphasis areas. Narrowing of the beach fringe to 500 feet and allowing construction of a limited number of narrow access corridors would greatly facilitate forest harvesting and subsequent management entries. The adverse effects associated with open roads would also be reduced through reduction of the size of the road network, and reduce entry into roadless areas. The resulting landscape of managed forests containing riparian corridors and interspersed old-growth forest elements will support a diverse wildlife population on a continuing basis, with wildlife community composition changing over time in response to forest development. While distribution of old-growth would change somewhat, the majority of the forested land base in the TNF would continue to consist of productive old-growth forest in reserve status as proposed in the TLMP.

The Conservation Area Design for the TNF proposed by The Nature Conservancy and Audubon Alaska embodies this kind of an approach by using Marxan software to identify and designate individual watersheds for conservation priority, integrated management and timber production. Congressionally-protected areas and private and other lands within the TNF are also identified. Land use allocations consider ecological values based on existing and historic conditions. This approach confers the advantages discussed above with regard to habitat change, timber operations and forest-wide biological diversity. The specific locations and values of core areas and amounts of timber harvest specified in Table 1 accompanying the Conservation Area Design map are not likely to be agreed upon by all parties, and result in retention of productive old growth forest at a level higher than that considered to present significant risk to ecological integrity. Thus while adjustments in harvest levels may warrant further discussion, the concept of spatially separating areas of ecological and economic emphasis, with a portion of the landscape integrating these values, could allow for rationally assigning timber and conservation priorities. (The Nature Conservancy and Audubon Alaska. 2007. Conservation Area Design map and accompanying description of map features for SE Alaska).

Coarse and fine filters / Management Indicator Species (MIS)

The conservation strategy uses Management Indicator Species (MIS), also referred to as umbrella species, which are the species considered to be most sensitive to loss of old-growth habitat, to represent a broader group of species of lower sensitivity to habitat loss. The approach assumes that if persistence thresholds of the umbrella species are not exceeded, then sufficient habitat should be present to meet the needs of the other old-growth associates. This concept may be applicable at the gross scale of "old-growth" forest but is not informative with regard to the habitat elements a particular species may be responding to, such as canopy openings, snags or down wood. Kremsater (2006) reviewed the work of Dykstra (2004) which examined literature on habitat thresholds and noted that attempting to associate species with amounts of old or natural forest is problematic, since species are not generally responding to age or "naturalness", rather they are responding to the mix and amounts of habitat elements and patterns encompassed by these broad terms. Thus while the assumption is for old-growth dependency, specific elements of that old-growth habitat are key to maintaining the species. The old-growth reserves resulting from all plan alternatives, including the timber emphasis, make up the vast majority of the forested land base and will provide for the presence of these key structural features as a means of maintaining associated wildlife species and mitigating the effects of the habitat changes that will occur through timber harvest.

The fine filter approach addresses the more specialized habitat requirements of species or communities whose needs are not met by the broadly applied coarse filter approach management (e.g. sensitive ecosystems, species at risk, species subject to hunting or trapping). The following section examines the importance of old-growth forests in meeting habitat needs of these species.

Habitat requirements of Management Indicator Species (MIS) and other sensitive species. The emphasis on old-growth retention in the plan is reflected in the selection of MIS, and other "umbrella" and sensitive species considered to be a greatest risk to loss of old-growth. The assumptions are that old-growth forests are critical, although research findings from SE Alaska and elsewhere indicate this is not the case with most of the species. It is also apparent that factors other than habitat (hunting, trapping) have major influences on population of several species. The question also arises as to whether these species would not be present with reduced levels of old-growth. In the TLMP, the high level of productive old-growth retention in all alternatives suggests that while distribution of some species may change in space and time, there is a low likelihood that species will be lost or reduced to levels of concern. Nevertheless, a review of existing information on habitat needs of these species may assist in understanding effects of plan implementation.

As noted above, it is often elements within the old forest that wildlife species are responding to, rather than simply old-growth, which in itself can be highly variable. Also separating habitat need from habitat preference can be difficult, but doing so better defines the degree to which the habitat in question, in this case productive old-growth forest, is critical. The habitat requirements of MIS, umbrella and Forest Service sensitive listed species and species of concern are discussed individually below.

Northern Goshawk – The status of the Queen Charlotte subspecies of Goshawk was reviewed by the US Fish and Wildlife Service (FWS) in 1995 and again in 1997 in response to a petition for its listing as a threatened species. Based on available information, including the fact that 75% of the productive old-growth forest considered important to the species was reserved under the 1997 forest plan (Brockman 2006), FWS concluded listing was not warranted at that time. Further appeals centering on the role of Vancouver Island as a significant portion of the range for the subspecies have stimulated another review which currently underway.

The Goshawk is classed as a sensitive species by the Forest Service. Proposed Habitat protection measures include long rotations and retention of low-elevation, high volume stands below 800 feet in elevations, with the levels of retention varying by alternative. In addition to the Standard and Guides for sensitive species, protection for goshawk and marten habitat is provided in the Legacy Forest Structure Standards and Guidelines which call for provision of legacy structure by retaining portions of each harvest unit. It is important to note that the peer review of the wildlife conservation strategy (Kiester and Eckhardt 1994) suggested not proposing connectivity leave-stands in harvest units until additional research is done and they are found to be needed. **The Legacy Forest Structure S&G were developed in the absence of the recommended research, thus the need for them and their value in providing connectivity has not been demonstrated.** Based on existing research information the expert panel assessments in 1997 concluded that while alternative 2 in the Forest Plan (comparable to 7 in the 2007 plan) had a low to moderate likelihood of maintaining viable, well-distributed populations, **there was a very low possibility of extirpation of goshawk from the Tongass, and a low likelihood that the goshawk would exist only in isolated refugia.**

Iverson et al (1996) in a conservation assessment for the Goshawk in SE Alaska noted that goshawks occur in a variety of habitats at the landscape scale (e.g., thousands of acres); some occur in landscapes dominated by productive old-growth forest, and others use landscapes dominated by scrub forest or clearcut lands. Goshawks observed in each of these situations reproduced successfully demonstrating their adaptability to a variety of landscapes. The observation that goshawks can successfully produce young in landscapes with moderate amounts of early seral forest stand structure was not unexpected because large-scale windthrow, an occasional disturbance event, creates essentially even-aged stands that may occupy hundreds of acres, and goshawks have either adapted to or can tolerate this disturbance regime. Despite wide variation in the size and habitat composition of goshawk use areas, 23 and 28 percent was the minimum proportion of productive old growth present in any breeding season use area for adult males and females, respectively.

Iverson et at (1996) also noted that Goshawks are not entirely dependent on only the productive old-growth forests included in the timber base. Productive old-growth forests not suitable or available for timber harvest (e.g., wilderness and riparian buffers) provide significant amounts of habitat. The abundance of these habitats that are not suitable or available for timber harvest differs among landscapes. Specifically, 46 percent of goshawk habitat use occurred in riparian buffers and other areas of productive old-growth forest stands unsuitable for timber harvest during the 100-year planning horizon under the current TLMP. These unsuitable for timber management acres of productive old-growth forest remain a permanent contribution to the old-growth habitat component across the landscape.

Availability of prey is also an important determination of goshawk habitat quality. Use of cover types by principal prey species ((Iverson et al 1996. Table 24) indicate that forest, riparian and beach fringe, permanent landscape fixtures under all Forest Plan alternatives, receive use by key prey species including Steller's jay, grouse and red squirrels at levels comparable to use made of high and mid-volume old-growth forest.

Other investigators have reported use of a greater variety of habitats than once thought. (Boyce et al 2006, Reynolds et al 2006 cited in DEIS).

Available information on Goshawk habitat selection patterns and habitat associations of principal prey species support the conclusion that extirpation is unlikely under the range of timber harvests proposed, since there is little evidence that unbroken old-growth forest is needed to meet habitat needs.
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American Marten. The marten's range in SE Alaska was expanded significantly in the past through its introduction to Baranof, Chichagof and Prince of Wales Islands (Burris and McKnight 1973 in Buskirk and Ruggiero 1994) Prey availability and harvest by fur trapping play significant roles in the population dynamics of this species. Flynn et al (2006) measured extreme fluctuations in populations in response to these 2 factors. Selection of den and resting sites is positively related to forest structure at the stand level (e.g forest cover and components that contribute to structural diversity such as large trees, snags and downed logs (EIS 3-204). Cavities in living or dead tree boles, logs or beneath the roots of trees and snag are used as maternal dens; root cavities beneath trees, snags and stumps are used as resting sites.

In the TLMP, old-growth forest at some level is considered essential habitat for marten, although several studies in Alaska and elsewhere suggest that younger forests containing key structural features support marten as well. Flynn et al (2006) showed that radio-collared marten used habitat ranging from non-forest and clearcut forest to large multi-storied stands, with a definite preference for the latter, probably in response to the increased availability of denning and resting structures. Telemetry observations documented marten use of some clearcuts 26-40 years of age on Mitkof Island where these clearcuts in general still contained a lot of understory forage and small mammals. Flynn et al (2006) Home ranges of the marten in the Mitkof study area were well-distributed across the matrix landscape, occupying 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.

Studies elsewhere indicate marten can utilize a range of habitats. Bunnell et al (1998) cited Magoun and Vernam 1986 and Johnson and Paragi 1993; both in Buskirk and Ruggiero 1994) who reported that when vegetation structure is complex and prey abundant, use of recently disturbed areas by American marten and fisher can be high. Buskirk and Ruggiero (1994) noted that coarse woody debris, especially in the form of large diameter boles, is an important feature of marten habitat, particularly for gaining access to subnivean areas and for resting. Bull et al (1997) also observed marten use of accumulations of down wood, which provided travel runways and now-free foraging and resting sites.

Marten display some flexibility in food selection as noted by Flynn et al (2006) in several study areas on the Tongass. The principal food of marten is rodents, however salmon carcasses became an important alternative food when rodents populations were low.

Available data suggest old forest is important habitat for marten, but that they will also utilize other habitats, including younger forests provided preferred structural features like large downed logs are present. Plan alternatives with the highest level of timber harvest retain up to 76% of productive old growth suggesting suitable marten habitat will continue to exist across the Tongass. Of more apparent importance to population levels is fur trapping which confounds interpretations of habitat need and which should be amenable to regulatory controls.

Sitka black-tailed deer. Habitat use and population status of deer on the Tongass is largely a function of forage availability and nutrition. The principal limiting factor to deer is considered to be deep snowfall which in some years affects both forage availability and its access by deer. **Forest-wide, plan alternatives are estimated to retain from 75 (alternative 7) to 83% (alternative 1) of the 1954 winter range habitat capability in 2105.**

Deer tend to be habitat generalists utilizing a variety of habitats in all seasons, including low-snow winters. Clearcutting typically results in an abundance of deer forage during the period between harvest and canopy closure, the length of which varies with site characteristics and stem density of the regenerating forest. The depauperate understories that follow are believed to persist for >100 years. Hanley (2005) noted several important deviations from that view; 1) red alder-conifer even-aged stands produce species-rich and high-biomass understories comparable to old-growth stands and much greater than similar-aged conifer stands, 2) commercial thinning of older, even-aged stands may result in much greater understory biomass, and 3) extrapolation of data from small scales of research plots to large scales of timber-management stands tends to greatly overestimate stand homogeneity and underestimate understory biomass of even-aged conifer stands. As a result of past disturbance and physiographic variation associated with slope, aspect, soil condition, and other factors, old-forest stands on the Tongass were variable in structure. While the projections are that the long-lasting stem-exclusion stage of forest development, with its limited understory development, will be the case following timber harvest, it is likely that second-growth stands will also vary in structure in response to these factors and not all young-growth stands will exhibit the stem-exclusion characteristics.

Hanley (2006) further discussed deer habitat relationships in relation to forest management on the Tongass in conjunction with an update of the Conservation strategy. He noted that thousands of acres of young-growth forest are approaching the time where they can be harvested commercially and that opportunities exist for improving even-aged, young-growth stands with timber harvest. Options include judicious placement (landscape pattern) of limited clearcuts, partial cutting with various patterns of retention, commercial thinning and combinations of these tools. Precommercial thinning can prolong the period of abundant forage post-logging. Hanley (2006) noted that wildlife Conservation Reserves (e.g., beach fringe, riparian buffers) offer some of the highest potentials for habitat improvement and that cutting there must be done to benefit wildlife habitat foremost. With regard to precommercial thinning, thousands of acres would benefit from treatments which include options like age of treatment, spacing, pruning, multiple entries, planting alder etc.,. but that data are very few and quantitative guidelines are even more rare. The Tongass-Wide Young-Growth Study (TWYGS) currently underway is expected to provide strong data on results of experimental silvicultural treatments and potential applications for management.

Additional studies indicate that silvicultural treatments can have significant effects on forage availability in young stands. McClellan (2006 Cons. Strategy review) presented study findings demonstrating significant increases in deer forage plants in responses to thinning and thinning and pruning treatments. Doerr et al (1995) noted that most clearcuts 20-46 years of age in their Mitkof Island study area had been precommercially thinned and contained considerable understory forage. While use of clearcuts was reduced during the deep snow winter of 1998-99, some use of clearcuts was made, also noted by Doerr and Sandburg (1986) in precommercially thinned clearcuts on Big Level Island following the deep snow winter of 1981-82.

Older forests benefit deer by providing a source of available forage during deep snow periods through canopy interception. In a study carried out on Mitkof Island, Doerr et al (2005) observed that stands selected by deer in a deep snow winter (1998-99; snowfall 43% above normal) included south aspects below 500 feet and within 1000 feet of the saltwater, likely due to the maritime influence on snow depth. Medium and high volume stands were preferred by deer. In a mild winter deer utilized all available habitats.

While old forests are important in deep snow winters, A number of the characteristics of snow in a particular winter will have a large influence on the degree to which older forests are important. Snowfall accumulations will vary with location and topography. Snow tends to come and go and often persists for relatively short periods, particularly in low-elevation areas with maritime climates. . Doerr et al (1995) observed that relatively warm maritime storms that originated from southerly directions played a major role in dissipating snowpack on Mitkof Island. Temperatures average 32 degrees Fahrenheit in SE Alaska, with warmest winter temperatures along the coast. Hennon and Shaw (1997 – EIS 3-11) note that winters have become warmer in recent years, reducing the snowpack in low-elevation areas.

While deep snow winters cannot be predicted, historically they are an infrequent occurrence. In a somewhat similar climatic area on Vancouver Island, levels of heavy snowfall and prolonged deep snow depths which concentrated deer in timber stands in the winter of 1972 (Bunnell and Jones 1984) were not observed again for over 20 years. Similar intervals between deep snow events apparently occur in SE Alaska (Owen Graham pers.comm., April, 2007) who noted G. DeGayner's observation that the mild snow years which occurred for a decade resulted in abundant food, i.e. deer, for wolves on Mitkof Island. The discussions of the Sitka Black-tailed deer expert panel convened in 1995 noted high variability in snow depths in SE Alaska. Similarly the peer review (Kiester and Eckhardt 1994) expressed concern about using a mean value for snowfall in the deer habitat capability model when there is considerable variation from north to south.. With infrequent occurrences of winters with deep and persistent snow, that are variable in location across the Tongass, widespread deer losses are unlikely. While other factors such as hunting mortality and predation are obviously important, in the event of severe winter losses, the reproductive potential of black-tailed deer should support relatively rapid population recovery.

For the reasons discussed above, **the likelihood of long-lasting declines in deer populations under all forest plan alternatives appears to be low. The potential for silvicultural treatments to improve forage conditions in current and future young stands is high.**

Alexander Archipelago Wolf. The DEIS (3-207) lists current mortality rates from hunting and trapping and long-term reductions in deer habitat capability as principal concerns associated with maintaining well-distributed and viable wolf populations. It is clear that Sitka black-tailed deer are a key element in the diet and affect population status of wolves. The application of hunting regulations tailored to deer population sizes and the utilization of silvicultural prescriptions which help prolong the period of high forage production in harvest units will contribute to maintaining deer population as discussed above. The other major influence, trapping and hunting of wolves, is likely of greater significance to wolf numbers. A frequent comment among peer reviewers was the need for hunting and trapping quotas regularly adjusted for population sizes of several of the old-growth associated species covered in the plan, including wolves.(Kiester and Eckhardt 1994). Maintaining open roads at low densities through access control is important to regulation of human-caused mortality. Person (2006 – Conservation Strategy review) noted the importance of road access to legal and illegal kill of wolves as well as the need to maintain high quality deer habitat within and outside of non-development lands.

Wolves in other locations show positive population responses when human-caused mortality is eliminated or reduced. While a number of factors differ from SE Alaska, including higher human densities and more highly modified landscapes, re-introductions have resulted in recovery of wolf populations in several areas of the intermountain west (ID, MT, WY). Recovery is largely attributed to the protection afforded by the Endangered Species Act and has resulted in US Fish and Wildlife Service proposals for delisting the species in these areas as well as Minnesota. (US Fish and Wildlife Service 2006).

Brown bear - While it does not speak to distribution and overall population levels, the 1997 forest plan determined that designated Wilderness and LUD II areas would essentially ensure brown bear persistence somewhere in SE Alaska during the 100-year planning horizon. The DEIS for the proposed plan (3-206) indicates **Alternative 7, which has the highest level of timber harvest, would have a moderately high relative likelihood of maintaining well-distributed, viable brown bear populations, with some potential for the development of temporary gaps in distribution, due to the reduction in the reserve system.** The major concern was the potential for reductions in the amount of roadless refugia important to limiting bear-human interactions.

Anadromous fish are a key component of the brown bear diet, making maintenance of productive streams an important factor in maintaining population viability. In addition to riparian buffers designed to protect water quality, fish and other aquatic resources, 500 foot no-harvest buffer zones are required around important brown bear foraging sites. Open roads are a concern with regard to human-bear interactions, although high bear populations are present on several islands (Chichagof, NE Chichagof, North Kruzof – DEIS 3-207) with relatively high road densities. A study currently underway on Chicagof (Flynn - 2006 Conservation Strategy review), comparing brown bear numbers and resource use patterns in relation to riparian management demonstrates the close association of brown bear with salmon-bearing streams, and supports the need for buffering of all salmon streams. **Within the context of the large amount of productive old-growth (76% under alternative 7), the combination of riparian protection and access control to limit human-bear interactions and illegal harvest, coupled with carefully regulated hunting, appear to be key elements in the approach to conservation of brown bear.** Although it is a different ecosystem, grizzly bear populations in the greater Yellowstone area of the intermountain west have recovered to the point that they have reached or exceeded recovery goals and the US Fish and Wildlife Service has proposed delisting the species. The Greater Yellowstone Area crosses the borders of Idaho, Montana, and Wyoming. Its 18 million acres (7.3 million hectares) encompass Yellowstone and Grand Teton National Parks, six national forests, two national wildlife refuges, Native American reservations, and assorted private properties. Major factors contributing to the improved status include a reduction in human-caused mortality through additional regulation, interagency cooperation and habitat protection (US FWS 2007 www.fws.gov/species/mammals/grizzly).

Endemic mammals. Fourteen species or subspecies endemic to SE Alaska were evaluated in the 1997 forest plan. Ranges of these species are restricted to a subset of the islands in SE Alaska. To eliminate potential risk to these species from habitat loss or alteration, all islands 1000 acres or less in size were eliminated from the timber base. Beach fringe and riparian corridors and old-growth reserves are considered to provide functional habitat for species with relatively small home ranges. These features are included in all alternatives except 7, which does not include the old-growth reserves. Expert panel assessments in 1997 considered risk of extirpation to be directly related to amount of timber harvested, thus alternative 7 would have a low likelihood of sustaining viable, well-distributed populations of endemic small mammals over the long term.

Following implementation of the 1997 forest plan several studies investigated habitat relationships of small mammals, with most research focused on the northern flying squirrel and the southern red-backed vole. Results were somewhat variable, and not always consistent with assumptions used in the plan. For example the northern flying squirrel was observed to be less dependent on old-growth forest due to relatively high habitat suitability of non-commercial, low volume, mixed-conifer forest, while precommercially-thinned young growth forest had high suitability for the southern red-backed vole (Hanley et al 2005). Smith et al (2005) also noted that flying squirrel habitat in SE Alaska does not reflect emergent properties of old-growth forests. In earlier work (Smith et al 2004) noted that redbacked vole captures were positively correlated with the percent cover of deciduous shrubs in the understory and that the species may be able to persist in patches where the overstory has been removed.

Information on habitat relationships of the endemic mammals is limited; the 1997 plan panel assessments emphasized that just being an endemic represented a viability risk and that all alternatives had some likelihood of causing extirpation of endemic species and that this likelihood increased with higher levels of proposed harvest. Additional study is needed to better define these relationships, including the effect of the maximum reduction of about 25% of the productive old-growth forest under plan alternatives.

Marbled murrelet. Populations of this species listed as federally threatened in the lower 48 and in Alaska as a USFWS species of concern are considered to be stable in Alaska (Kirchoff 2006, Conservation strategy review). Degange (1996) reported that marbled murrelets are broadly distributed across marine waters throughout southeast Alaska and are abundant, numbering at least in the low hundreds of thousands. Marbled murrelets are believed to be at increasing risk in biogeographic provinces of the Tongass National Forest subject to extensive harvest of old-growth forests, on which they are believed to be dependent for nesting. Over the short term, risk to their persistence in the Tongass National Forest seems low; however, gaps in their nesting distribution likely will occur in some biogeographic provinces if the Tongass if current forest harvest practices are continued over the long term (Degagne 1996). In the Pacific Northwest Raphael (2007) reported that populations appear stable as determined in at-sea surveys and that they correlated with the amount of higher-suitability older forest habitat present on the adjacent mainland. Fifty to 90 percent of older forest habitat in PNW coastal forests has been lost to logging and development, with about 2.0 million acres remaining on federal lands, 90 percent of which is in reserves. This contrasts with the situation in Alaska where Piatt and Ford (1993) estimated there were at least 160,000 murrelets, most of which are concentrated in the Alexander Archipelago, Prince William Sound, and the Kodiak Archipelago. **Given these population levels and the amount of old forest suitable as habitat that is retained under all alternatives, it appears unlikely that marbled murrelet populations will be at risk due to habitat loss.**

Bald eagle. The retention of the beach fringe where timber harvest occurs is a feature of all plan alternatives and should result in negligible risk to bald eagles since 90% of nests are within 50 feet of the saltwater beach (DEIS 3-209) and large amounts of shoreline forest are included in other reserves. The selection by eagles of nesting sites in close proximity to the beach makes it unlikely that reduction of the beach fringe reserves to 500 feet as proposed in alternative 7 will confer significant risk to eagle populations. The recovery of bald eagle populations in the Pacific Northwest, here the degree of disturbance is much greater and potential nesting sites much fewer than in Alaska, has led the US Fish and Wildlife Service to propose delisting the species.

Resident and breeding birds. Species in this group utilize legacy elements of the old-growth forest (snags, large trees) to meet nesting and foraging habitat requirements. The level of habitat protection for this group is considered to be directly related to amount of old forest in reserves (DEIS 3-210). As with several other species, the range of alternatives will result in 76 to 88 % of the productive old-growth remaining in 100 years. While there may be local shifts in distribution, it is unlikely that any of the species in this group will be at risk of major population declines. As noted earlier, timber harvest will create habitat conditions suitable for a number of other species, resulting in higher species richness on the landscape scale.

Summary The Conservation Strategy is clearly a conservative approach, and calls for levels of productive old-growth retention in excess of those that should present a very low risk to the maintenance of biodiversity and wildlife on the Tongass National Forest. Old-growth retention levels exceed those applied on Federal lands elsewhere in the west, without considering the contribution of other reserved lands on the Tongass and other lands in SE Alaska. It seems likely that with attention to distribution of future timber harvests relative to levels and patterns of past harvest and in relation to location of existing reserves, and through broader application of silvicultural practices such as pre-commercial and commercial thinning, ASQs greater than those specified in current plan alternatives could be achieved without significant risk to biodiversity and wildlife.

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