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United States Department of the Interior

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Memorandum

To: Assistant Regional Director, Ecological Services, Portland, Oregon (Attention: Larry Salata)

From: Manager, Western Washington Office, Lacey, Washington

Subject: Biological Opinion (1-3-01-FR-2099), Following Reinitiation of Consultation for the Proposed Amendment of th Incidental Take Permit (PRT-808398) for Plum Creek Timber Company (FWS Reference: 1-3-98-FR-0357; X-Reference: 1-3-96-FW-190), to Include Canada Lynx (*Lynx canadensis*), King and Kittitas Counties, Washington

This memorandum constitutes the U.S. Fish and Wildlife Service's (FWS or we) Biological Opinion (BO) on the proposed amendment to the section 10(a)(1)(B) Incidental Take Permit (ITP or permit) previously issued to Plum Creek Timber Company (Plum Creek). This BO follows reinitiation of consultation, in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1536 et seq.) (Act). The extant ITP and this proposed amendment are based upon Plum Creek's Habitat Conservation Plan (HCP) (Plum Creek 1996) and Implementation Agreement (IA) (Plum Creek et al. 1996). The reinitiation of consultation and this subsequent BO are for our proposed action of amending the subject ITP, in order to address the potential effects of adding the Canada lynx (*Lynx canadensis*) (lynx) to ITP PRT-808398. The IA between Plum Creek, the FWS, and the National Marine Fisheries Service (NMFS) included unlisted species provisions for all vertebrate species that may be found in the HCP Planning Area ("Planning Area"; Plum Creek's lands and surrounding public/private lands within the larger action area). At the time of initial Permit issuance, it was assumed that consultation would be reinitiated prior to adding any additional (listed) species to the ITP. Lynx is a newly listed species. This BO assesses whether the proposed addition of the lynx to the ITP is likely to jeopardize the continued existence, or destroy or modify the critical habitat, of any listed species.

We have also considered whether the proposed action of adding the lynx to the ITP is likely to adversely affect the northern spotted owl (*Strix occidentalis caurina*), a federally listed threatened species; the marbled murrelet (*Brachyramphus marmoratus marmoratus*), a federally

listed threatened species; the grizzly bear (*Ursus arctos = U.a. horribilis*), a federally listed threatened species; the gray wolf (*Canis lupus*), a federally listed endangered species; the bald eagle (*Haliaeetus leucocephalus*), a federally listed threatened species; the Columbia River Distinct Population Segment (DPS) of bull trout (*Salvelinus confluentus*), a federally listed threatened species; and the peregrine falcon (*Falco peregrinus*), a former federally listed endangered species. We have concluded that the proposed action of adding lynx to the existing ITP would not affect any of these species.

We are unaware of any significant changes in circumstances or actions that may have occurred since completion of the BO dated June 24, 1996, for Plum Creek's HCP (ITP PRT-808398), with respect to these species. Additionally, we are unaware of any significant changes in circumstances or actions that may have occurred since the consultation reinitiations and resulting BOs completed on July 13, 1998 (USFWS 1998), for addition of the Columbia River DPS of bull trout, December 22, 1999 (USFWS 1999), for modification of the HCP to accommodate a land exchange, and for addition of the Puget Sound/Coastal DPS of bull trout (*Salvelinus confluentus*) to the subject ITP.

No critical habitat is currently designated or proposed in the Plum Creek HCP Project Area (lands owned by Plum Creek per the subject ITP, within the larger Planning Area and even larger action area). Within the action area (all areas to potentially affected directly and indirectly by the ITP action considered), critical habitat has been designated for the northern spotted owl and marbled murrelet on lands adjacent to Plum Creek's ownership. Potential effects to critical habitat were analyzed as part of our 1996 and 1998 BOs associated with the original Plum Creek HCP/ITP, and the 1998 amendment. No effects to critical habitat for any species are anticipated as part of the proposed action of adding lynx to the subject ITP.

CONSULTATION HISTORY

A complete description of the consultation history is contained in the original June 24, 1996, BO (USFWS 1996a), some of which is repeated below for convenience.

On December 20, 1994, we determined that the listing of the lynx as threatened or endangered was not warranted. We found that "the petition to list did not present substantial information that the southern Rocky Mountain population of the lynx meets the definition of a "species." In addition, we could not substantiate that the continued existence of the lynx was threatened by trapping, hunting, poaching, and present habitat destruction (59 ***FR*** 66509). We stated that we did take into account those efforts being made by state and federal agencies to protect the species. Following a series of court opinions and FWS decisions, a settlement was reached between the FWS and the group Defenders of Wildlife on February 12, 1998, to finalize a proposed rule by June 30, 1998, to list the lynx in the contiguous United States.

Consultation on the original HCP action was initiated on February 13, 1996. As part of this consultation, we conducted an Unlisted Species Assessment (USFWS 1996b); this assessment is an analysis of effects on unlisted species, including lynx, from implementation of the Plum Creek

Interstate-90 HCP. On June 27, 1996, we issued an ITP (PRT-808398) to Plum Creek, pursuant to section 10(a)(1)(B) of the Act. That permit authorized the incidental take of the northern spotted owl, marbled murrelet, grizzly bear, and gray wolf, in the course of the otherwise legal forest-management and related land-use activities in portions of King and Kittitas counties, Washington. Pursuant to the HCP and the IA, Plum Creek received assurances that then-unlisted vertebrate species would be added to the permit upon listing under the Act, if doing so were consistent with the IA.

On July 8, 1998, we proposed to list the lynx range-wide within the conterminous 48 states as threatened (63 ***FR*** 36993). The final rule for listing the lynx was originally scheduled for completion within one year of the July 8, 1998, proposed rule. We extended the listing deadline by 6 months to allow the public to provide additional comments to us. On August 7, 1998, Plum Creek requested that lynx be added to their permit. On March 24, 2000 (65 ***FR*** 16052), we listed the contiguous United States DPS of the lynx as threatened, pursuant to the Act. The listing became effective on April 24, 2000.

On June 25, 1999 (64 ***FR*** 34216), we gave public notice that Plum Creek had requested the addition of Puget Sound/Coastal bull trout and lynx to their existing permit. The addition of lynx is the subject proposed permit amendment. We will respond to public comments on this proposed amendment in our Reassessment of Section 10 Findings document.

On December 22, 1999, we completed formal consultation on separate modification of the subject HCP and ITP. The Interstate-90 Land Exchange Act (105 P.L. 277 (112 Stat. 2681-326), Title VI, §§ 601-612 (1998)), as amended by the Interior Appropriations Bill, November 1999 (H.R. 2466 – amendment number 1630), resulted in a decrease of Plum Creek ownership within the Planning Area, but a slight increase in Plum Creek ownership within the Green River (west side of the Planning Area).

This BO is based upon: information contained in our 1996 BO for the original Plum Creek permit; the previous BOs on amendments to the subject HCP of July 13, 1998, December 22, 1999, and other information cited later in this document and listed in the Literature Cited section. This BO also incorporates by reference portions of the final documents associated with the original Plum Creek section 10 application package. Additionally incorporated by reference are the December 1999 "Biological Assessment of the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx"; the February 7, 2000, "Canada Lynx Conservation Agreement" of which the U.S. Forest Service (USFS) and the FWS are signatories; the January 2000 "Canada Lynx Conservation Assessment and Strategy" (LCAS); and "Ecology and Conservation of Lynx in the United States" published in 2000 (Ruggiero et al. 2000), hereafter referred to as the "Lynx Science Report". In addition, information in our files, including but not limited to information related to the proposed and final rules for lynx were also considered.

BIOLOGICAL OPINION

It is our biological opinion that the proposed action of adding lynx to Permit PRT-80839 is not likely to jeopardize the continued existence of lynx. It is also our biological opinion that the proposed action is not likely to result in destruction or adverse modification of critical habitat for any species.

DESCRIPTION OF PROPOSED ACTION

We propose the addition of lynx to existing Permit PRT-808398. Plum Creek was issued a permit authorizing incidental take of the northern spotted owl (spotted owl), marbled murrelet, grizzly bear, and the gray wolf under Section 10(a)(1)(B) of the Act on June 27, 1996. At that time, the FWS and NMFS signed an IA with provisions to conserve currently unlisted fish and wildlife species that may be associated with habitats on Plum Creek's properties in the Planning Area. The IA provided that Plum Creek may request that these species be added to the permit, should any of them be listed in the future. In such an event, we would reinitiate consultation, and make a determination that the species may be added, that additional mitigation be required from Plum Creek before such species may be added due to extraordinary circumstances, or that the species cannot be added because to do so would violate section 7(a)(2) of the Act (i.e., it would jeopardize the continued existence of any endangered or threatened species).

Pursuant to the HCP and IA that were developed and finalized as part of their 1996 permit application, Plum Creek committed to specific management directions for its lands within the Planning Area. The term of the HCP and the extant permit are 50 to100 years. Some aspects of the HCP and IA may terminate at year 50 (Phase I), while others (Phase II) may continue for an additional 50 years. The HCP and IA allow for the possibility of early termination of the permitted activity by the applicant subject to the permit condition requiring that any past incidental take of listed species has been sufficiently mitigated prior to termination. Other provisions for revocation or amendment by the FWS or NMFS, are included in the IA, including a provision for termination of the HCP due to a material violation of the HCP with respect to any unlisted species.

Covered Area and Action Area Location and Description

Plum Creek's ownership within the Planning Area is located both east and west of the Cascade Mountains crest along the I-90 corridor in central Washington, approximately 100-160 kilometers (60 to 100 miles) east of Seattle. In selecting the geographical boundaries (Planning Area) for implementation of the HCP (HCP Figure 1), Plum Creek considered the then-proposed Growth Management Act zoning in King and Kittitas counties, the potential use areas of the species to be covered, and the anticipated future activities that might result in incidental take of the species proposed for coverage. Plum Creek's lands in the Planning Area incorporate portions of 11 Townships on the western slopes of the Cascade range, and 19 Townships on the eastern slopes of the Cascade range (HCP Appendix 1). The Project Area consists of 60,060 hectares

(148,300 acres) Plum Creek's ownership in the I-90 corridor of the central Cascades Mountain Range in Washington.

For purposes of consultation under the Act, "action area" is defined at 50 CFR 402 to mean "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Although the proposed activities (that would potentially cause effects to listed and other covered species) are restricted to the area owned by Plum Creek and covered by the ITP (the Project Area; the area subject to direct effects of the action), the indirect effects of these actions on these species extend beyond this area. For purposes of this consultation on lynx, we have defined the action area to include: 1) the Project Area; 2) adjacent and interspersed federal, state, and private lands, described as the Planning Area in the HCP and herein; 3) areas outside the HCP Project Area or Planning Area where movement or presence of lynx would potentially be indirectly affected by project actions (for example, disruption or enhancement of a corridor or linkage for lynx movement across the project area between affected adjacent lands).

The subject ownership of Plum Creek (Project Area) occurs in a "checkerboard" pattern in an area commonly referred to as the I-90 Corridor. The outer boundaries of the Planning Area as analyzed in the HCP encompass approximately 170,000 hectares (419,000 acres); because of the checkerboard configuration of land ownership, the area includes 109,600 hectares (270,600 acres) of other ownership beside Plum Creek.

The action area is the Cascade Mountains of central Washington. More detail on the action area is provided in the Environmental Baseline below.

Covered Activities

This proposed ITP amendment would only authorize incidental take of lynx in connection with those aspects of commercial forest management and other uses specifically considered in the HCP. These activities include timber harvest (cutting, felling, experimental silviculture, limbing, yarding and yarding corridors, construction and use of landings, loading and hauling); road construction, maintenance, decommissioning, and administrative and commercial road use; road access; site preparation including slash and residual treatment (including use of fire); firewood cutting; planting; fertilizing; brush control; fire and erosion control; thinning and pruning; administration and monitoring; surveying, conducting stand examinations and inventory, and cruising timber; painting or marking of timber or stand boundaries; entry by silviculturalists, wildlife biologists, foresters, management, enforcement, and other personnel for miscellaneous activities such as assessments, land surveys, and general reconnaissance; and other activities substantially related to the conduct of the timber-management program and required actions of the HCP (e.g., research). Also included are use of gravel pits and rock quarries as necessary for forest management; and administration and maintenance of all existing (as of 1996) buildings, radio towers, and associated telecommunication facilities; and ecosystem-based forest planning on 60,060 hectares (148,300 acres) of Plum Creek's ownership in the I-90 corridor. Recreation is not a covered activity.

Summary of HCP Actions

The most important HCP commitments by Plum Creek relative to lynx are to provide specific amounts of forest stand structural classes and specific covered species "habitat types." As specified within the HCP, timber harvest and road construction must be consistent with maintaining those stand or "habitat levels." In general, the HCP does not make silvicultural prescriptions outside of some minimal leave-tree requirements and relatively few situation-specific standards and guidelines pertaining to special habitats, such as strict limitations to activities within the riparian zones. It is a programmatic-style plan. No predictions of the number of hectares (acres) to be treated per decade are made in the HCP because the HCP and our permit do not limit the amount of timber harvest in uplands so long as the required conditions are met.

Individual management units are not scheduled for harvest at any particular time and individual road locations and management are not specified. The HCP focuses on management associated with timber production and associated roads as the primary landscape-influencing factors, as well as the factors with generally the most influence on covered species in action area. As long as Plum Creek's activities are consistent with the HCP, the permit provides a mechanism to authorize incidental take of listed species under section 10 of the Act. In addition, under the HCP, Plum Creek is required to comply with State Forest Practices Rules and Regulations throughout the ITP period. However, Washington Administrative Codes 222-16-080-7(a) and other state regulations exempt activities covered under an HCP from the similar provisions of state regulations.

Silvicultural Methods

By definition, even-aged harvest methods include clearcuts, seed-tree harvests (in which 49 or fewer trees per hectare (20 or fewer trees per acre) remain after harvest), and overstory removal (where more than 12,350 board feet per hectare (5,000 board feet per acre) are removed and fewer than 123 trees per hectare (50 trees per acre) at least 3 meters (10-feet) in height remain after harvest). Shelterwood regeneration harvest is also considered by the State of Washington to be an even-aged harvest method when 49 or fewer dominant, vigorous trees per hectare (20 per acre) remain after harvest. However, Plum Creek's policy when using the shelterwood method is to leave more than 49 trees per hectare (20 trees per acre). As such, the shelterwood method used by Plum Creek is considered, under State definition, an uneven-aged harvest method.

Plum Creek will use even-aged and uneven-aged harvesting techniques in its ownership in the Cascade range. In 1994, Plum Creek used even-aged harvesting techniques in approximately 17 percent of its harvest operations east of the Cascades crest, and in about 65 percent of its operations west of the Cascades crest.

Even-aged harvesting, particularly clearcutting, is a widely used form of timber harvesting on the west side of the Cascades. These harvesting techniques favor tree species, such as Douglas-fir,

which grow best in open conditions with full sunlight. On the east side of the Cascades, where arid conditions prevail and stand structure and species composition are more varied, uneven-aged techniques, such as shelterwood, overstory removal, and selective harvesting, are more common. Even-aged harvesting will also be conducted on the east side where Plum Creek determines it to be appropriate.

Shelterwood harvesting and other uneven-aged techniques favor shade-tolerant trees such as western hemlock. Under standard silvicultural practices, shelterwood prescriptions will usually followed by a shelterwood-removal harvest (subsequent removal of shelterwood trees), 10 to 20 years following harvest and successful regeneration. However, because of Plum Creek's HCP commitment to its Environmental Principles, trees are left on site until the next harvest rotation.

Overstory removal involves harvesting trees that comprise the upper canopy layer to encourage rapid growth of trees in the understory, creating an even-aged stand. By selectively removing or leaving large, scattered, mature trees, overstory removal can be used as an cost-effective uneven-aged harvesting method.

Plum Creek will conduct variations on the standard silvicultural methods where necessary for site-specific objectives, such as to maintain structural diversity. To achieve this objective, Plum Creek will leave not only dominant, vigorous trees, but also leave trees with a variety of species, diameters, and vigor classes (i.e., dead and dying trees) to retain some structural diversity. Except where noted, trees counted by Plum Creek as remaining after harvest will be those trees at least 10 inches in diameter at breast height and have at least the top one-third of the stem supporting green, live crowns.

Plum Creek will leave representative trees, either individually or in clumps within the harvest units (outside of riparian buffers), to provide for wildlife. As mentioned earlier, unlike seed-tree or shelterwood harvesting techniques done elsewhere, trees are left on-site until the next harvest rotation. Regeneration is accomplished primarily through planting.

Harvesting Methods

Per the HCP, timber falling contractors are required to: (1) avoid yarding downed logs through streams; (2) refrain from causing soil erosion or degradation of side slopes; (3) mitigate impacts to natural resources; (4) comply with special conditions (i.e., trail protection or visual sensitivity); and (5) maintain a cost-effective production level while meeting state and federal safety guidelines. In addition, Plum Creek ensures that riparian buffers will be maintained along some smaller, nonfish-bearing streams which normally do not require protection under state law. Trees are also left standing in designated Upland Management Areas, as wildlife reserves and green recruitment trees, and for visual buffers, green-up strips, and wildlife corridors.

Current State Forest Practices Rules and Regulations adopted in 1992 stipulate that, as a minimum in eastern Washington, two wildlife reserve trees (i.e., defective, dead, damaged, or

dying trees which provide or have the potential to provide habitat for wildlife species dependent upon standing trees), two green recruitment trees (trees left to become future wildlife reserve trees), and 5 downed logs shall be retained for each hectare (2 per acre) harvested. Plum Creek will exceed these standards.

Stand Maintenance

Stand maintenance or vegetation management is important in commercial seedling establishment and involves the control of vegetative competitors. Vegetative competition for light is a major contributor to seedling mortality and growth in western Washington, whereas strong competition for moisture is a major cause of seedling mortality in eastern Washington.

Plum Creek will use traditional means of treatment including aerial and ground application of herbicides or mechanical cutting techniques to control competing vegetation. Newly established trees are inspected for several years following planting to ensure that the growth of trees is not impeded by vegetative competitors. However, Plum Creek has committed to minimize its use of herbicides, and spraying is prohibited in riparian areas. During the period 1990 through 1994, herbicides were applied to less than 280 hectares (700 acres) annually, less than one percent of the total 68,517 hectares (169,177 acres) of Plum Creek's ownership at that time. The use of herbicides in site preparation and in stand release within the HCP Planning Area remains low compared to typical industry use, because:

1. High utilization of harvested material supports rapid reforestation prior to the establishment of potential competing vegetation;

2. Use of high-function seedlings and seedling handling and planting techniques for reforestation ensure high survival and rapid establishment of seedlings;

3. More uneven-aged and partial harvests are conducted which do not require as much site preparation and replanting following harvesting, thereby reducing the need to use herbicides or other measures to control vegetative competitors;

4. Use of uneven-aged and partial harvests (common east of the Cascade Crest) increase costs and reduce the effectiveness of spraying herbicides as a result of the snags and large, standing timber's potential to interfere with aerial application;

5. Plum Creek exceeds State Forest Practice Rules and Regulations by prohibiting spraying in riparian areas, and by not allowing spraying within 30.5 meters (100 feet) of water bodies;

6. Herbicides are used primarily on highly productive sites, at lower elevations. Because of decreased vegetative competition at higher elevations, herbicide use is reduced;

7. All herbicides used are registered for forest use by the Environmental Protection Agency; and

8. The Washington State Forest Practices Board has adopted regulations regarding the handling, storage, and application of forest pesticides and herbicides. Requirements of these regulations are incorporated into the HCP as minimum standards.

Road Building and Maintenance

As committed to in the HCP, all roads to be constructed by Plum Creek will located to minimize impact to the landscape and to facilitate forest-management activities. Almost all roads will be designed as single lane, with occasional turnouts. Typical road-construction techniques will include installation of a 15-foot subgrade with a 2-foot drainage ditch. Nearly all roads are underlain with small-diameter rocks to enhance all-weather use. The typical running (driving) surface width for roads is 12 feet. Roadway grades are typically less than 15 percent with occasional variances determined on a site-by-site basis.

Please see our 1996 BO, the HCP, and the IA for more specific information regarding covered activities.

HCP Mitigation Measures

"Mitigation measures" include actions taken by Plum Creek to avoid, minimize, and mitigate impacts to species addressed in the HCP. These actions include management actions as well as actions to monitor and address impacts during implementation of the HCP. We considered herein only the mandatory measures and elements of the HCP in our evaluation of mitigation and resulting impacts. Measures contained in the HCP to monitor and mitigate for impacts to listed species, as well as unlisted species, are described in the 1996 BO, pages 4 through 11.

Within the subject HCP, Plum Creek has committed to maintaining specified proportions of forest structural stages (generally equivalent to stand age classes) across the Project Area throughout the term of the HCP. Some of these structural stages partially relate to potential lynx habitat/life history needs, as analyzed below in Effects of the Action.

During the permit term, at least 69 percent of the Project Area will be maintained in forest stand structural stages ("young forest", "pole timber", "dispersal forest", "mature forest", "managed old growth", or "old growth"; see Figure 31c of the HCP); these stages are expected to function for lynx dispersal (please see Status of the Species below) during the ITP period. These areas consist of forest stands above 460 meters (1,500 feet) elevation, and the following forest structural stages (please see Table 31C in the HCP): Young Forest, Pole Timber, Dispersal Forest, Mature Forest, Managed Old Growth, and Old Growth.

At least 30 percent of the Project Area above 920 meters (3,000 feet) elevation will be maintained by the applicant through normal forest practices as forest stand stages of "young forest" or "pole timber" (see Figure 31c of the HCP) at any time during the permit term; these two structural classes best approximate potential foraging habitat for lynx (vegetatively suitable for snowshoe hare, lynx's primary prey) when found above 920 meters (3,000 feet) elevation. Note: It is undetermined what proportions of these stands would remain unthinned by Plum Creek (timber industry forest practices typically involve pre-commercially thinning in these structure stages) in any one year; thinning typically reduces tree stem-densities (stems per acre) such that stands do not provide functional lynx foraging (snowshoe hare) habitat. Thus, these stand stages are expected to provide forage habitat for lynx while they remain unthinned, but the proportion of the Project Area that would consist of unthinned Young Forest or Pole Timber in any year is undetermined.

Throughout the ITP period, 1-3 percent of the Project Area above 920 meters (3,000 feet) elevation will be maintained by the applicant as forest stand stages potentially suitable for denning by lynx (please see Status of the Species below). These potential lynx denning areas primarily consist of stands of Old Growth Forest or Managed Old Growth Forest structural stages (please see Table 31C of the HCP).

As specified in the HCP and 1996 BO, minimal leave-tree requirements and situation-specific standards and guidelines pertaining to special biological use areas, such as strict limitations to activities within the riparian zones, are likely important parts of the subject action for lynx as they pertain to general cover (for travel particularly), and to a much lesser extent, large woody debris development and maintenance during the ITP term.

Plum Creek will monitor acreages of forest structural stages throughout the permit term, which will roughly account for potential forage, denning, and dispersal habitat for lynx at appropriate elevations during the ITP term. They will also monitor the acreage of forest stands within proximity (0.8 kilometer/0.5 mile) of distinct edges, as a coarse index of potentially usable areas for "Lifeform 5" species (as termed in the subject HCP), including: California wolverine (*Gulo gulo luteus*), lynx; elk (*Cervus elaphus*), Rocky Mountain mule deer (*Odocoileus hemionus hemionus*), black-tailed deer (*Odocoileus hemionus columbiana*), and ruffed grouse (*Bonasa umbellus).* "Security habitat" (forest stands with low road densities) will be monitored under the grizzly bear and gray wolf monitoring programs in the HCP; and undetermined portion of these areas will likely be suitable for lynx use during the permit term, in part due to their relatively low human occupation. Most of the monitoring effort in the HCP that relates to lynx is directed at determining quantity and function of lynx foraging habitat.

STATUS OF THE SPECIES

Species/Critical Habitat Description

The lynx is a highly mobile (U.S. Forest Service 2000a), medium-sized cat with: long legs, large, well-furred paws; long tufts on the ears; a distinct facial ruff with black stripes running down from the corner of the eyes; and a short, fully black-tipped tail (McCord and Cardoza 1982). The winter pelage of the lynx is dense and has a grizzled appearance with grayish-brown mixed with buff or pale brown fur on the back, and grayish-white or buff-white fur on the belly, legs, and feet. Summer pelage of the lynx is more reddish to gray-brown (Koehler and Aubry 1994). Adult males average 10 kilograms (22 pounds) in weight and 85 centimeters (33.5 inches) in length (head to tail), and females average 8.5 kilograms (19 pounds) and 82 centimeters (32 inches) (Quinn and Parker 1987). Although the long legs and thick fur of the lynx make them appear considerably larger than bobcats, adult male bobcats typically weigh more than adult male lynx (Quinn and Parker 1987; Rolley 1987; Verts and Carraway 1998). Lynx are good swimmers and tree climbers (Deems and Pursley 1983; O'Donoghue et al. 1998; Mowat et al. 2000: ch.9), but they have low endurance and tire relatively quickly after a chase (Seton 1992; Jackson 1961; Ognev 1962 *in* McCord and Cardoza 1982) compared to other large mammal predators such as canids. Although they have excellent vision and hearing, their sense of smell is relatively poor (Lindemann 1955; Saunders 1963b). The lynx is well-adapted for life in snowy regions of the far north and high elevations. Its long legs and huge, furry feet (which are as large as those of a mountain lion) act like snowshoes, enabling the lynx to hunt and navigate through deep snow (Predator Conservation Alliance 2000) and give them a competitive advantage in deep snow over other carnivores that might otherwise compete for habitat and prey (Stinson 2000).

Critical habitat for lynx has not been proposed or designated at this time.

Status and Distribution

The historical and present range of the lynx north of the contiguous United States includes Alaska and that part of Canada that extends from the Yukon and Northwest Territories south across the United States border and east to New Brunswick and Nova Scotia. In the contiguous United States, lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern United States region from Maine southwest to New York (McCord and Cardoza 1982; Quinn and Parker 1987).

The lynx occurs in the boreal forests of Alaska and Canada, and northern portions of the western mountains of the contiguous U.S., where environmental conditions at higher elevations support boreal forest conditions in subalpine areas.

At its southern margins in the contiguous United States, the boreal forests become naturally fragmented as they transition into other vegetation types. Southern boreal forest patches are small relative to the extensive northern boreal forest of Canada and Alaska. Nevertheless, many southern subalpine forests within the contiguous United States support resident populations of lynx and their primary prey species. (Note: no true "boreal" conditions exist in the lower continental United States. We are using the desriptions of the subalpine zone described in Franklin (1973) for consideration as potential lynx habitat in OR and WA). In *The Potential Natural Vegetation of Oregon and Washington* (Franklin 1973), a variety of potential vegetation series are identified that together represent the boreal/subalpine zone, including mountain hemlock, silver fir, and subalpine fir.

Lynx are typically found in areas where it's primary prey species, the snowshoe hare, occurs in relative abundance and areas that receive deep winter snows, both key elements to the survival of the species (Ruggiero et al. 2000b). Lynx occupy the boreal, subboreal and western montane forests of North America (McCord and Cardoza 1982; Quinn and Parker 1987; Agee 2000; McKelvey et al. 2000b) and use a variety of forest types. In Canada, lynx are found in black and white spruce forests of the taiga (Poole 1994). In Wyoming, lynx are associated with lodgepole pine, aspen and spruce-fir forests (Squires and Laurion 2000), in the Great Lakes and Northeastern geographic areas they primarily use mixed conifer and hardwood stands (McKelvey et al. 2000b), and in northern Idaho, northeastern Washington, portions of Montana and the Great Lakes Region, lynx are found in lower elevation mixed cedar/hemlock stands.

The final rule determining threatened status for the lynx in the contiguous United States (March 24, 2000) summarized lynx status and distribution across four regions where lynx are known to currently exist. These distinct regions are the Northeast, the Great Lakes, the Northern Rocky Mountains/Cascades, and the Southern Rocky Mountains. While these regions are ecologically unique and discrete, the lynx is associated with southern boreal forest in each and, with the exception of the Southern Rocky Mountains Region, each area is geographically connected to the much larger population of lynx in Canada. These regions are separated from each other by ecological barriers consisting of large expanses unsuitable for lynx.

The following status and distribution information was presented in the final rule:

> *Northern Rocky Mountain/Cascades Region* (Washington, Oregon, Idaho, Wyoming, Utah) - In this region, the majority of lynx occurrences are associated at a broad scale with the "Rocky Mountain Conifer Forest"; within this type, most of the occurrences are in moist Douglas fir (*Pseudotsuga menziesii*) and western spruce/fir forests (McKelvey et al. 2000b). Most of the lynx occurrences are in the 1,500 to 2,000 meters (4,920 to 6,560 feet) elevation class (McKelvey et al. 2000b). These habitats are found in the Rocky Mountains of Montana, Idaho, eastern Washington, and Utah, the Wallowa Mountains and Blue Mountains of southeast Washington and northeastern Oregon, and the Cascade Mountains in Washington and Oregon. The majority of verified lynx occurrences in the United States and the confirmed presence of resident populations are from this region.

The boreal forest of Washington, Montana, and Idaho is contiguous with that in adjacent British Columbia and Alberta, Canada.

Lynx research has been conducted across Canada and Alaska, but the only lynx research projects that have been completed in the contiguous United States are in north-central Washington and western Montana. Ongoing studies in Wyoming, Maine, and tracking information for the relocated lynx in Colorado, may provide more information in the near future. Surveys are scarce throughout most of the former range of the species in the contiguous United States. The species occurs at low densities, is primarily nocturnal, has inconspicuous behavior, resides in remote areas, and is thus difficult to detect in the wild. Unless they are commercially trapped or intensive surveys are conducted, their presence often goes unnoticed (Zielinski and Kucera 1995). The paucity of data on lynx was acknowledged in the LCAS, the Final Rule for listing, and the Lynx Science Report. Due to a general lack of research information and surveys from within the contiguous United States, sighting data are limited to trapping records, anecdotal information, incidental sighting reports, and information obtained from prior and on-going research.

Confirmed lynx reports have been documented on both sides of the Cascade crest in Oregon and Washington (McKelvey et al. 2000, Stinson 2000, Dalquest 1948). However, intensive surveys over a large geographic area were not conducted for lynx in Oregon or western Washington prior to 1998. Thus, all lynx sightings in these areas are incidental reports and trapping records. In Washington, there are about 36 sighting reports and another 67 trapping records of lynx on the westside of the Cascade crest (Department of Natural Resources Heritage database and USFS databases;WDFW 1993; WA State archives).

Twelve verified reports and a total of 72 lynx occurrences have been listed for Oregon (McKelvey et al. 2000). Currently 90 lynx sightings are reported from Oregon, and 247 lynx are recorded in Oregon State Bounty Claim Registers (dated 1899 - 1960). Oregon and Washington State Bounty Claim Registers recorded a total of 274 lynx.

Much of what is known about lynx in Washington, and the southern range of the species in general, was derived from research studies conducted in the north-central area of the state. Although significant data exists on lynx populations and forest-type use within the study areas, survey information is sparse or lacking for the rest of the state. Because lynx are both rare and highly secretive, very little research has been conducted on the species. Trapping records, sightings, and tracking reports comprise the remainder of the information for the species, but are inadequate to give us a clear understanding of the distribution and current population status of the species throughout much of the state. Aside from the locations associated with the research studies, there are approximately 150 reported lynx sightings (trap records, sightings, and tracks) scattered throughout Washington state (DNR 1998). Surveys for lynx and/or snowshoe hares are currently being conducted in many of these areas in an effort to gain a better understanding of the distribution and population status of the lynx in Washington state.

In Washington, lynx occurrences have been documented within the high-elevation forests along the Cascade crest down to just north of Stevenson, including the Mount Baker-Snoqualmie, Gifford Pinchot, and Wenatchee National Forests, the Ross Lake National Recreation Area, and the North Cascades and Mount Rainier National Parks; the north-central portion of the state, including the Okanogan and Colville National Forests as well as private timber lands and the Department of Natural Resource's Loomis State Forest; and the northeastern corner of the state where the Colville and Idaho Panhandle National Forests join near the Idaho border. In Washington, these occurrences have been documented above 980 meters (3,200 feet) elevation in Chelan, Okanogan, Ferry, Stevens, and Pend Oreille counties (Brittell et al. 1989). The lynx is the rarest of three cat species native to Washington (Stinson 2000). Stinson (2000) estimates that at most 200, and perhaps fewer than 100, individuals are living in Washington. Brittell et al. (1989) estimated that lynx numbers in Washington oscillate around 200 animals, with 150 to 300-plus as an estimated range.

Hair-sampling surveys conducted in 1998 indicated potential lynx presence north and south of I-90 in the action area (U.S. Forest Service 2000a), although the results of these surveys have not been verified. The historic and current range of lynx includes the Planning Area. In north-central Washington, lynx are known to occupy forest types consisting of Englemann spruce *(Picea engelmannii)*, subalpine fir *(Abies lasiocarpa)*, lodgepole pine *(Pinus contorta)*, and aspen *(Populus tremuloides)* (Koehler 1990a).

Life History

Diet

Lynx are largely dependent upon a single prey species, the snowshoe hare (*Lepus americanus*), but they also eat small mammals, birds, and carrion (Stinson 2000). Snowshoe hares comprise 35 to 97 percent of the diet throughout the range of the lynx (Koehler and Aubry 1994). Other prey species include red squirrel (*Tamiasciurus hudsonicus*), grouse (*Bonasa umbellus*, *Dendragopus* spp., *Lagopus* spp.), flying squirrel (*Glaucomys sabrinus*), ground squirrel (*Spermophilus parryii, S. richardsonii*), porcupine (*Erethrizon dorsatum*), beaver (*Castor canadensis*), mice (*Peromyscus* spp.), voles (*Microtus* spp.), shrews (*Sorex* spp.), fish, and ungulates as carrion or occasionally as prey (Saunders 1963a; van Zyll de Jong 1966; Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Koehler 1990b; Staples 1995; O'Donoghue et al. 1998). Most research has focused on the winter diet. Summer diets are poorly understood throughout the range of lynx. Mowat et al. (2000) reported through their review of the literature that summer diets have less snowshoe hare and more alternate prey species, probably because of a greater availability of other species.

During the cycle when hares become scarce, the proportion and importance of other prey species, especially red squirrel, increases in the diet (Brand et al. 1976; O'Donoghue et al. 1998; Apps 2000; Mowat et al. 2000). However a diet of red squirrels alone might not be adequate to ensure lynx reproduction and survival of kittens (Koehler 1990b).

Little research has been performed on lynx diet specific to the southern portion of its range, except in Washington (Koehler et al. 1979; Koehler 1990b). Southern populations of lynx may prey on a wider diversity of species than northern populations because of lower average hare densities and differences in small mammal communities. In areas characterized by patchy distribution of "classic" lynx habitat, lynx may prey opportunistically on other species that occur in adjacent communities, potentially including white-tailed jackrabbit (*Lepus townsendii*), black-tailed jackrabbit (*Lepus californicus*), sage grouse (*Centrocercus urophasianus*), and Columbian sharp-tailed grouse (*Tympanichus phasianellus*) (Quinn and Parker 1987; Lewis and Wenger 1998). Patchy and disjunct distribution of hare habitat in the southern portion of lynx range may force lynx to travel greater distances in search of prey (Aubry et al. 2000).

In northern regions, hare densities go through cyclical declines. During declines, the lower function diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, which causes the numbers of breeding lynx to level off or decrease (Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Poole 1994; Slough and Mowat 1996; O'Donoghue et al. 1997). Relative densities of snowshoe hares at southern latitudes are generally lower than those in the north, and differing interpretations of the population dynamics of southern populations of snowshoe hare have been proposed (Hodges 2000).

Reproduction

Lynx ovulate in late March and early April (Alaska Dept. of Fish and Game 1977; Brittell et al. 1989; Quinn and Parker 1987) and give birth to 2 to 5 kittens nine weeks later. An average litter size of 2.77 (N=26) has been reported for lynx populations in Canada, Alaska, and Washington state (Hatler 1988). An average of 2 kittens (N=4) was reported in one study (Brittel et al. 1989), while another found litters of three and four kittens (N=3) for a study area in northeastern Washington (Kohler 1990). In Montana, one marked female produced two kittens in 1998 (Squires and Laurion 2000). In 1999, two of three females produced litters of two kittens each. In Wyoming, one female produced 4 kittens in 1998 and 2 kittens in 1999 (Squires and Laurion 2000).

Perhaps the greatest factor influencing the reproductive success of females and kitten survival is prey availability. During the highs in the hare cycle, litters of 4 young are common, but when hare populations are down, productivity declines markedly and in some years no litters are produced at all or the kittens that are produced do not survive (Brand et al. 1976, Brand and Keith 1979, O'Conner 1984, Slough and Ward 1990). However, Mowat et al. (2000) suggested that in the far north, some lynx recruitment occurs when hares are scarce and this may be important in lynx population maintenance during hare lows.

The kittens open their eyes after about 2 weeks and are weaned by 12 weeks (McCord and Cordoza 1982). Young lynx remain with their mothers through the first winter and disperse at around 10 to 11 months of age (Poole 1997). Lynx generally reach sexual maturity as yearlings, but females are generally not able to successfully raise a litter until their second year (Brand and

Keith 1979; Poole 1994; Slough and Mowat 1996). Male lynx may be incapable of breeding during their first year (McCord and Cardoza 1982) and do not help with rearing the young (Eisenberg 1986).

For denning, females mature forest habitats that contain large woody debris. Lynx give birth in a den in a hollow log, stump, dense windfall, or clump of timber (Chapman and Feldhammer 1982). Lynx use denning sites with security and thermal cover for their kittens. During the first few months of life, kittens are left alone at these sites while the female hunts; downed logs and cover provide protection from predators.

Lynx Habitat

Lynx are strongly associated with a mosaic of early seral vegetation interspersed with older forest types, and are thus highly dependent on disturbance elements that prevent significant patches of forest vegetation from successionally reaching their climax potential. For example, many of the areas managed by Washington state for lynx are in (subalpine fir and Douglas-fir) associations that are currently dominated by lodgepole pine, a successional stage that follows fire and also supports high densities of snowshoe hares (Martha Jensen, pers. comm. 2001).

Foraging Habitat

Lynx heavily utilize early successional forests that contain high numbers of prey (snowshoe hares) for foraging. Lynx rely heavily on cover while searching for prey (Brand et al. 1976) but often hunt along edges and forest margins where prey densities are higher (Mowat et al. 2000). Kesterson (1988) and Staples (1995) reported that lynx hunted along the edges of mature stands within a burned forest matrix, and Major (1989) found that lynx frequently hunted along the edge of dense riparian willow stands. Lynx generally avoid large forest openings (such as large clear-cuts) during movements (Koehler 1990a; Staples 1995). In north-central Washington, lynx are known to occupy forest communities consisting of Engelmann spruce (*P. Engelmannii*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*P. Contorta*), and aspen forests (Koehler 1990a). Lynx observations are substantially associated with high elevation forest, deep snow in winter, and its main prey, the snowshoe hare (Predator Defense Institute 1997); this association is likely because most detections of lynx are of foraging individuals (versus denning or dispersal habitat use). Forests stands in Washington above 920 meters (3,000 feet) elevation and with dominant trees over 15 years old with high stem densities are generally considered potential foraging habitat for lynx, particularly unthinned forests 15 to 35 years old (Martha Jensen, pers. comm. 2001).

Snowshoe hares have evolved to survive in areas that receive deep snow (Bittner and Rongstad 1982). Snowshoe hares prefer stands of conifers or mixed conifer/hardwood stands with dense shrub understories that provide forage, cover to escape predators, and protection during extreme weather (Wolfe et al. 1982; Monthey 1986; Kuechler and Aubrey 1994). Early successional forest stages generally have greater understory structure than do mature forests and therefore

support higher hare densities (Hodges 2000a, 2000b). Mature forests provide relatively stable hare populations; the populations are maintained by openings created in the canopy when trees or stands succumb to disease, fire, wind, ice, or insects (Buskirk et al. 2000). In the Okanogan, dense, young (20-year-old) stands of lodgepole pine support hare densities 4 to 5 times greater than comparatively older (>82-year-old) stands (Koehler 1990a). Young lodgepole stands also support hare densities 9 times greater than those found in Engelmann spruce-subalpine fir stands. Total stem densities in good hare cover in Washington and elsewhere can exceed 14,800 stems per hectare (6,000 stems per acre) (Wolff 1980; Litvaitis et al. 1985; Koehler 1990a), which is equivalent to approximately a 1 meter (3 foot) spacing between trees. Hares will browse stems up to 25 mm (1 inch) in diameter (Pease et al. 1979; Litvaitis et al. 1985; Koehler 1990b).

Dispersal/Connectivity Habitat

Lynx seem to prefer to move or travel through continuous forest, using the highest terrain available such as ridges and saddles (Koehler 1990a; Staples 1995; U.S. Forest Service 2001), as differentiated from lower in elevation riparian zones. Lynx generally avoid large forest openings (such as clear-cuts over 90 meters (300 feet) wide) during movements (Koehler 1990b; Staples 1995; U.S. Forest Service 2001; Martha Jensen, pers. comm. 2001). Travel cover corridors for lynx in Washington consists of stands greater than 90 meters (300 feet) wide (Brittel et al. 1989). Lynx are capable of dispersing extremely long distances (Mech 1977). Lynx usually use travel corridors with tree densities of 450 per hectare (180 stems per acre) (U.S. Forest Service 2001). Although lynx may cross openings less than 90 meters (300 feet) in width, they generally do not hunt in these more open areas (Koehler and Aubrey 1994). Lynx tend to avoid continuously steep, dissected areas (U.S. Forest Service 1999c).

In western Washington, nearly all of the documented lynx occurrences are below 1,220 meters (4,000 feet) elevation, with most occurrences between 460 and 1,220 meters (1,500 and 4,000 feet) elevation (Martha Jensen, pers. comm. 2001). In areas with steep topography, lynx may be restricted to traveling along riparian corridors or at lower elevations (Martha Jensen, pers. comm. 2001).

Potential lynx dispersal habitat in Washington is considered herein to be contiguous forest areas above 460 meters (1,500 feet) elevation with tree cover typically associated with stands older than 15 years of age.

Denning Habitat

For denning, females select dense, mature forest habitats that contain large woody debris (Koehler 1990a, Koehler and Brittell 1990, Kesterton 1988, Murie 1963). Lynx use large woody debris, such as downed logs, root wads, and windfalls, to provide denning sites with secure cover for their kittens (McCord and Cardoza 1982; Koehler 1990a; Koehler and Brittell 1990; Mowat et al. 2000; Squires and Laurion 2000; J. Organ, U.S. Fish and Wildlife Service, in litt. 1999).

Downed logs and overhead cover provide protection from predators, such as owls, hawks, and other carnivores during this period.

Lynx den in a hollow log, stump, dense windfall, or clump of timber (Chapman and Feldhammer 1982. Important features of denning sites have been documented to be a 2 hectare (5 acre) or larger stand containing large patches of high density of downed trees, many supported above the ground, minimal human disturbance, and proximity to foraging habitat (usually early successional forests).

Information on lynx den sites is very limited in the lower 48 states. The largest data set for lynx maternal den sites was recorded by Slough (1999), who inspected 39 dens in the Yukon Territory. Every den except for three were in live or dead stands of mixed lodgepole pine/spruce/willow that lacked subalpine fir or had only a minor component of subalpine fir in the overstory. Slough (1999) concluded that the common feature of lynx maternal den sites is the amount of down woody debris, not the overstory tree composition of the stands. Denning habitat is expected to always be within the daily travel distance of foraging habitat (the typical maximum distance for females is 5 to 10 kilometers (3 to 6 miles)) (Ruediger et al. 2000). After performing field studies on lynx in Okanagan County of north-central Washington, Brittell et al. (1989) found the key characteristics of denning habitat of 4 sites to be: dominant 150 years or older sub-alpine fir or Englemann spruce; downed woody material; minimal human disturbance; adjacent to travel or forage/hiding/thermal-stalking cover on 50 percent of the denning habitat edge; at least 2 hectares (5 acres) in size; interspersed among other cover types. These denning locations in north-central Washington contained large quantities of layered down wood and other structure, in cool, mesic (moist), mature forests (Interagency Lynx Committee 1999).

Denning habitat is generally conifer stands that have mature to old growth characteristics. Desirable characteristics include structure from piles of dead woody debris or root tangles to provide kitten security and thermal protection (Brittell 1989, Koehler 1990b). Typical downed woody debris conditions for denning habitat are: logs greater than 15 centimeters (6 inches) diameter at the large end, in quantities of 100 or more down whole trees per hectare (40 or more down whole trees per acre), many arranged in loose, jack-strawed piles 0.3 to 1.2 meters (1 to 4 feet) in height (Koehler 1990a). Denning habitat sites are consistently at least 2 hectares (5 acres) in size with down debris generally present in a minimum 50 percent (2.5 acres) of denning sites (Lloyd 1996). The coarse woody debris found in denning habitat is well distributed over a large area, ostensibly providing adequate protection to kittens from predation. Two or more debris piles per denning stand of 2 hectares (5 acres) are needed (Interagency Lynx Committee 1999).

The surrounding age of the forest stand does not seem as important for denning habitat as the amount of downed, woody debris available (Mowat et al. 2000). The common denominator in denning habitat is woody structure, particularly blowdown or deadfall that usually including overtuned root wads (Interagency Lynx Committee 1999). In north-central Washington, known lynx denning use occurred in forests with an overstory of *Pinus contorta* (lodgepole pine), *Picea*

spp. (spruce), and *Abies lasiocarpa* (subalpine fir) older than 200 years with an abundance of downed woody debris for denning (Koehler 1990a); forested stands in the Okanagan area where lynx denned were greater than 250 years old (Interagency Lynx Committee 1999). These north-central Washington sites had north to northeast aspects; and had a high density of more than 1 tree/meter (0.3/foot) of downed trees supported 0.3 to 1.2 meters (1 to 4 feet) above the ground, which provided both the vertical and horizontal structural diversity (Brittell et al. 1989, Koehler 1990a). A den site in Wyoming was located in a mature subalpine fir/ lodgepole pine forest with abundant downed logs and a high amount of horizontal cover (Squires and Laurion 2000). The ground component at four dens in the Okanogan Highlands, Washington, consisted of loosely pile logs and upturned root wads over extensive areas (Interagency Lynx Committee 1999). The logs were 152 mm (6 inches) or greater in diameter and jack-strawed off the ground at an average density of 40 logs per 46 meters (150 feet) (linear transect) (Interagency Lynx Committee 1999). Patches of denning habitat are typically larger than 2 hectares (5 acres) with multiple potential den sites in the stand (Interagency Lynx Committee 1999).

Important features of denning sites are minimal human disturbance, proximity to foraging habitat (early successional forests) (Koehler and Brittell 1990). Potential denning areas must be in or adjacent to foraging habitat to be functional denning habitat. The hunting range of females is restricted at the time of parturition, and their need to feed kittens requires an abundance of prey. Lynx, like other carnivores, frequently move their kittens until they are old enough to hunt with their mother. Multiple nursery sites are needed that provide kittens with overhead cover and protection from predators and the elements. Downed logs and overhead cover must also be available throughout the home range to provide security when lynx kittens are old enough to travel (Bailey 1974).

Potential lynx denning habitat in Washington is considered herein to be relatively mature forest stands above 920 meters (3,000 feet) elevation and larger than 2 hectares (5 acres) in size, with significant accumulations of large woody debris, in proximity to lynx foraging habitat and isolated from human activity; old growth forests are expected to have the necessary structural characteristics.

Dispersal

Lynx are capable of dispersing extremely long distances (Mech 1977; Washington Department of Wildlife 1993); for example, a male was documented traveling 616 kilometers (370 miles) (Brainerd 1985). This type of movement is considered unusual (Chapman and Feldhammer 1982). Two types of dispersal, subadult and adult, likely exist. Adult lynx disperse primarily when prey populations decline (Ward and Krebs 1985; Koehler and Aubry 1994; O'Donoghue et al. 1997; Poole 1997). Subadult lynx disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges in an area without resident lynx.

Home Range

Lynx establish a home range when they become resident in an area containing suitable habitat including an adequate prey base. Home range sizes and shapes are influenced by a combination of factors, including geographic and physiographic features, abundance of prey, seasons, gender, and the density of lynx populations (Hatler 1988; Koehler 1990b; Poole 1994; Slough and Mowat 1996; Aubry et al. 2000; Mowat et al. 2000). Individual home ranges generally overlap, particularly between sexes, but the territories of males tend to be more exclusive (Mech 1980; Ward and Krebs 1985; Stephenson 1986; Brittell et al. 1989; Koehler 1990b; and Poole 1995). Mutual avoidance apparently reduces conflict in shared home ranges and core areas rarely overlap (Brittell et al. 1989:62; Poole 1995). Food availability generally is the most important criterion in the determination of home range size for many carnivores (Gittleman and Harvey 1982). Poole (1985) documented that home ranges in an untrapped population of lynx in the Northwest Territories were stable for several years but broke down when prey densities declined. Research conducted in the Yukon found that lynx increased their home ranges considerably during a decline in snowshoe hare densities (Ward 1984; Ward and Krebs 1985). However, a recent study also conducted in the Yukon, found increased overlap of home ranges during peaks in hare populations but little difference in the overall sizes of the individual home ranges during the peaks and lows of the prey density cycles (Slough and Mowat 1996). The study suggests that some lynx populations may maintain stable large home ranges at any prey density. Home range size may also be influenced by physiography and the distribution of potential lynx habitat (Apps 2000).

Documented home ranges vary from 8 to 800 square kilometers ($km^{2)}$ (3 to 300 square miles) across the range of the species (Saunders 1963; Brand et al. 1976; Mech 1980; Parker et al. 1983; Koehler and Aubry 1994; Apps 2000; Mowat et al. 2000; Squires and Laurion 2000). The average annual home range reported in the southern boreal forests (Washington, Montana, and Wyoming) was about 151 km^2 for males and 72 km^2 for females (Aubrey et al. 2000: ch 13). In northeastern Washington, mean home range sizes of lynx in two study areas ranged between 50 to 70 km^2 for males (N=13) and around 40 km^2 for females (N=5) (Brittell et al. 1989; Koehler 1985). Preliminary research supports the hypothesis that lynx home ranges at the southern extent of the species' range are generally larger than those in Canada or the Yukon (Koehler and Aubry 1994; Apps 2000; Squires and Laurion 2000).

Mortality

Lynx rarely survive more than 15 years in the wild, though they may live 22 years in captivity (Tumlison 1987). Reported causes of lynx mortality vary. Starvation is the most commonly reported cause of death for young lynx, especially during declines in snowshoe hare populations (Seton 1925; Ward 1985; Brittel et al. 1989; Quinn and Parker 1987; Koehler 1990b). Various studies have shown that, during periods of low snowshoe hare numbers, starvation can account for up to two-thirds of all natural lynx deaths. Lynx are also killed by other predators, including cougars, wolves, wolverines, coyotes, and bobcats (Berrie 1974; Koehler et al. 1979;

O'Donoghue et al. 1995), and occasionally by other lynx (Elsey 1954; O'Donoghue et al. 1995). Squires and Laurion (2000) reported 2 of 6 mortalities of radio-collared lynx in Montana were due to mountain lion predation.

Out of 96 lynx released into Colorado during the period of 1999 to 2001, 33 known mortalities have been confirmed (6 lynx are currently missing for more than 1.5 years, and 7 lynx have been missing for 6 months based on current data). One lynx probably slipped her collar. Results of the 33 mortalities indicate: 8 by starvation, 5 hit by cars, 5 unknown (but can rule out starvation), 4 shot, 3 plague, 1 predation by bobcat, 1 unknown trauma (Colorado Division of Wildlife 2001).

Lynx are highly susceptible to trapping (Mech 1980; Carbyn and Patriquin 1983; Parker et al. 1983) and fur trapping is the highest leading human-related cause of mortality recorded (Ward and Krebs 1985; Bailey et al. 1986). Half of the marked animals in eight research studies (N=98) died due to trapping and other human-related causes (Nellis et al. 1972, Mech 1980, Carbyn and Patriquin 1983, Parker et al. 1983, Ward and Krebs 1985, Bailey et al. 1986, Stephenson 1986, and Bailey et al. 1987). Yearlings and kittens seem to be more vulnerable to trapping than adults, and males are trapped more frequently than females (van Zyll de Yong 1963, Stewart 1973, Berrie 1974, Parker et al. 1983, Quinn and Thompson 1987). Trapping mortality may be additive, especially during periods of low populations, and may even lead to local extirpations (Brand and Keith 1979). Dispersal and establishment of new territories may increase the exposure of lynx to trapping and highway collisions (Brand and Keith 1979, Carbyn and Patriquin 1983, Ward and Krebs 1985, Bailey et al. 1986). Lynx are no longer legally trapped in the lower 48 states of the United States. Winter recreation activities such as snowmobiling provide additional roads and trails into lynx habitat, and have the potential to increase take of lynx by hunters, as well as mortality by roadkill (State of Wyoming 2000).

Highways have resulted in significant mortalities in several recent efforts to reintroduce lynx back to areas where their populations were extremely low or even extirpated. In New York, 18 translocated lynx were killed on highways (Brocke et al. 1990). Similarly, two lynx were killed on Colorado highways following their release as part of a reestablishment effort there (G. Byrne, CDOW, pers. comm. 1999). Brocke et al. (1990) suggest that translocated animals may be more vulnerable to highway mortality than resident lynx because the animals are trying to establish territories in unfamiliar terrain. Two occurrences of highway mortality in Wisconsin (Theil 1987) and Minnesota (Don Carlos, unpubl. report 1997) have been documented. Twelve resident lynx were documented being killed on highways in Canada and Alaska (Staples 1995; Gibeau and Heur 1996; T. Clevenger, pers. comm. 1999; Alexander, pers. comm. 1999).
Because lynx have low populations densities, incidental mortality of lynx from trapping, illegal harvest, and road kill may adversely affect populations, particularly during population lows (Marcot et al. 1997). Lynx populations are just as adversely impacted by road mortality as other carnivore populations (Brocke et al. 1992; Gibeau and Heuer 1996). Since they have relatively large home ranges, low population densities and low reproductive rates, lynx are not likely able to compensate, biologically, for additional significant sources of mortality (Ruediger 1996). It

appears likely that lynx persist in the long-term in the Continental United States mainly in roadless or low road density areas (Northwest Ecosystem Alliance 1999).

Fire

Fire generally has profound effects on ecosystem structure, diversity, and function, and is referred to as a keystone ecosystem process (Noss 1991). Fire suppression reduces the capacity of areas to support high number of snowshoe hare, and thus lynx (Predator Conservation Alliance 2000). The ability of burned areas to support hares decreases over time, so strict fire suppression may lead to low hare numbers (Predator Conservation Alliance 2000).

High function habitat for snowshoe hare results from large, stand-replacing fires from burns of 15 to 30 years previous (U.S. Forest Service 2000b). New burns in subalpine zones are soon blanketed with conifer seedlings; these burns successionally develop into forage habitat for snowshoe hares in otherwise appropriate areas (U.S. Forest Service 2000b). Snowshoe hares avoid bowsing in the open; dense forests with trees at least 5 meters (15 feet) tall allow the hares to browse on twigs even when snows are 2 meters (6 feet) deep, and still take cover from predators.

Fire suppression has altered some of those natural fire patterns on mountain landscapes (U.S. Forest Service 2000b). Fire suppression often leads to more uniformity and less of a forest mosaic. Putting out fires often result in smaller burns than might have naturally occurred, leaving relatively large areas of older lodgepole and subalpine firs (U.S. Forest Service 2000b). However, eventually fires driven by high fuels, drought and winds will be too hot to contain and will burn very large expanses at once (U.S. Forest Service 2000b). Fires that burn with mixed severity in an older stand retain living trees, add downfall, and open up small clearings that give hares more places to browse (U.S. Forest Service 2000b). Fire suppression may be one of the main reasons for continuing population declines in lynx (Bureau of Land Management 1998).

Interspecific Relationships with Other Carnivores

Buskirk et al. (2000) described the two major competition impacts to lynx as exploitation and interference. Of several predators examined (birds of prey, coyote, gray wolf, mountain lion, bobcat, and wolverine), coyotes and bobcats were deemed to most likely pose local or regionally important impacts to lynx (Buskirk *et al.* 2000).

Habitat fragmentation and interspecific competition are two important forces that likely work together in affecting lynx populations (U.S. Forest Service 1999a). Fragmentation operates by various mechanisms, including direct habitat loss, vehicle collisions and behavioral disturbance from roads, and changes in landscape features such as edges (U.S. Forest Service 1999a). Competition takes two forms: exploitation competition involves potential competitors, such as coyotes and raptors, for food with lynx (Litvaitis 1992). Interference competition involves aggressive acts, usually by a larger animal, that can include attacking and killing (Case and

Gilpin 1974). Habitat fragmentation tends to facilitate competition by generalist predators, of which the most likely beneficiary (particularly between lynx and coyote) is the coyote (Goodrich and Buskirk 1995, Hunter 1990, U.S. Forest Service 1999a). Other potential interference competitors with lynx include cougars and bobcats. Bobcat, coyote, and mountain lion are all are more widespread and more abundant within the southern distribution of the lynx than 50 years ago.

Major predators of snowshoe hare include lynx, northern goshawk, great horned owl, bobcat, coyote, red fox, fisher, and mountain lion. Exploitation competition may contribute to lynx starvation and reduced recruitment. In southern portions of snowshoe hare range, increased predation may limit hare populations to lower densities than in the taiga (Dolbeer and Clark 1975; Wolff 1980; Koehler and Aubry 1994). Additionally, differences between northern and southern boreal forests possibly include a larger suite of generalist predators (bobcat, long-tailed weasel) in southern boreal forests (Hodges 2000). Anecdotal observations have indicated that snow compaction on forest roads and trails may affect the degree to which lynx must compete with coyotes and other carnivores (Stinson 2000).

Coyotes often prey on rabbits and hares and have expanded into much of the boreal forest since the early 1800s (Voigt and Berg 1987:fig.2). In Washington, coyotes were historically present in the Columbia Basin and adjoining valleys, but were absent from western Washington (Suckley and Cooper 1860:75, Brooks 1930, Voigt and Berg 1987: fig 2). Historical accounts suggest that coyotes have indeed substantially expanded their range and number within the range of the lynx.

In the Yukon, coyotes are a facultative specialist that feeds heavily on hares, especially during winter when other prey are unavailable (O'Donoghue et al. 1998). Buskirk et al. (2000) suggest that the density of coyotes affects lynx populations, based on reciprocal abundances in 2 study areas. The potential for competition between lynx and coyotes has led to speculation that human induced changes to the landscape, particularly logging roads, compacted trails, and clearcuts, have increased the amount of crusted or compacted snow, thus improving the coyote's ability to exploit higher elevation habitats. Lynx would still possess the advantage of lower foot loading in deep snow and would be able to use higher elevations and snow conditions where coyotes would likely be excluded, but considerable areas (at the lower elevations originally utilized by lynx) historically excluded from most competition may now be competitively utilized by coyotes. Additionally, lynx may avoid whole areas once coyotes are detected (such as by scent marks) through perceived need for protection, even if coyotes are actually limited by deeper snows to compacted snow trails and roads. If so, this would result in a net loss in effective habitat for lynx.

Parker et al. (1983) discussed anecdotal evidence of competition between bobcats and lynx. On Cape Breton Island, lynx were found to be common over much of the island prior to bobcat colonization. Concurrent with the colonization of the island by bobcats, lynx densities declined and their presence on the island became restricted to the highlands, the one area where bobcats did not become established.

Top predators appear to regulate many ecosystems (Terborgh et al. 1999), preventing hyper-abundance in herbivores and mesopredators (Soule and Noss 2001). Large predators initiate chains of far-reaching and manifold ecological interactions; in the absence of these keystone species, many ecosystems become degraded and simplified (Soule and Noss 2001). Once large predators are restored, many other keystone and "habitat-creating" species, "keystone ecosystems" (DeMalynadier and Hunter 1997), and natural regimes of disturbance and other processes will recover on their own. Buskirk et al. (2000) speculate that lynx would benefit from the recovery of wolves because they would reduce coyote populations and, unlike coyotes, wolves would not compete with lynx for hares. Wolves have been observed to exclude coyotes in some areas, but coexist in others (Peterson 1995, Crabtree and Sheldon 1999), but likely significantly reduce coyote populations wherever the two occur together. Paquet (1991) observed that in southwest Manitoba, coyotes were not displaced by wolves, but that wolves killed coyotes opportunistically. In Washington, coyotes were historically absent from western Washington (but are now relatively common), possibly having been excluded from the coniferous forest by wolves (Suckley and Cooper 1860:75, Brooks 1930, Voigt and Berg 1987). Wolves are currently found in very limited range and numbers in Washington compared to 150 years ago. The reduced range and number of wolves in Washington has likely contributed to the decline of lynx in the state.

Population dynamics

In Canada and Alaska, lynx populations undergo extreme fluctuations in response to snowshoe hare population cycles, enlarging or dispersing from their home ranges and ceasing the recruitment of young into the population after hare populations decline (Mowat et al. 2000). In the southern portion of the range in the contiguous United States, lynx populations appear to be naturally limited by the availability of snowshoe hares, as suggested by large home range size, high kitten mortality due to starvation, and greater reliance on alternate prey. These characteristics appear to be similar to those exhibited by lynx populations in the taiga during the low phase of the population cycle (Quinn and Parker 1987, Koehler 1990b, Aubry et al. 2000).

A lack of accurate data limits our understanding of lynx population dynamics in the contiguous United States and precludes drawing definitive conclusions about lynx population trends. Formal surveys designed specifically to detect lynx have rarely been conducted. Many reports of lynx (e.g., visual observations, snow tracks) have been collected incidentally to other activities, but cannot be used to infer population trends. Long-term trapping data have been used to estimate population trends for various species. However, trapping returns are strongly influenced by trapper effort, which varies between years, and therefore may not accurately reflect population trends. Another important problem is that trapping records of many states did not differentiate between bobcats and lynx, referring to both as "lynxcats." Overall, the available data are too incomplete to infer much beyond simple occurrence and distribution of lynx in the contiguous United States (McKelvey et al. 2000b)

We expect that some areas in the contiguous United States naturally act as sources of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000a). Other areas may function as sinks, where lynx mortality is greater than recruitment, and lynx are lost from the overall population. Sink habitats are most likely those places on the periphery of the southern boreal forest where habitat becomes more naturally or artificially fragmented, or where artificial mortality factors are significant (i.e., significant road densities/vehicle-caused mortality, or where competitor populations are artificially high). Fluctuations in prey populations likely cause some habitat patches to change from being sinks to sources, and vice versa. The ability of naturally dynamic ecosystem functions to support lynx populations likely changes as potential and existing lynx habitat plant communities undergo succession following natural or manmade disturbances (i.e., fire, blowdown, clearcutting, thinning).

Lynx populations in the continental Unites States occur at low densities and habitat fragmentation of moderate sized areas can result in isolation of small populations. Large carnivores such as lynx require extensive, connected, heterogeneous habitat to maintain population viability (e.g., Frankel and Soulé 1981). Small, isolated populations of animals are vulnerable to accidents of demography and genetics and to environmental fluctuations and catastrophe, underlining the need for large core areas and connectivity (Franklin 1980, Frankel and Soulé 1981). Inter-regional connectivity is seen as necessary for providing genetic and demographic rescue and for viability of wide-ranging species (Noss 1983, Harris 1984, Noss and Harris 1986, Soulé 1987), such as lynx (genetic and demographic rescue is the arrival of immigrants into a small population; it is generally beneficial because it slows the rates of loss of genetic variation and inbreeding and it lowers the chance of extinction caused by small numbers of individuals). Small populations in the wild suffer from increased localize extinction, in part because of an unavoidable increase in matings between close relatives. Inbreeding reduces reproductive success most species (Frankham 1995a) and increases extinction rates in laboratory populations of fruitflies and mice (Frankham 1995b). From their studies of metapopulations of Glanville fritallary butterflies (*Lelitaea cinxia*), Saccheri et al. (1994) empirically found that inbreeding contributes to extinction of wild populations. Genetic factors are likely involved in the extinction of wild populations of most species (Frakham and Ralls 1998). These results are particularly relevant to the species with small populations due to habitat loss and fragmentation (Lande 1998).

Simply representing a species in a reserve or series of reserves does not assure or guarantee that it will be able to persist in those areas (or anywhere) indefinitely (Noss 1992). The representation objective should be complemented by the goal of maintaining viable populations of every species integral to the ecosystem. Population viability and vulnerability is a central concern of conservation biology (Shaffer 1981, Soule' 1987). A viable population is one that has a high probability of (for example, 95 or 99 percent) or persisting for a long time (100 to 1000 years). With a few interesting exceptions, viable populations are generally on the order of thousands of individuals (Thomas 1990).

Washington/British Columbia Metapopulation

Lynx populations in the contiguous United States historically (and may currently in some areas) likely occurred in the southern portion of a metapopulation whose core was located in the northern boreal forest of central Canada (McCord and Cardoza 1982; Quinn and Parker 1987; McKelvey et al. 2000a), although this may no longer be true for lynx in Washington (Martha Jensen, pers. comm.). Lynx in Washington are likely part of a metapopulation that includes lynx in British Columbia. This metapopulation is currently isolated (or the populations connections appear "tenuous") from other populations in Canada (such as in Alberta) (Biodiversity Legal Foundation 1998) and other states in continental United States (Martha Jensen, pers. comm.).

Lynx numbers in Washington state are estimated at 100 to 200 individuals (Brittell et al. 1989; Stinson 2000). Lynx numbers of the populations of Southern British Columbia (connected to Washington) likely similarly consist of a few hundred individuals (Martha Jensen, pers. comm.). Thus, the total Washington/British Columbia metapopulation likely currently consists of less than a thousand individuals. Viable populations of vertebrates generally require an effective *breeding* population of at least 500 individuals (Franklin 1980). Understanding that many individuals in a population do not breed, viable populations usually order in the thousands of individuals (Thomas 1990). Thus, we expect that considerably more than a thousand lynx in the Washington/British Columbia metapopulation will be necessary for a viable population if it is, or becomes, isolated from other populations in the U.S. or Canada. Thus, immigration and genetic exchange between British Columbia and Washington is likely essential to the long-term viability of the Washington/British Columbia lynx metapopulation (Stinson 2000), as well as an increase in population numbers, enhancement of north-south connectivity, and expansion of resident lynx distribution in Washington.

Threats

Rangewide, the noted factors affecting lynx habitat and lynx populations include: forest management (thinning, slash treatment, brush control, pesticides, herbicides), extensive timber harvest, forest maturation, fire suppression (and associated ecosystem susceptibility to disruptions, such as landscape scale insect infestations), catastrophic wildfire following suppression, artificial mortality (management of lynx trapping/hunting and roadkill), livestock grazing, artificial competition with other carnivores, management of lynx habitat, recreational use, increased road access, human disturbance, habitat modification/fragmentation, geographic isolation, reduced numbers of lynx in (and immigrating from) populations in British Columbia, and legal and illegal trapping (Bureau of Land Management 1998; Stinson 2000; U.S. Fish and Wildlife Service 2001). Habitat modifications that reduce the amount and availability of foraging and denning habitat, combined with fire suppression and the effects of prior trapping, may be the main reasons for continuing population declines (Bureau of Land Management 1998).

The research is not conclusive, but it appears that lynx may persist in the long-term in the continental United States mainly in roadless or low open-road density areas (Northwest

Ecosystem Alliance 1999). A possible reason is that roads give access to trappers, competitors, and/or predators. Also, if roads are being used by "anything that eliminates snow—that melts it, plows it, or compacts it—they are likely a way coyotes, cougar, and bobcat can have greater access to the high country" (Northwest Ecosystem Alliance 1999). Important risk factors that can impact lynx populations include high open road densities; roads are directly correlated with human access, and consequently lynx vulnerability to trapping and shooting (especially during the winter season) (U.S. Forest Service 1999c).

Noss *et al.* (1996) identified legal and illegal hunting/trapping of carnivores as a major threat posed by roads. More roads allow for more public access to wildlands. Using open road densities to measure road access, researchers found that as road densities increase, carnivore habitat suitability decreases partially due to hunting and trapping (McLellan and Shackleton 1988; Mech et al. 1988). Felid-specific (cat-specific) studies have supported this statement (Van Dyke et al. 1986b; Lovallo and Anderson 1996) and revealed that hunting/trapping plays a significant role in creating rare populations of mountain lion (Beldon and Hagedorn 1993), bobcat (Lovallo 1993) and lynx (Mech 1980). Dirt roads can fragment landscapes for wolves, jaguars, and other species vulnerable to opportunistic poaching (Foreman et al. 2000b). For example, at least five released Mexican wolves were shot along roadsides in the Apache National Forest in 1998 (Foreman et al. 2000b).

Roadways, powerline corridors and other linear networks fragment habitats used by a variety of species (Noss and Cooperrider 1994). Research on mountain lions and the issue of fragmentation found: 1) near human presence, lions shift their activity patterns (Van Dyke et al 1986b); 2) lions move through areas containing low density housing (1 unit/16 ha) but show an aversion to intermediate and high density areas (Beier 1995); and 3) roads and associated human developments effectively fragment local population of lions - leading Beier to say, "for cougars, any connection between two isolated patches is better than no connection." (Beier 1995).

Carnivores are particularly vulnerable to highway habitat fragmentation because of the large spatial requirements of individuals and populations. Highways adversely affect carnivores by increasing direct and indirect mortality, displacement and avoidance of habitat near highways, habitat fragmentation, direct habitat loss and habitat loss due to associated human developments.

It is generally accepted that road density is one key predictive variable that can be used to estimate the effects of disturbance and habitat fragmentation (Mattson 1987). Although the literature varies with regard to the amount of displacement and other impacts, there is irrefutable evidence that roads and the disturbances associated with roads reduce habitat effectiveness resulting in reduced fitness and increased risk of mortality to mammals (Paquet 1994).

Roads fragment wildlife habitat, reducing the capability of these areas to provide security from humans (Paquet et al. 1994). This results in animals avoiding or underutilizing the fragmented areas or being exposed to elevated risk of mortality; thereby reducing habitat effectiveness for meeting the biological requirements of wildlife. Moreover, habitat fragmentation may precipitate

population decline and extinction by dividing an existing widespread population into two or more subpopulations, each in a restricted area. Fences may exacerbate the problem by preventing the natural movement of species over their home range (Primack 1993).

Legal Status

Most states across the range of the lynx have laws and regulations regarding environmental issues that may indirectly promote the conservation of lynx habitat on non-federal lands. Many states have also classified the lynx as state-listed or species of special concern. At a minimum, states across the lynx's range in the contiguous United States currently protect lynx from legal hunting/trapping.

Table 1. Status of Lynx by Northern Rockies and Cascades States

Montana	Protected from harvest, 1999
Idaho	Species of Special Concern, protected from harvest, 1997
Washington	State-listed Threatened, 1993
Oregon	Not considered resident
Wyoming	Species of Special Concern
Colorado	Colorado Wildlife Commission approved the reestablishment of lynx into Colorado in 1998

For most states, there is no regulatory protection in addition to closed hunting/trapping seasons for species listed as state-sensitive, special concern, threatened or endangered. Because most conservation actions, especially habitat conservation actions, are voluntary under these designations, no assurance of habitat protection can generally be attributed to state species designations.

Washington State Status

Lynx were legally trapped or hunted in Washington until 1991, when a decline became readily apparent (Stinson 2000). The Washington Department of Fish and Wildlife (WDFW) maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). Species are evaluated for listing using a set of procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The WDFW's final Status Report and listing recommendation for the North American lynx were presented to the Washington Wildlife Commission in August of 1993. The lynx was declared a threatened species in Washington state by the Washington Wildlife Commission in October 1993.

Federal Status

On December 20, 1994, we determined that the listing of the lynx as threatened or endangered was not warranted. We found that "the petition to list did not present substantial information that the southern Rocky Mountain population of the lynx meets the definition of a 'species". In addition, we could not substantiate that the continued existence of the lynx was threatened by trapping, hunting, poaching, and present habitat destruction (59 ***FR*** 66509). We stated that we did take into account those efforts being made by state and federal agencies to protect the species.

Following a series of court opinions and FWS decisions, a settlement was reached between the FWS and Defenders of Wildlife on February 12, 1998, to finalize a proposed rule by June 30, 1998, to list the lynx in the contiguous United States. The proposed rule to list lynx in the contiguous United States as threatened range-wide was published on July 8, 1998 (63 ***FR*** 36994). On August 7, 1998, Plum Creek requested that lynx also be added to their permit.

The final rule was originally scheduled for completion within one year of the July 8, 1998, proposed rule to list the lynx. We extended the listing deadline by 6 months to allow the public to receive and evaluate the new information contained in the Lynx Science Report and provide comments to us. In the final rule, March 24, 2000 (65 ***FR*** 16052), we listed the contiguous United States DPS of the lynx as threatened, pursuant to the Act, as amended. The listing became effective on April 24, 2000.

History of Lynx Conservation Planning by Federal Agencies

Due to awareness by federal agencies of the uncertain status of lynx populations and habitats and the pending listing proposal, an interagency lynx coordination effort was initiated in March 1998. This effort represented initiation of informal conferencing between the FWS, USFS, Bureau of Land Management (BLM), and the National Park Service regarding lynx and their habitats.

Led by a National Interagency Lynx Steering Committee (comprised of representatives from the FWS, USFS, BLM, and National Park Service), the coordination effort directed the compilation of the following documents considered essential for understanding lynx ecology and implementing appropriate conservation measures on federal lands:

1) *Lynx Science Report*: A Science Team was selected to prepare a scientific report that amassed and interpreted all available scientific knowledge regarding lynx, lynx prey, and lynx habitats. This report was first distributed to the public electronically in 1999, and subsequently published as a book entitled "Ecology and Conservation of Lynx in the United States" (Ruggiero et al. 2000).

2) *Canada Lynx Conservation Assessment and Strategy*: An interagency Lynx Biology Team used information provided in the Lynx Science Report to develop a conservation strategy for lynx on federal lands. This effort was initiated through an action plan

approved by the affected Regional Foresters of the USFS, State Directors of the BLM, and Regional Directors of the FWS by memo dated June 5, 1998. Publication of the Canada Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) culminated this effort.

3) *Canada Lynx Conservation Agreement*: The USFS (Regions 1, 2, 4, 6, and 9) and FWS (Regions 1, 3, 5, and 6) entered a Canada Lynx Conservation Agreement on February 7, 2000, to promote the conservation of lynx and lynx habitat on federal lands managed by the BLM and USFS. As part of the USFS/FWS Conservation Agreement, the parties agreed to apply the LCAS for assessment and implementation of federal land management decisions in lynx habitat.

4) *Canada Lynx Conservation Agreement*: The BLM and FWS (Regions 1, 3, 5, and 6) entered into a Canada Lynx Conservation Agreement on to promote the conservation of lynx and lynx habitat on federal lands managed by the BLM and USFS. As part of the BLM/FWS Conservation Agreement, the parties agreed to apply the LCAS for assessment and implementation of federal land management decisions in lynx habitat.

Each national forest and BLM District began assessing lynx habitats and potential project impacts by using the Draft LCAS and coordinating with respective FWS field offices. Specific tasks included: 1) prepare maps of lynx habitat on national forests and BLM districts, 2) delineate Lynx Analysis Units (LAUs), 3) prepare lists of ongoing and proposed activities and projects, and 4) proceed with conferencing on projects at the "may affect" level.

Interagency coordination was initiated among biologists from the FWS, USFS, and BLM in each Lynx Geographic Area (Cascade Mountains, Northern Rocky Mountains, Southern Rocky Mountains, Great Lakes, and New England). These meetings were initiated to promote interagency coordination, ensure consistency in mapping across states and regions, and refine conferencing/consultation procedures. These meetings began in November and December 1999. Many state-specific interagency meetings between local FWS and USFS/BLM offices were also held on various dates, to develop and improve lynx habitat and LAU maps and to facilitate coordination regarding potential project impacts on lynx.
Using the aforementioned lynx biology and planning documents, an interagency team of biologists and planners from the USFS and BLM prepared a biological assessment (BA) that evaluated potential effects on lynx of 57 USFS Land and Resource Management Plans and 56 BLM Land Use Plans (collectively referred to as Plans). The BA described how Plans were included or not included for analysis, based on then available information related to the potential range of lynx. The BA was formally submitted to the FWS on February 18, 2000, to initiate conferencing, or formal consultation should the lynx be listed. The FWS received the BA on February 29, 2000.

The Northwest Forest Plan concluded that lynx were at a moderate level of risk because they occurred primarily on public lands where loss of old-growth forests posed a long-term threat (USDA/USDI 1994). The Northwest Forest Plan called for extensive surveys of lynx within the

range of the northern spotted owl in Washington and Oregon as a first step in developing conservation plans for lynx. Snow Tracking and Camera/Bait Stations were used by USFS and others for a number of years to detect lynx. A new survey technique recently emerged capitalizing on the natural cheek-rubbing behavior of cats to collect hair for DNA analysis. This technique can yield information on distribution, abundance, and genetic structure of populations as well as habitat and landscape features used by lynx. A hair-snagging survey protocol was developed by the Missoula Forestry Sciences Laboratory. Cooperative surveys have been initiated on national forest lands in the Cascade Mountain Range of Washington and Oregon (Weaver and Amato 1999). Most of the forest ecosystems with existing lynx and potential to support lynx in Washington occur on federal lands, and most of these areas are managed by the USFS. Management, primarily by the USFS has had the greatest affect on ecosystem-based lynx conservation in Washington. Depending on how habitat is defined, about 80 to 90 percent of the lynx habitat in Washington is managed by the USFS (WDNR 1996, USFWS 2000:16073). Significant portions of potential lynx habitat lie in designated Wilderness areas, although the habitat is highly fragmented (USFWS 2000:16073). Of the portion in managed forest, additional acres lie within late successional reserves under the Northwest Forest Plan that allow limited timber harvest.

Recovery Planning by the State of Washington

The State of Washington has developed a draft recovery plant, entitled: Draft Washington State Recovery Plan for the Lynx (Stinson 2000). The goal of Washington's lynx recovery program is to restore lynx populations to a level where there is a high probability that lynx will reside in Washington through the foreseeable future. The Recovery Objectives for the recovery plan are:

> The lynx will be considered for downlisting from State Threatened status to State Sensitive when:
>
> 1) Recovery Zone maps have been revised, adding potential lynx habitat that can be expected to sustain reproductive lynx populations, and removing any areas of existing recovery zones that prove to be unsuited to sustaining lynx.
>
> 2) Lynx are consistently present during 10 consecutive years in greater than 75 percent of the LAUs in the Okanogan-Cascades, Northeast, and any new identified Recovery Zones.
>
> 3) Lynx surveys indicate that recruitment from local reproduction regularly occurs.
>
> 4) Agreements or forest management plans are in place for federal, state, and major private landholdings that assure suitable habitat will continue to be managed in a way consistent with lynx conservation after downlisting.

The WDFW in the mid-1990's identified six Lynx Management Zones (LMZ's) that represented the as-then-understood distribution of primary lynx habitat in Washington (Brittell et al. 1989,

WDW 1993). LMZ's do not currently encompass all areas potentially used by lynx, but habitat management within these zones is expected by WDFW to hold the greatest promise for supporting lynx populations. LMZs have been divided into LAUs, that were established for assessing lynx habitat. These LAUs are utilized in the draft recovery plan.

The Recovery Strategy in the draft recovery plan consists of:

1. Survey and monitor lynx.
2. Manage habitat to improve conditions for lynx over time.
3. Protect lynx by minimizing human-caused mortality.
4. Undertake research designed to improve recovery of lynx in Washington.
5. Maintain information management system for lynx data.
6. Develop public information and education materials and programs.
7. Coordinate and cooperate in recovery activities with landowners and other public agencies.
8. Enhance lynx populations by direct intervention if needed and feasible.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area which have undergone section 7 consultation, and the impacts of state and private actions that are contemporaneous with the consultation in progress.

Setting

The action area characteristics (such as climate and dominant vegetation) were described in the HCP and the 1996 BO (USFWS 1996a); please refer to these documents for greater detail. A description of other features of the area such as vegetative types, land form, slope, aspect, and parent material is presented in Jensen (1995). Distribution of stand structures and future projections were presented in HCP Figures 46-48 and HCP Tables 30 and 30b, these were replaced by HCP modification document Figures 46A-48A and Tables 30A and 30bA. Community categories for forested lands are defined and described in HCP section 2.3.

The action area is characterized by mountainous topography. Peaks in the landscape reach elevations over 1,900 meters (6,200 feet). These rugged peaks along the Cascade crest create a substantial "rain shadow" effect, with the western portion of the action area receiving 360 centimeters (140 inches) of precipitation each year and the eastern portion receiving 80 centimeters (30 inches) (U.S. Forest Service 1997). Snow accumulation can reach 9 meters (30 feet) at Snoqualmie Pass (Cascade Mountains crest), while rarely exceeding 1 meter (3 feet) near Cle Elum. Lynx are present in the central Washington Cascades, and have been recorded on both sides of I-90 (U.S. Forest Service 2000a).

The configuration of forest communities in the action area has been influenced by a variety of historic factors. A land grant made by the federal government to the Northern Pacific Railway Company in the 1864 was an especially important factor. Every other square mile or section (2.6 square kilometers) of land along the route of a rail line running through the center of the action area was deeded to Northern Pacific Railway Company. Most of these lands were sold, however some mountainous forested lands were retained by the rail company and became commercial timberlands. This resulted in a checkerboard land ownership pattern across much of the Planning Area landscape. Different management objectives between the public and private ownerships have resulted in a fragmented forest landscape. An extensive land exchange was recently completed to consolidate land holdings in this area (U.S. Forest Service 1999b; Plum Creek 2000).

The predominant non-federal land use in the action area is commercial timber production. Federal lands are managed for multiple uses, but logging has traditionally been the most significant human land use that has affected ecosystem processes in the action area, followed by fire suppression and highway related development. In addition to the I-90 and timber harvest,

other visible features influence the action area for wildlife. Two high-voltage electrical transmission lines and a railroad traverse the action area. The Yakima River valley bottom along the eastern edge of the action area is experiencing substantial suburban residential development. For the residents of urban communities around Seattle, Snoqualmie Pass is one of the most accessible areas for outdoor recreation, and there is an extensive ski resort development at the top of the pass.

Plum Creek's ownership in the Planning Area is generally intermingled with federal lands, and currently (following the I-90 Land Exchange) consists of 60,060 hectares (148,300 acres) of alternating sections (2.6 square kilometers/1 square mile) of Plum Creek lands bordered, mainly, by federal lands administered by the USFS.

Plum Creek's ITP associated "ownership" consists of approximately 60,060 hectares (148,300 acres), which includes lands that they own in fee title, and 567 hectares (1,400 acres) of Tacoma lands for which Plum Creek retained timber rights. These lands are hereinafter referred to as Plum Creek ownership. Plum Creek's ownership covered by the permit on the west side of the Cascade Crest is approximately 21,460 hectares (53,000 acres); the ownership on the east side of the Cascade Crest totals approximately about 38,600 hectares (95,300 acres).

Within the 170,000 hectare (419,000 acre) Planning Area, approximately 40,000 hectares (100,000 acres) are between 460 meters and 920 meters (1,500 feet and 3,000 feet) elevation (23 percent), and approximately 130,000 hectares (319,000 acres) are above 920 meters (3,000 feet) elevation (76 percent). Practically all of the Planning area is above 460 meters (1,500 feet) elevation. Of the Planning Area, 62,0000 hectares (155,000 acres) were mapped as "late seral" stage forest in 1974; thus, at most, about 37 percent of the Planning Area was late seral forest as late as the 1970's. As documented in the HCP, approximately 6 percent of the Planning Area (all elevations) is currently "old growth", 6 to 8 percent is "managed old growth", and 21 to 26 percent is "mature forest."

Within Plum Creek's HCP ownership (based on mapping of 56,984 hectares/140,701 acres of their ownership), approximately 13,000 hectares (31,000 acres) are between 460 meters and 920 meters (1,500 feet and 3,000 feet) elevation (22 percent), and approximately 45,000 hectares (110,000 acres) are above 920 meters (3,000 feet) elevation (78 percent). Practically all of Plum Creek's HCP ownership is above 460 meters (1,500 feet) elevation. Of this HCP ownership, 15,000 hectares (38,000 acres) were mapped as "late seral" stage forest in 1974; thus, at most, about 11 percent of the HCP ownership was late seral forest as late as the 1970's. As documented in the HCP, approximately 1 percent of the Project Area is currently "old growth", 2 to 4 percent is "managed old growth", and 14 to 19 percent is "mature forest."

Per the Northwest Forest Plan, the land-designations for the lands of the169,642-hectare (418,870-acre) Planning Area are presented in Figure 10 and Table 5 of the HCP. Approximately 52 percent of the Planning Area is federal land. Within the Planning Area, about 2 percent of the land (4 percent of the federal lands) is designated as Congressionally Reserved

Area, 23 percent of the land (27 percent of the federal lands) as Late-Successional Reserve (LSR), 42 percent of the land is (49 percent of the federal lands) as Adaptive Management Areas, less than 1 percent of the land (less than 1 percent of the federal lands) as Managed Late-Successional Areas, 19 percent of the land (17 percent of the federal lands) as matrix, and about 12 percent of the land (none of the federal lands) is not designated.

Interstate 90

Interstate 90 is a high-volume, high-speed roadway that traverses the action area. Highway configuration in the action area ranges from 4 lanes in each direction, separated by a concrete median barrier, to 2 lanes in each direction separated by a broad forested median. Average daily traffic volume through the study area is approximately 24,400 vehicles with an average daily peak volume of 3,920 vehicles per hour (including both east and west bound traffic) (U.S. Forest Service 2000a). By 2018 these volumes are projected to increase to 41,400 vehicles per day with peak volumes of 6,190 vehicles per hour. Highway expansion is planned to meet the increasing needs (U.S. Forest Service 2000a).

Despite substantial development and road right-of-way affects along the highway corridor, I-90 passes through a relatively narrow gap between large blocks of federal and state land managed primarily for conservation and recreation. The Alpine Lakes Wilderness Area is less than 1.6 kilometers (1 mile) north of the highway in some places, while the Norse Peak Wilderness Area lies at least 24 kilometers (15 miles) to the south. LSR areas designated by the Northwest Forest Plan are located approximately 1.6 kilometers (1 mile) south and 11 kilometers (7 miles) north of the highway.

In 1998, the Washington State Department of Transportation and the USFS launched a cooperative research effort to study the effects of I-90 on wildlife movement. The team discovered that small mammals - but not medium and large carnivores - use I-90 drainage culverts (U.S. Forest Service 2000a). Three locations along/across this portion of I-90 - Easton Hill and the north and south ends of Keechelus Lake - are important connectivity areas for large mobile vertebrates (USFS). It is undetermined which specific locations are most important for maintenance of lynx.

Recreation

Some investigators indicate that lynx do not appear to significantly alter their behavior to avoid typical forest human recreation activities (Staples 1995; Roe et al. 1999; Aubry et al. 2000; Mowat et al. 2000), although the lynx behavior studied is likely confined mostly to foraging. The exceptions are human activities that affect denning (such as causing abandonment of a den site), which likely affect kitten survival (Ruggiero et al. 2000) or productivity in general. Large developed sites, such as four-season resorts, likely alter lynx foraging , travel, and denning habitats, and fragment the landscape. Developed recreation sites such as ski areas and warming huts encourage snow compaction in lynx habitat (please see Interspecific Relationships with

Other Carnivores above). Snoqualmie Pass Ski Area is within the action area (please see Other Pertinent Federal Actions below).

Recreational developments are generally not expected to occur within federal reserves in the action area. Potential effects of major developments such as ski areas or resorts include loss of suitable habitat and impediments to lynx movements. Additional information needs on the interrelationships between lynx and other carnivores during deep snow periods, and the influence of compacted snow routes on interspecific competition are identified in the LCAS.

Dispersed recreational uses and activities, such as snowmobiling, cross-country skiing, and snowshoeing are increasing within higher elevation environments. Buskirk et al. (2000) hypothesize that the usual spatial segregation of lynx and coyotes conditions (Murray and Boutin 1991; Litvaitis 1992; Murray et al. 1994) may break down where snow compaction facilitates access by coyotes to moderate/deep snow areas.

Recreation occurs on non-federal lands, federal matrix lands, and within federal reserves of the Planning Area, although motorized recreation is generally not expected to occur within federal reserves. These activities may provide packed trails into snow areas that allow competitors to more easily enter lynx habitat in winter.

Action Area Threats

Within the action area, the major factors affecting lynx populations and lynx habitat likely include forest management, fire suppression (and associated ecosystem susceptibility to disruptions), lynx habitat fragmentation, loss or degradation of travel corridors, loss or degradation of potential denning and foraging habitat, artificial mortality (particularly roadkill and poaching), human disturbance, and artificially high competition and predation levels (due to disrupted balance of carnivores in the Cascade Mountains, particularly involving coyotes, wolves (the lack thereof), bobcats, and mountain lions).

Northwest Forest Plan and Conservation Planning

With implementation of the Northwest Forest Plan and many subsequent dependent HCPs in the associated area, federal lands are relied upon to carry out the major responsibilities of conserving species that utilize late-successional forests, such as lynx (particularly for denning). However it is also anticipated that non-federal lands will provide some essential habitat functions for lynx, particularly migration corridors and core foraging habitat. The Northwest Forest Plan only covers a portion of the lynx's range. While contributions from non-federal lands remain important to lynx in many areas (including the action area discussed herein), implementation of the Northwest Forest Plan in protecting core lynx habitat areas, allows flexibility in the management of these non-federal lands, as evidenced in the subject HCP. Continued implementation of the Northwest Forest Plan is imperative to the functioning of many HCPs in the Pacific Northwest, and is a key feature of the Status of the Species and Environmental

Baseline utilized in this BO for lynx. Continued implementation of the Northwest Forest Plan is imperative to the conclusions made herein, in large part because it is imperative to providing complementary amounts and types of lynx habitat to that afforded by the subject HCP. Significant changes in implementation of the Northwest Forest Plan within the areas potentially utilized lynx would likely adversely affect these conclusions.

Habitat Conservation Plans

Washington Department of Natural Resources

Subsequent to the approval of Plum Creek's HCP (1996), the Washington Department of Natural Resources (WDNR) received approval for a HCP covering 730,000 hectares (1.8 million acres) in the state. The WDNR HCP and associated IA and ITP cover forestry and other activities on those State-managed lands. The complexity of the WDNR HCP precludes Plum Creek or the NMFS/FWS from being able to model the specifics for the relatively small amount of WDNR ownership in the Planning Area. The WDNR HCP covers lands that are lower in elevation than the Planning Area. A recent land exchange has added to the WDNR lands within the Green River. These additional lands will receive the same management under the WDNR HCP. The HCP primary land management strategy for listed species is based on protections of spotted owl life forms (as an umbrella strategy).

City of Seattle

The HCP developed by the Seattle Public Utilities for the City of Seattle's ownership in the Cedar River Watershed provides information regarding the environmental baseline in that area. The Seattle Public Utilities HCP is a complex plan addressing reservoir management, instream flows, artificial production of salmon, forest management, watershed restoration, and road management and decommissioning just to the north of the Green River watershed. The 50-year plan covers the City's 36,670 hectare (90,545-acre) Cedar River Municipal Watershed and the City's water supply and hydroelectric operations on the Cedar River.

The HCP provides protection of all existing old-growth forest (5,625 hectare/13,889 acres); (2) elimination of timber harvest for commercial purposes in their extensive ownership in the Cedar River watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) restoration thinning of about 4,500 hectares (11,000 acres), ecological thinning of about 800 hectares (2,000 acres), and restoration planting of about 600 hectares (1,400 acres) designed to facilitate structural development of mature forest characteristics in second-growth forest in some areas; and (5) removal of 38 percent of existing watershed roads. Approximately 5,625 hectares (13,889 acres) of old-growth forest, 9,687 hectares (23,918 acres) of late-successional forest, and 13,929 hectares (34,932 acres) of mature forest are projected to exist in the watershed by the year 2050 under the HCP.

Other Pertinent Federal Actions and Permits

Snoqualmie Pass Ski Area

The Summit at Snoqualmie Ski Area has proposed to update its master plan to include additional chair and surface lifts, addition of a multi-user gondola and restaurant, addition of new lifts and ski terrain within existing special-use permit boundary, adjustments of the boundary for crossover trails, expanded night skiing, additional of parking lots, day lodges and other related facilities, maintenance facilities and utilities to support the ski area operations and other year-round recreational opportunities.

Reversal of Huckleberry Land Exchange

In an opinion filed on May 19, 1999, in Muckleshoot Indian Tribe and Pilchuck Audubon Society vs. USFS, No 98-35043, the Ninth Circuit Court reversed a previous favorable opinion on National Environmental Policy Act (NEPA) and National Historic Preservation Act grounds regarding the Huckleberry Land Exchange. This opinion resulted in an injunction on "further activities" on lands exchanged even though the exchange occurred over a year earlier (March 1998). The Huckleberry land exchange involves a small amount of acreage relative to the Planning Area.

Status of the Species (in the Action Area)

Little is known about the historic status of lynx in the action area. Reports exist for lynx caught in Kittitas County in the 1960's and 1970's (Stinson 2000). More recent lynx detections have been reported in Kittitas County (Weaver and Amato 1999) that could represent transients, or small local populations (Stinson 2000) in the action area. Documented lynx records for the action area exist for the 1960's, 1970's, 1980's, and 1990's (U.S. Forest Service and Bureau of Land Management 1999c; Figure 2). The USFS (2000a) report lynx from hair-sampling surveys conducted in 1998 that "indicated lynx presence north and south of I-90." In June 2000, a lynx was observed near the Rachel Lake trailhead, just north of I-90 and Kechalus Lake (Martha Jensen, pers. com. 2001). Lynx were likely never common historically in the action area, and are currently considered uncommon or rare in this area. Although there are enough recent documented occurrences of lynx in the area to conclude that lynx likely are present, but rare (and reduced compared to historic numbers).

The agencies responsible for managing forests and wildlife in the action area are assessing lynx habitat conditions across the landscape and are currently cooperating with one another. The WDFW is writing a final Recovery Plan for lynx in Washington and has written Priority Habitats and Species Guidelines for managing lynx habitat. The WDNR and Boise Cascade and Stimson Timber companies are implementing plans to manage for lynx habitat over time. WDFW and the USFS are monitoring lynx distribution and density. The USFS has developed a Lynx Conservation Strategy for evaluating impacts of proposed activities in potential lynx habitat. In

1999, the Interagency Lynx Committee produced The Lynx Habitat Field Reference Notebook to assist resource managers in identifying lynx habitat. Agencies and some private landowners are monitoring forest changes in potential lynx habitat over time in the action area. In the future, results obtained from research and monitoring may be used to adjust forest management activities to benefit lynx.

Project Area Lands – Limiting Factors and Silviculture Methods

Forest practices of the past occurred regionally under less-conservative management regimes than the present HCP or state forest practices, and largely contributed to the current legacy of extensive fragmentation of native forest community stand and structure mosaics through logging and fire suppression.

Plum Creek has used (and continues to use) even-aged and uneven-aged harvesting techniques on its ownership in the Cascade range. In 1994, Plum Creek used even-aged harvesting techniques in approximately 17 percent of its harvest operations east of the Cascades crest, and in about 65 percent of its operations west of the Cascades crest. Please see our 1996 BO and the subject HCP for more details.

EFFECTS OF THE PROPOSED ACTION

Please see our 1996 BO for a detailed analysis of effects of the action.

The primary importance of the action area to lynx in the long-term is to provide connectivity and linkage between core lynx habitat areas to the north and south in the Cascade Mountains, particularly for genetic and demographic rescue of populations to the south of the action area. Of secondary importance is the provision of core habitat itself for lynx residing in the overall action area. The Planning Area lands are relatively unique in the Cascade Mountains in that they form an east-west band of significant private ownership (private/federal checkerboard ownership pattern) across the width of the Cascades.

Effects by Lynx Habitat Type

Lynx are wide-ranging species requiring large, interconnected areas of suitable habitat. Habitat connectivity for lynx along the Cascade Mountains is important for long-term lynx population viability and maintenance of the contiguous United States DPS. Lynx are likely adversely affected by management activities that reduce or degrade essential habitat elements for lynx used for denning, travel, or foraging, or that increase habitat fragmentation and lynx mortality.

As proposed, commercial thinning or clearcut logging (regeneration harvest) in otherwise appropriate locations in the Project Area likely degrades, removes, or precludes natural successional development of denning habitat and degrades lynx foraging habitat. However, in the absence of natural fire, regeneration harvest techniques artificially resets successional processes resulting in the establishment of future lynx foraging habitat. As proposed, Plum Creek will continue to practice fire suppression. Proposed use of roads will likely cause avoidance of some otherwise appropriate lynx habitat use areas, particularly temporary avoidance of areas adjacent to logging activities. If lynx den in areas adjacent to roads that then receive moderate use, the disturbance associated with traffic and with human activities could lead to reproductive failure (such as abandonment of kittens). Road use may result in direct mortality of lynx.

Denning Habitat Effects

Lynx denning habitat is used for parturition and rearing of young. The common component of denning habitat appears to be large amounts of coarse woody debris (Koehler 1990b, Staples 1995). This woody debris structure for denning must be available, in or adjacent to foraging habitat to be functional. Proposed vegetation management activities (such as salvage harvesting and site preparation) removes existing coarse woody debris and/or adversely affect its recruitment. Typical vegetation management in the form of logging precludes development of woody debris through cyclic removal of most live trees before they can ultimately become significant coarse woody debris through blowdown and natural death processes. Typical site preparation for planting, as expected to be utilized by Plum Creek, removes most existing large

woody debris through stockpiling and burning. Timber harvest and vegetation management activities expected to be used by Plum Creek directly affect the function and quantity of available lynx denning habitat. Removal of coarse woody debris by vegetation management and harvesting likely adversely affects the survival of any lynx kittens produced, and likely precludes development of denning potential in the first place.

Approximately 2 to 5 percent of the Project Area (all elevations) consisted of "old growth forest" in 1996, with approximately 2 percent "old growth" and 3 percent "managed old growth." A similar proportion of the Project Area lands above 920 meters likely is old growth with potential for denning; no potential for denning is expected in the action area below 920 meters, as lynx are not known to den below 920 meters elevation in Washington. Thus, roughly 2 to 5 percent of the lands above 920 meters likely consisted of consistently suitable denning habitat in 1996 (please see HCP Table 31c). Throughout the ITP term, 1 to 3 percent of the Project Area is expected to remain in this general condition, with approximately 1 percent "old growth" and 2 percent "managed old growth." Thus some losses of suitable denning habitat to logging related activities are expected during the ITP term.

A very small amount of denning is expected in non old growth forest areas of the Project Area. This is based on the paucity of substantial coarse woody debris in most of these areas, in configurations necessary for denning by lynx. Some potential exists for development of layered coarse woody debris over time (during the ITP term) in larger, high elevation leave-tree areas or riparian buffer zones (above 920 meters elevation), where management activities will be extremely limited. Studies of north-central Washington lynx denning habitat indicated key characteristics of: dominant 150 years or older fir or spruce stands; extensive quantities of layered downed woody material; stands at least 2 hectares (5 acres) in size (Brittell et al. 1989; Interagency Lynx Committee 1999). These features will be rare outside of existing old growth stands, in the Project Area.

Within adjacent/nearby federal reserves (e.g., wilderness, roadless, late successional reserves) in the action area (north and south of the Project Area), denning habitat for lynx will likely be maintained at levels similar to those that occurred historically only in the limited areas where: a) no logging activities have ever occurred, and; b) where fire suppression has not caused stand replacing wildfire or a lack of sufficient lynx forage habitat in close proximity to otherwise suitable denning areas.

Functional denning habitat will likely develop or improve during the ITP term on many adjacent/nearby LSR lands, including areas that have been harvested in the past, as a result of the continued no-harvest restrictions associated with the Northwest Forest Plan. In many LSR areas that have been harvested, but currently have substantial (large diameter) standing and large downed trees, further development of extensive areas of layered coarse woody debris in these stands will occur over time (decades) such that denning habitat will improve or develop. These LSR stands will likely provide consistently improving lynx denning habitat for use by lynx

utilizing the action area during the ITP term. Resident lynx in the action area will likely heavily depend upon denning habitat found adjacent to the Project Area in these LSR areas.

It is undetermined whether lack of denning habitat is currently limiting to lynx numbers in the action area (as compared to foraging or dispersal habitat, or direct mortality factors).

Foraging Habitat Effects

The primary prey of lynx is snowshoe hare. Within the forest types that support snowshoe hare, certain successional stages and stand structures are highly favored, with dense horizontal cover being the key component of snowshoe hare in numbers supportable of lynx (Wolfe et al. 1982, Litvaitis et al. 1985, Sievert and Keith 1985, Fuller and Heisey 1986, Thomas et al. 1997, Sullivan and Sullivan 1988, Hodges 2000). Dense horizontal cover of conifers, just above snow level in winter, is critical for snowshoe hares. Red squirrel is the most important alternate prey species throughout the range of the lynx, although a diet of this species alone likely is not adequate to ensure lynx reproduction and survival of kittens (Koehler 1990a, O'Donoghue et al. 1988, Apps 2000). As proposed, forest management and wildland fire suppression/management activities will modify vegetation structure and mosaics of forested landscapes, and thereby affect the habitat of lynx prey. Functional lynx foraging habitat on Project Area lands is likely to be maintained at a level substantially less than the level provided under natural disturbance regimes historically. Snowshoe hare foraging habitat will likely be artificially maintained across some of the Project Area lands based on forest structural stage HCP commitments. Pre-commercial thinning and other stand management activities will reduce the length of time/area that these structural stages are maintained on the landscape as functional foraging habitat for snowshoe hare and lynx.

No clearcut cycle is specified by Plum Creek in the HCP, but a harvest cycle between 65 to 120 years is expected, with higher elevation lands on a longer cycle than lower elevations. Thus approximately 1 to 2 percent of the Project Area harvestable lands west of the Cascades would likely be clear-cut each year. At least 30 percent of the Project Area lands will be maintained as "young forest" or "pole timber" throughout the ITP term. Assuming these proportions hold for elevations above 920 meters (the lower limit for lynx foraging), this is roughly equivalent to the 15 to 35 year old age "window" of typical moderate/high-function snowshoe hare habitat, based on age-classes for artificially managed forests. Other forest stand stages in the Project Area are also expected to be utilized by foraging lynx.

An "aggressive" thinning schedule of "young forest" and "pole timber" stands (allowable under the HCP) could eliminate or degrade their function as foraging habitat for lynx, on a stand by stand basis. Thinning typically substantially reduces function of hare foraging habitat, through removal of structure and cover (stems per acre density) preferred by hares. The timing of thinnings by Plum Creek is unspecified in the HCP. Thus, the availability of foraging habitat for lynx on Project Area lands on an annual basis is undetermined.

In Washington, lynx populations may be limited by the effective availability of snowshoe hare prey, as suggested by large home range sizes, high kitten mortality due to starvation, and greater reliance on alternate prey, especially red squirrels, as compared with populations in northern Canada. Artificially high levels of competition (as discussed above), likely caused by a combination of extreme reduction in wolf numbers/increase in coyote numbers, forest fragmentation and fire suppression, and snow compacting activities (as discussed in Status of the Species), likely reduce the effective availability of snowshoe hare to lynx in significant portions of the action area. Some of the contributing factors (such as winter road use) to this competition will likely continue on the Project Area lands as part of HCP covered activities.

Dispersal Habitat/Connectivity Habitat Effects

Maintenance of dispersal habitat across the action area and project area is highly important to lynx survival regionally. The project area is strategically located between essential core lynx areas of the Cascade Mountains to the north and south. An effective combination of contiguous dispersal habitat, with core areas of foraging and denning habitat along the length of the Cascades in Washington is likely highly important for maintenance of lynx populations (through genetic and demographic rescue) that make up a metapopulation across Washington and British Columbia. Fortunately, the management prescriptions proposed are expected to sufficiently facilitate movement of lynx north-south across the project area.

Of all the actions proposed within the HCP, mainly clear-cuts over 90 meters (300 feet) wide would adversely affect travel movements by lynx, assuming substantial foraging habitat is available to support north-south dispersal movement. Lynx must find adequate prey during dispersal (such as one snowshoe hare/day) in order to continue with dispersal itself. If adequate structural cover for lynx dispersal is available for north-south movement in any year (as is expected herein), but viable foraging opportunities for lynx along the way are not, then available foraging habitat within the Planning Area would likely be the main limiting factor to north-south lynx movement associated with the proposed action. In that case, thinning (usually pre-commercial thinning) of foraging habitat stands would likely be most important action of the HCP on potential lynx dispersal.

The limitations on movement by lynx imposed by clearcuts would last for approximately the first 15 years following site logging, after which typical tree regeneration would substantially provide cover for lynx movement. All other forest age/structure classes expected in the Project Area should function serviceably for lynx travel, and most forest roads described in the HCP would not form substantial barriers to lynx movement. Other open areas, such as quarries and mining pits would likely be avoided by lynx, but these features will be sporadic and dispersed on the landscape.

Management on complementary adjacent federal lands is expected to result in equal or better lynx dispersal habitat (than that on the Project Area lands); functional dispersal habitat on the adjacent federal lands is a necessary component of dispersal across the Planning Area

considering the checkerboard ownership patterns. Because dispersal travel (longer distance/multi-day) across the Planning Area will require foraging opportunities, adequate combinations of foraging and travel cover are needed north-south across the Planning Area to maintain connectivity for lynx. Most clearcuts specified in the HCP will be limited to 17 hectares (42 acres) in size and dispersed across the landscape in space and time.

Substantial Matrix and Adaptive Management allocations are designated on adjacent federal lands of the Planning Area. The checkerboard ownership of the Planning Area is such that the northern 2/3 of the Planning Area federal lands are predominately Adaptive Management, with the southern 1/3 of the Planning Area federal lands designated predominately as matrix and LSR (please see Figure 1 enclosed). We expect that future management of these federal lands will be subject to consultation on lynx, and lynx dispersal and foraging habitat will be retained or enhanced on these federal lands, complementary to the dispersal habitat provided on the Project Area lands. Thus we expect that logging and management as specified within the HCP and on the adjacent federal lands will maintain dispersal connectivity with sufficient foraging habitat (along the way) to provide for north-south lynx movement across the Planning Area and Project Area lands (to and away from the edges of the I-90 corridor) annually during the ITP term.

Effects by Activity Type

Logging and Type-Conversions

Logging, which is an important factor in the dynamics of many boreal forests, artificially restarts one type of succession necessary to create effective hare habitat usable by foraging lynx; this same logging, often removes (or is associated with the removal of) the coarse woody debris structure needed for denning by lynx. Whether the regrowth on a logged area becomes effective hare foraging habitat will depend on site level factors and silviculture treatment post-harvest (Thompson 1988; Koehler and Brittell 1990). In a study conducted in British Columbia, significant reductions in snowshoe hare densities were found in thinned stands compared to unmanaged plantations (Sullivan and Sullivan 1988). Increased hare and lynx populations would likely occur with logging plans that incorporate numerous small stands of mature forest, hence increasing the amount of uncut forest-successional edge (Thompson 1988). A limit to the benefit of edges for hares likely exists, because predation on hares probably increases in small habitat patches; very small patches may present predation risks that are not sustainable for hares.

Forest management activities result in conversion of vegetation types, as well as age classes and stand mosaic patterns, which all affect potential stand suitability for use by lynx. For example, silvicultural prescriptions might be designed to change species composition to favor western larch, which has a high economic value, at the expense of lodgepole pine, which has low economic value but provides higher-function habitat for snowshoe hare. Type-conversions such as this would reduce lynx foraging habitat in otherwise appropriate areas. This type of conversion has likely occurred in the Project Area and would be perpetuated during the ITP period.

Thinning

Thinning can reduce horizontal cover that is critical to maintain the snowshoe hare prey base for lynx. Silvicultural prescriptions, such as pre-commercial thinning or herbicide application, thin or remove understory vegetation. Except when occurring in extremely dense stands, this generally reduces foraging habitat function for snowshoe hares and thus lynx (Sullivan 1988). Thinning of young dense stands could adversely affect lynx by reducing foraging habitat. Within the Project Area lands, high potential exists for thinning activity to occur over broad areas and result in adverse effects on lynx.

Fire Management

Fire plays an important role in maintaining the mosaic of forest successional stages that provide habitat for both snowshoe hare and lynx (Fox 1978, Bailey et al. 1986, Quinn and Thompson 1987, Koehler and Brittell 1990, Poole et al. 1996, Slough and Mowat 1996), although fire's importance has been reduced by suppression and logging. Periodic vegetation disturbance/nudation, particularly from fire, (naturally) maintains the snowshoe hare prey base for lynx. In the period immediately following large stand-replacing fires, snowshoe hare and lynx densities are low. Populations increase as the vegetation grows back and provides dense horizontal cover, until the vegetation grows out of the reach of hares. Low to moderate intensity fires also stimulates understory development in older stands.

Fire exclusion has altered the pattern and composition of vegetation in boreal forests. Within federal reserves of the action area, natural processes are expected to predominate without fire suppression with implementation of the Northwest Forest Plan. In these areas, fire will likely have a significant role in creating natural mosaics of vegetation in the mid-term. Within the federal matrix and on the HCP Project Area lands, aggressive fire suppression is likely to occur and will thus limit the natural creation of foraging habitat. Natural foraging habitat for lynx resulting from fire will thus largely be expected on adjacent federal lands within the Planning Area. An undetermined amount of artificially maintained mosaics of comparatively lower-function foraging habitat will be maintained on Planning Area lands.

Chemical Application

A number of factors contribute to the frequency of Plum Creek's herbicide applications within the Project Area: Plum Creek's stated commitment to rapid reforestation, the stated use of high-function seedlings and high-function seedling handling and planting techniques all contribute to an expected frequency of herbicide application considered less than typically used in industrial forestry. Uneven-aged management and partial harvests do not require as much site preparation and replanting, thereby reducing Plum Creek's need to control vegetative competitors (mainly east of the Cascade Mountains crest). Uneven-aged and partial harvests increase the cost and decrease the effectiveness of herbicides. Additionally, vegetative competition is generally decreased at higher elevations (as in the Project Area for lynx). Plum Creek has committed to avoid "sensitive areas" and to not allow spraying within 30 meters (100 feet) of water bodies or

within riparian areas. Nevertheless, the actual amount and frequency of use of herbicides proposed to be by Plum Creek is undetermined beyond the labeling instructions provided by the Environmental Protection Agency.

The proposed chemical vegetation management activities would likely adversely affect foraging habitat for snowshoe hares, and consequently lynx foraging habitat in the Project Area. Prime snowshoe hare habitat in artificially maintained forest includes young forest stands at higher elevations. To be available for snowshoe hare during the winter months, desirable forage and cover must be significantly above average snow depth. Some hardwoods are used by snowshoe hares during the winter months, but hardwoods are more important during the summer. However, hardwood species that protrude above the snow likely provide forage during the winter as well. Herbicide use by the applicant would be directed at plant competitors to those species desired by Plum Creek (generally softwoods are desired). Herbicide use on clear-cuts can decrease forage diversity for a number of years making areas less valuable to snowshoe hare (Western Newfoundland Model Forest 2001). Herbicide use is not expected to largely affect travel or denning habitat use by lynx. The extent of proposed herbicide use is undetermined. The potential for contaminants effects on lynx is considered low due to minimal exposure.

Forest Roads

Existing open road densities within the Project Area are generally high, contributing to relatively high vulnerability or low security for lynx. Lynx have been documented using little-used forest roadbeds for travel and foraging (Parker 1981; Koehler and Brittell 1990). A recent analysis of the Okanogan National Forest in Washington indicated that lynx show no preference or avoidance of unpaved forest roads, and that forest road density does not appear to affect lynx habitat selection (McKelvey et al. 2000c). However, forest/backcountry roads provide human access into remote areas and defacto facilitate snowmobile use and other snow-compacting activities, which may facilitate competing predators access into lynx habitat during the critical winter period.

Roads that receive moderate to heavy traffic have been shown to be a major cause of lynx mortality in some areas, it would be rare that lynx would be killed by vehicles on remote gravel forest access roads. However, these forest roads provide human access into potential habitat and accidental mortality of lynx may result from activities such as trapping or shooting.

Administrative and commercial uses of forest roads are known to disturb many species of wildlife (Ruediger 1996). However, preliminary information suggests that lynx do not avoid forest roads (Ruggiero et al. 2000a), except at higher traffic volumes (Apps 2000). Plum Creek's covered activities will likely directly generate higher traffic volumes only during somewhat isolated logging/management activities. The effects of new forest road construction in lynx habitat are largely unknown.

Plum Creek will maintain and use roads in the Project Area. Recreation is not a covered activity. Plum Creek has specified road closures (gates) and some road abandonment within the HCP (such as for grizzly bear protection; see section 3.2.1.3 of the HCP), both of which would likely benefit lynx. It is undetermined what proportion of the road traversing Plum Creek's lands are closed to the public. Some potential exists for roadkill of lynx from Plum Creek's administrative or management vehicle activity of the Planning Area roads during the ITP term. Plum Creek's vehicle speeds on forest roads will kept relatively low by conditions (narrow, curvy, dirt/gravel surfaced roads), and the amount of night-time driving associated with the proposed covered activities will be small: both of these factors are important for reducing potential roadkill of lynx. Additionally, the frequency of vehicle use of these roads associated with the proposed covered activities is relatively low compared to typical blacktop roads where most lynx roadkill occurs.

Some plowing of high elevation roads is expected with Plum Creek's proposed covered activities (such as late in the Fall and early in the Spring), but Plum Creek is not expected to regularly plow Project Area roads free of snow throughout the winter. Some snow compacting activities are expected annually as a result of typical forest management (such as surveys), with resultant potential degradation of lynx habitat through interspecific competition as discussed above.

Summary of Effects

Connected forest core areas allow lynx and other forest carnivores to move long distances to disperse, exchange genetic material, re-establish extirpated populations, and find food/dens/mates. Barriers to movement, such as large cleared areas, highways, and development are a major concern for lynx (and many other predators), as they have high potential to severely and/or permanently disrupt connectivity. Highways with high-speed, high-volume traffic and associated developments likely inhibit lynx home range movement and dispersal, and likely contribute to loss of habitat connectivity and direct mortality associated with vehicle collisions. Maintaining connectivity for north-south movement of lynx along the Cascade Mountains between core areas is likely the most important function of the Planning Area lands. In concert with management of the adjacent federal ownership, the Project Area lands are expected to retain connectivity for lynx to and from the north/south edges of the I-90 corridor.

Nothing in the proposed action considered herein alters or modifies the commitments of the Plum Creek Timber Company under the current HCP. The conservation measures of the HCP over time will improve the permeability of the Project Area lands for lynx dispersal compared to the existing, somewhat degraded condition, and improve the dispersal structure for lynx within limited forest stands throughout the course of the HCP period. Net improvements in dispersal habitat function and amount is expected over the ITP term over the current condition, due to specified leave/mature tree retention, reserve areas, buffers, specified structural stage commitments, and limited clearcut sizes. The amount and extent of foraging habitat available on the Project Area lands during the ITP period is undetermined, as foraging is largely dependent on younger stands remaining unthinned for extended periods, and the extent and timing of thinning

by the applicant is undetermined. Denning habitat is currently sparse in the Project Area, and will likely continue to be rather sparse in the Project Area during the ITP term. Nevertheless, the negative effects of the HCP will be largely local for lynx.

Denning habitat is expected to be increasingly available on some of the adjacent federal lands of the Planning Area during the ITP term, mainly within LSRs and Congressionally Withdrawn Lands, due to conservation of old growth, late seral forests, and coarse woody debris associated with the continued implementation Northwest Forest Plan. It is also expected that management of these federal lands will improve for lynx in the future, including improvement in management that provides foraging opportunities for dispersing lynx. Landscape-level dispersal habitat is expected to improve across the Planning Area over the ITP term; dispersal habitat will likely be provided in sufficient configurations for annual movement by lynx across the Planning Area north-south (to the edges of I-90).

The combination of denning, travel, and foraging habitat on adjacent federal lands, and the travel habitat on Project Area lands is expected to provide for the important regional needs of the species during ITP period, and will be an improvement over conditions that existed in the previous two decades.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future state, tribal, local, or private actions, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation. These are actions, unrelated to the proposed action, that are likely to occur, bearing in mind the economic, administrative, or legal hurdles which remain to be cleared (50 CFR 402; Subpart A). Future federal actions that are unrelated to the proposed action are not considered in this section, because they require separate consultation pursuant to section 7 of the Act. Cumulative effects per the Act substantially differ from "cumulative impacts" under the NEPA, in that NEPA cumulative impacts are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions.

The most important cumulative effects are from non-federal forest-land management, non-federal highway related development, recreation, and urbanization on adjacent non-federal land (particularly as it related to connectivity north/south through the Cascade Mountains). Proposed modifications and expansions of the I-90 Freeway, or changes in management of the national forests, have high potential for adverse effects on lynx, but these activities and any related development "expected to result" are generally considered federal actions, and thus not cumulative effects. It is expected actions of this type will be consulted upon. To the extent that any of these actions are not effectively consulted upon for their effects on lynx, then their effects remain cumulative to the proposed action considered herein.

The 1996 BO addressed cumulative effects and that analyses is incorporated herein by reference. Actions on non-federal lands, such as urban development, logging, road building, and recreation will continue to contribute to habitat degradation and outright loss, which will affect the species. Habitat fragmentation, habitat loss, and habitat degradation are expected to continue as development in the action area and environs creates a demand for additional public services and facilities. Disturbances caused by human development will continue to cause loss and degradation of habitat, disruption of connectivity, and direct mortality.

Overall in Washington, most potential lynx habitat occurs on federal land. Due to the forested nature of lynx habitat, most extant lynx habitat in Washington and in the action area on non-federal land occurs on private and state lands where timber harvest and thinning occurs. Other private lands potentially usable by lynx in the action area are developing for residential or business, and recreational uses, with substantial potential for future management of these lands to adversely affect lynx. Connectivity concerns associated with highways and development are a substantial in the central Cascades, as they are in other areas.

In addition to timber management, non-federal activities expected in the future in the action area include mineral extraction, urban and rural development, recreation site construction and use, road construction, highway construction, maintenance, and widening; development; and utility

corridors. Habitat loss or degradation and direct mortality of lynx are likely to adversely affect lynx. More detailed analysis can found in our 1996 BO.

Forestry

It is anticipated that non-federal forestry activities in the action area will continue at somewhat the same level as in the last decade, although State Forest Practice Rules and the resultant forest management will likely somewhat improve relative to lynx during the ITP period, particularly in reduction of habitat fragmentation and improvement of travel corridors. These improvements are expected to result from passage of legislation by the Washington Legislature (ESHB 2091, June 1999) directing the revision of Washington Forest Practice Rules. This effort should indirectly benefit lynx (compared to management under past rules) through improved management of buffer strips, retention of some mature trees, and reduced clear-cut sizes on non-federal lands within the action area. Because these benefits will mainly result in improvements in travel corridors (compared to more extensive clearcuts, for example) than for other life history functions, it is undetermined whether these latest forest practice rules will contribute significantly to conservation of lynx in the region, as other limiting factors may be involved.

Growth and Development

The planning efforts in King and Kittitas counties have identified lands that are unlikely to be managed for forestry in the foreseeable future. These include an area from Cle Elum to the south end of Kachess Lake (excluded from the Planning Area) and an area in the Snoqualmie Drainage near the town of North Bend. These areas will likely be subject to activities such as housing developments, commercial activities, and recreational developments. On these lands, these activities will likely have different and more significant long-term adverse effects on lynx than would have occurred as a result of traditional forestry, although portions of these lands are not likely to have high potential (and importance) for utilization by lynx even in ideal conditions due to low elevations. Growth and development above 460 meters elevation likely will result in permanent conversion and loss of potential habitat (potential dispersal habitat above 460 meters, potential foraging/denning habitat above 920 meters elevation). The related increase in human use and traffic would particularly cause increased habitat fragmentation and degradation of highly significant lynx travel corridors, within an already partially degraded area important for lynx movement north and south of I-90. However, outside of the I-90 corridor, lands above 460 meters elevation in the action area are owned and managed mainly by the USFS and industrial timber companies.

Recreation

Recreation is not a covered activity of the subject HCP. Some ongoing and future recreation in the action area will involve a federal nexus, and thus are federal activities subject to consultation. To the extent that this recreation is not consulted upon, its effects remain cumulative to effects of the action considered herein.

Substantial recreation is likely to occur within the action area, with the most important effects to lynx stemming from hunter access and winter recreation that compacts snow and fragments forest communities. The demands for winter recreation will likely affect most lands in the action area that are open (or quasi-open) to public use. These effects will mainly occur along roads and trails. Most activity will likely be concentrated around Snoqualmie Pass, existing ski areas, several snow park areas, and proposed resorts.

Winter recreation, such as snowmobiling, is a popular activity within the Planning Area. The State of Washington has 33,000 registered snowmobiles, and approximately 1/3 of these utilize the Planning Area (Lyn Cole, Washington State Snowmobile Committee, pers. comm. 2001). An undetermined number of groomed and ungroomed snowmobile trails will continue to facilitate high levels of winter recreational use into a large portion of lynx habitat within the action area. Other roads considered as open, or seasonally restricted, provide additional winter access. Often many of these roads are heavily used and will likely continue as such. In addition, open and semi-open areas adjacent to developed trails and other areas of high use often receive periodic dispersed snowmobile use. It is expected that lynx will likely be displaced from areas where high levels of winter recreational use occurs, which may possibly reduce the availability of winter forage and dispersal habitat within the Planning Area. Maintained trails for snowmobiling provides easy access for winter trapping for other furbearers which is known to be a potential source of inadvertent lynx mortality. Also, maintained winter recreational trails, high-use dispersed winter snowmobile areas and snow play areas are known to provide increased opportunities for competing predators such as the coyote and bobcat to enter areas occupied by lynx.

The summit at Snoqualmie Ski Area has proposed to update its master plan to include additional chair and surface lifts, addition of a multi-user gondola and restaurant, addition of new lifts and ski terrain within existing special-use permit boundary, adjustments of the boundary for crossover trails, expanded night skiing, additional of parking lots within and outside the special-use permit boundary, day lodges and other related facilities, maintenance facilities and utilities to support the ski area operations and other year-round recreational opportunities.

Another potential expansion includes a destination resort in the Gold Creek/Snoqualmie Pass area. Another resort is currently being developed along the Cle Elum River by Jen-Weld. The unused Milwaukee Railroad line has been converted into a series of hiking trails, and recreation along this route is expected to increase. Dispersed recreation may also have adverse effects to lynx in all four seasons of the year. It is expected that impacts from backpacking, fishing, and other non-motorized forms of recreation (except those that would likely lead to poaching) will have minimal impacts on lynx. Motorized recreation, especially concentrated and repeated use of local areas along riparian corridors and ridgetops, will likely degrade lynx habitat and result in impacts to lynx.

Agriculture Areas

Agricultural areas to the east of the Planning Area in the Yakima Valley also contribute to the cumulative effects. One of the primary effects is the demand placed upon the water supply. Reservoirs are reduced to extremely low levels, to the point where the edge of the water is often far removed from the nearest vegetation. Reservoirs in the action area apparently do not contain conservation pools, but are subject to near complete draining. Reservoir expansions to increase storage capacities are being considered, as are additional reservoirs. If implemented, these measures would likely result in loss of potential lynx forest dispersal habitat. Because the Cle Elum, Kachees, and Keechelus lakes were originally created by terminal moraines, it is not clear how much forested habitat might be lost as a result of new dam construction and raising of pool levels.

Fire Related Activities

Fire suppression efforts are expected to become more urgent in portions of the action area as encroaching development and recreational activity increases in the area. Both wildfire risk and the potential for insect damage will likely increase during the ITP Period in the action area, due to continued fire suppression. Additionally, fire is a key ecological process involved in the natural spatial and temporal mosaics of high function foraging and denning habitat for lynx. To the extent that this suppression has not been consulted upon or subject to a section 10 permit, the effects of suppression and resultant wildlife/insect damage and forest mosaic modifications remain cumulative to the effects of the action considered herein. Outside of federal reserves, these fire suppression associated factors will likely continue to increase because of the successional maturation of most of the forests involved, combined with the existing forest stand densities, mosaics, and species compositions.

As a result of fire suppression, certain forests in the region are more susceptible to catastrophic fires and epidemic attacks of insects and disease. Stand-replacing fires may remove some denning habitat, but tend to create desirable foraging habitat. This trend within the action area is shared with other areas, especially east of the Cascade crest, where forests are accumulating fuels and over-crowded in many areas. Thus, in the absence of any change in management direction, forests in the action area can be expected to have increasing risks of catastrophic fire, insect damage, and artificially modified stand structure/age mosaics.

Grazing and Mining

These activities are not common in the Planning Area. Extraction of rock for construction of forest roads is considered part of the forestry activities. Most grazing and mining activities in the action area are conducted in areas downslope of the Planning Area. As native habitats begin to be developed, some level of "hobby" farming and grazing occurs, but generally diminishes as housing density increases.

Conclusion

Range wide, lynx populations in the continental United States are likely substantially depressed in numbers compared to historic conditions. Primary factors that are known to have contributed to the decline in lynx populations in the lower 48 states include trapping, loss of habitat, and isolation of populations. Substantial areas of potential/restorable lynx habitat rangewide occur on federal land. Rangewide and within the action area, a legacy of large clear-cuts and/or fire suppression remains on the landscape, and fragmentation is increasing in many important areas outside of federal ownership or managed under an approved HCP. Most of these large clearcut units are regenerating under current forest practice rules. Fire suppression continues in most of the lynx's range in the continental United States, with notable exceptions.

Direct mortality from trapping of lynx has been largely reduced, but direct mortality from roadkill continues, and will likely proportionally increase with human population/traffic/recreation/development pressures. Although these human pressures are concentrated at elevations below those utilized by lynx, substantially increased traffic pressure will be generated at higher elevations. The importance of mortality from roadkill in the future to the status of the species remains undetermined, but lynx are wide ranging, populations consist of small numbers, and a series of high-volume/high-speed roadways cross the range of the species.

Artificial interspecific competition is apparently high in much of the lynx's range and will likely increase on private lands, but will likely decrease on federal lands and limited areas (such as where HCPs are in place) where native carnivore diversity and numbers are expected to be significantly restored. Thus, lynx numbers and metapopulation viability are depressed by the combined effects of habitat degradation and direct mortality, and to a much lesser extent from outright habitat loss (such as from development). The secondary importance of outright habitat loss bodes well for improvements in the lynx's status in core habitat areas in the Western United States, through management (around issues of fire, logging, carnivore re-establishment, recreation, roads) of federal lands under the Northwest Forest Plan and on lands subject to approved HCPs, but reliance on other lands for connectivity and linkage remains highly important.

Federal land accounts for the preponderance of lynx habitat across the action area of the central Cascades. Core habitat areas for lynx in central Cascades are based on these federal lands. Significant proportions of these federal lands are in federal reserves or Adaptive Management Area, where natural ecosystem processes (such as fire) are being allowed to proceed under Northwest Forest Plan to a greater extent than in previous decades.

The status of lynx in the action area is little known outside of occasional occupation reports. Lynx likely occur in small numbers in the action area. Lynx have likely always been naturally rare in the action area, but current numbers are likely well below historic levels. Substantial core areas are expected to be maintained/improved for lynx on federal/state lands in the Cascade Mountains within and to the north and south of the action area as a result of the continued

implementation of the Northwest Forest Plan and specific management directed for lynx. The prime necessary function of the Planning Area relative to the continued existence of lynx is the effective connectivity between these core areas within the Cascades north and south of I-90. The development surrounding I-90, and I-90 itself, are major barriers (but are not likely impassable barriers currently) to lynx movement and ecosystem functioning (we are currently working with to develop improvements for wildlife movement under/across I-90 at key locations). The HCP does provide effective connectivity to the edges of this I-90 corridor development.

After reviewing the current status of the lynx; the environmental baseline for the action area; the effects of the proposed plan; and the cumulative effects for the action area, it is our opinion that continued implementation of the HCP and the inclusion of the lynx on the subject ITP are not likely to jeopardize the continued existence of the lynx. This is largely based on continued implementation of the Northwest Forest Plan, that provides important conservation for this species, and the expected enhanced management of federal lands in Washington for lynx in the future. Critical habitat for the lynx has not been proposed or designated at this time; therefore, none would be affected. The specified timber-harvest associated activities of Plum Creek on Project Area lands are expected to adversely affect the lynx and anticipate incidental take of individual lynx is likely to occur within acceptable levels.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, prohibits taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. ***Harm*** *in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such acts may include significant habitat degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.* For lynx, harm may include significant habitat modification or degradation where it actually kills or injures lynx by significantly impairing essential behavioral patterns, including breeding, feeding, traveling, migrating, and sheltering. ***Harass*** *in the definition of "take" in the Act means an intentional or negligent act, or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.* Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The HCP and its associated documents identify anticipated impacts to lynx likely to result from the proposed taking and the measures prescribed to minimize those impacts. Covered activities with a high likelihood of causing injury or death to individual lynx include logging, thinning, site preparation, wood salvage, and forestry-related road maintenance and use. The frequency, location and duration of covered activities likely to cause harm to lynx is not known specifically; the details of these activities are too speculative to do more than very roughly estimate numbers of lynx likely to be taken under this HCP amendment.

This incidental take statement applies only to lynx. The northern spotted owl, marbled murrelet, grizzly bear, gray wolf, Columbia River DPS of bull trout, Puget Sound/Coastal DPS of bull trout were addressed in other BOs. Should Plum Creek request that bald eagles, peregrine falcons, or any of the currently unlisted species be added to the permit, formal consultation under section 7 of the Act will be reinitiated, at which time a definitive incidental take statement would be issued for the species, provided the proposed action is in compliance with section 7(a)(2) of the Act.

It is our policy (per Region 1 memorandum of July 27, 1998) to not consider for inclusion, pesticide and herbicide applications as a covered activity under section 10(a)(1)(B) permits, with the exception of those HCPs that address this topic and were submitted to us before July 27, 1998. The subject HCP was submitted to us before 1998. Thus take is anticipated herein as a result of herbicide use in the Project Area as a result of the proposed action.

Take Not Covered

Easements and rights-of-ways likely occur within Project Area lands, with associated maintenance activities performed by parties other than the permitee. Incidental take resulting from these activities is not covered herein, except for activities undertaken by permitee or their agents as clearly specified in the HCP. Examples of activities not covered herein include: construction or maintenance of powerlines or railroads, associated right-of-way/easement vegetation maintenance, or right-of-way access construction or maintenance. Additionally, recreation is not a covered activity. Any take resulting from these activities would likely be subject to the prohibitions of section 9 of the Act and would need to be excepted or permitted separately through the section 7 or section 10 process.

No take is herein anticipated for activities/actions occurring outside the 60,060 hectares (148,300 acres) of Plum Creek Project Area lands.

AMOUNT OR EXTENT OF TAKE

We expect that this action is likely to result in incidental take of lynx in the form of harm, harassment, or mortality due to effects from timber harvest and related activities, including road use, logging, site preparation, thinning, fire suppression, wood salvage, etc. Our action of adding lynx to the subject permit is contingent upon the implementation of the conservation measures in the HCP, and as such they are fully part of the proposed action. Estimates of incidental take account for the operation of these conservation measures. Because of the inherent biological characteristics of lynx, the likelihood of discovering an individual death or injury attributable to this action is extremely small.

We anticipate that impacts to lynx will be difficult to detect at the individual organism level for the following reasons: (1) lynx are wide-ranging and are affected by many factors beyond the control of Plum Creek; (2) finding dead or impaired specimens (besides roadkill) is unlikely, especially considering the remoteness of the area; (3) losses may be masked by seasonal fluctuations in numbers, or it may be hard to distinguish ultimate from proximate causes; (4) dead or impaired specimens may be found far from the site where the impact occurred; (5) dead or impaired specimens may be consumed by other wildlife species; and, (6) the area to monitor is quite large. However, habitat conditions may be used as a surrogate preliminary indicator of take or impact. This assessment in part focused on the amounts and expected function of potential lynx habitats provided/affected.

Therefore, even though we expect incidental take to occur from the effects of the action, the best scientific and commercial data available are not sufficient to enable the FWS to do more than very roughly estimate a specific number of individuals incidentally taken based on loss or injury of individuals of the species. For instance, if many lynx were to enter or become established in

the Planning Area during the permit period, some portion of them may become subject to some level of take. Conversely, if lynx remain infrequent/occasional visitors to the Planning Area, less take might occur. Current lynx residence in the action area and Project Area is undetermined.

We anticipate that an undetermined number of lynx would be taken over a 50 to 100 year period as a result of the proposed action. Take is herein anticipated for the proposed actions occurring within the 60,060 hectares (148,300 acres) Project Area owned by Plum Creek. Lynx are known from the action area. The number of lynx anticipated to be taken is small, mainly because of the small number of lynx expected to occur within the Project Area and action area during the proposed ITP term, and the level and type of activity in the proposed HCP.

The incidental take over 50 to 100 years is anticipated to be in the following forms:

Harm and/or Harassment

Take from harm or harassment is likely to be a small amount. Harm and harassment will mainly occur in three forms: 1) loss or reduction of habitat function (such as loss of foraging habitat); 2) disturbance and/or displacement of lynx during timber harvest/management related activities, including road use. At least 2/3 of the Project Area is expected to function as potential dispersal habitat for lynx based on elevation and location; exceptions within the remaining 1/3 of the project area are larger open/cleared areas and clearcuts younger than 15 years old (at most approximately 1/3 of the Project Area). Dispersal habitat requirements for lynx are the least specific of all life history needs, thus dispersal habitat covers (and will continue to cover) the largest portion of the Project Area (compared to habitat needs for foraging or denning). Proposed covered activities could occur in practically any portion of the Project Area lands, thus take of lynx could occur anywhere on approximately 2/3 of the Project Area (40,000 hectares/100,000 acres) at any time. This take is expect to be in the form of harassment when lynx occur in the proximity of covered activities, which would likely result in lynx moving away from a specific area. New clearcuts would be annually produced in forest stands (mostly in stands 65 to 120 years old), such that 3 to 11 percent or 1,800 to 6,600 hectares (4,400 to 16,300 acres) of the Project Area would be in the "stand initiation" structural stage at any time in the first 50 years of the ITP (see Figure 31c of the HCP). Approximately 30 percent of the forested Project Area lands above 920 meters (approximately 13,500 hectares/33,000 acres), could be foraging habitat for lynx at any time during the ITP period (if no thinning occurred). Logging, thinning, site preparation, road use, and other specified activities are likely to occasionally take traveling or foraging lynx through disturbance in the short-term, or through modification of forest structure/function so as to make areas unsuitable for lynx in the mid-term. Thinning of forests will likely be the most important proposed covered activity potentially causing take of lynx in extant foraging habitat. Most potential high-function foraging habitat for lynx on Project Area lands will be subject to thinning during the ITP; an unquantified proportion would be thinned in any one year. Old growth forests remained on approximately 2 to 5 percent of the Project Area in 1996, and denning by lynx on Project Area lands is expected to be mainly limited to a undetermined subset of these forests where they occur above 920 meters. Some proposed

logging and log salvage in old-growth forests is anticipated to occur above 920 meters; these activities could result in harm or harassment of denning lynx in the Project Area. Approximately 600 hectares (1,450 acres) of "old growth" and 600 hectares of "managed old growth" are anticipated to be logged during the ITP period, an undermined portion of which is above 920 meters elevation and thus potential lynx denning habitat; some take of denning lynx may occur in these areas. Proposed logging, site-preparation, fire suppression, and log salvage activities are anticipated to take lynx by preventing natural successional development of lynx denning habitat. Harm and harassment of lynx is reduced within a portion of the Project Area (I-90 Lakes Subunit, see Figure 22 of the HCP) by prescriptions designed to protect grizzly bears (section 3.2.1.3 of the HCP), including restricting public access by installing gates on roads that Plum Creek has total administrative control, reducing open road density to 0.6 kilometer per square kilometer (1.0 mile per square mile) on roads that Plum Creek has total control over until the year 2006, visual screening along open roads, and prohibiting firearms in all company and contractor vehicles (except where firearms are necessary for law enforcement, etc.).

Direct Injury or Death

We anticipated that one (1) lynx adult and/or kitten could be killed during the 50 to 100 year ITP period as result of proposed covered activities, particularly due to the permitee's vehicle-use-caused- roadkill on existing and newly constructed forest roads above 460 meters elevation, or during logging operations in forest denning habitat above 920 meters elevation.

Take is expected to be avoided in most covered activity situations due to lack of occupation by lynx. Lynx are likely to occur in limited areas of the action area at any one time, and take is anticipated to be rare and localized. Therefore, the number of individuals likely to be taken, is small, yet unquantifiable beyond our estimates of mortality. Estimates of take for harm and harassment are in terms of amount of potential lynx habitat affected to the extent that take could possibly occur.

This incidental take statement applies only to lynx.

The measures described below are non-discretionary, and must be implemented by the FWS so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. We have a continuing duty to regulate the activity covered by this incidental take statement. If the FWS: (1) fails to require the permitee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

EFFECT OF THE TAKE

In the accompanying biological opinion, we have determined (for the following reasons) that this level of anticipated take is not likely to jeopardize the lynx or destroy or adversely modify critical habitat.

Take in the form of harm, harassment, and kill (mortality) may occur. The type of activities covered by the permit can in many cases result in take such as:

Harm or mortality may occur due to habitat modifications resulting from logging, timber management, wood salvage, and/or road maintenance activities.

Harassment or mortality may occur when logging, timber management, and/or road use/management activities are conducted near or where lynx are present.

Mortality or direct injury may occur due to vehicle strikes during road use and/or through abandonment of kittens during logging or salvage activities.

This level of take is small enough that it will not appreciably reduce the likelihood of survival and recovery of lynx in the wild.

REASONABLE AND PRUDENT MEASURE

The following reasonable and prudent measure, contained within our 1996 BO on the subject HCP, remains necessary and appropriate to minimize take of lynx:

1. Any incidental take of [lynx] must comply with all the terms and conditions of the Section 10(a)(1)(B) permit (including the provisions of the Implementing Agreement and the HCP) to ensure that conservation measures included to protect the various species are properly implemented.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the FWS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions, also contained in the June 24, 1996, Biological Opinion, are nondiscretionary.

1. A Section 10(a)(1)(B) permit, as evaluated in this Biological Opinion, must be issued by the Fish and Wildlife Service [Service]. The Implementing Agreement for the Habitat Conservation Plan for the Section 10(a)(1)(B) permit must be

agreed to by the Fish and Wildlife Service and the permit conditioned upon implementation of the Habitat Conservation Plan and the Implementing Agreement.

2. We have provided a protocol for the handling of dead, injured or ill listed species for pesticide analysis. When we suspect a species has been taken in violation of label restrictions, the incident(s) shall be reported to the Division of Law Enforcement or their designee in the Region in which the species is found.

Instructions for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement: Assistant Regional Director; Division of Law Enforcement; 911 N.E. 11th Avenue; Portland, Oregon 97232-4181; (503) 231-6125

3. We shall retain permit condition (H) which reads as follows: *The permittee will notify the Service if locations of nesting murrelets not described in the HCP are discovered, if additional owl site centers not described in the HCP are discovered, if additional stream reaches are found to contain bull trout, or if any observations of wolves or grizzly bears are made within the HCP Planning Area during the course of the HCP.*

The following Term and Condition is added:

4. We shall add a permit condition which reads as follows: *The permittee will notify the Service if any observations of lynx are made within the HCP Planning Area during the course of the HCP.*

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We offered conservation recommendations in the 1996 BO, which are incorporated herein by reference. We offer the following additional recommendations with respect to the lynx associated ecosystem:

1. We should further research the historical status and distribution of lynx in Washington in order to better understand the current natural potential for reestablishment of demonstrably viable populations in the state. We should further research possible limiting factors associated with the ecosystems surrounding lynx (such as fire suppression, loss of old-growth forest, reductions in coarse woody debris, road densities and roadkill, loss of keystone ecosystem processes or carnivores, artificial enhancement of competitor populations, etc.). We should further research artificial restrictions or

blockages of potential linkages/movement corridors (particularly those associated with highways) between potential lynx core habitat areas.

2. Lynx have large home-range sizes and need connected, high function boreal forest habitat; effective management of lynx occurs on a very large scale. We should continue to endeavor to acquire and manage key linkage and corridor lands. We should further encourage development/improvement of viable crossings and movement corridors between core areas for wide ranging native vertebrates across highways at important locations in Washington, such as across and proximal to I-90 between North Bend and Cle Elum (east of Seattle in the central Cascade Mountains). Interstate-90 passes through a number of elevation and precipitation zones. Different varieties of wildlife associated with lynx and its ecosystem are present in these different zones. Landscape permeability should be maintained at intervals through the length of the highway to provide for animal movement in each elevation and precipitation zone. We should address landscape permeability at two scales; 1) the landscape, by maintaining or restoring habitat that can provide for landscape-scale animal movements, and 2) the highway, by providing viable opportunities for animals to cross over or under the highway at appropriate locations.

3. We should endeavor to fulfill the following suggestions for vegetative manipulation of managed forests (at appropriate elevations) to benefit lynx in Washington (most recommendations are per Brittel et al. 1989):
   - Managed stands (of a singular age and structure) should not exceed 16 hectares (40 acres) in size.
   - Clearcuts should be limited to 8 to 16 hectares (20 to 40 acres) in size.
   - The width of openings should not exceed 90 meters (300 feet) for travel corridors.
   - Openings (such as clearcuts) should not exceed 30 percent of the area expected to be utilized by lynx.
   - Coarse down material and other woody debris should be retained.
   - Lodgepole pine dominated areas should be maintained and not converted to other (commercial) species.
   - Thinning of forests will increase non-lynx cover areas and should be delayed where and when appropriate.
   - Herbicides, if necessary, should be managed to minimize effects on hare habitats.
   - Major ridges should be managed to for travel cover, with special emphasis on saddles.
   - Travel cover corridors need to be greater than 90 meters (300 feet) wide.
   - Management units should be designed to provide travel corridors, especially along ridges and saddles (U.S. Forest Service 2001).
   - Trees in harvested units should be 2 meters (6 feet) or taller, before adjacent areas are logged or thinned.
   - Recommended landscape cover ratios for lynx habitat in Washington:
     Denning – 6 percent
     Travel – 30 percent
     Forage – 30 percent

Non-lynx cover areas – 33 percent

- Road management recommendations:
  a) Minimize new road construction, esp. main access roads
  b) Construct and maintain roads to minimum possible standards to discourage heavy use.
  c) Abandon and remove roads following logging operations where possible. Planting trees in the former roadbed may be effective in discouraging snowmobile use where appropriate.
  d) Construct dead-end roads rather than loop roads to minimize public use disturbance.

4. Three independent features characterize contemporary wildlands conservation: large, protected core reserves, connections between core areas provided by functional corridors, and the full complement of native carnivores (Noss 1983, 1987, 1992, Noss and Harris 1986, Craighead et al. 1997, Craighead and Vyse 1995, Paetkau et al. 1997). Conservation Biologists Soulé and Noss (1998) recognize these features, in shorthand, as "the three C's: Cores, Corridors, and Carnivores." These three features are likely the basic keys to the ecosystems that lynx depend upon. Recent studies have shown that ecosystem integrity is often dependent on the functional presence of large carnivores (Foreman et al. 2000a). Because wolves are "keystone species" within Western Washington, we should endeavor to reestablish resident wolf populations within the Cascade Mountains historic range of the lynx.

In order to document actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we shall provide, in writing, reports of the implementation of any conservation recommendations at the time of the periodic reporting. Any variances from the recommendations may be reported instead.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the proposed action of amending of the Plum Creek's ITP PRT-808398 to add the lynx. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Item 2 above, regarding new information, could include deviations from the Northwest Forest Plan. Should such deviations occur to the extent that the baseline is significantly altered or the

integrity of the HCP and its assumptions are compromised, consultation will need to be reinitiated.

If you have any questions regarding this Biological Opinion, please contact Jon Avery of my staff at (360) 753-5824.

Ken S. Berg

cc: DOI - SOL, Portland (E.Nagle)
FWS, Portland (K. Hollar)
FWS, Lacey (J.Avery, C. Hansen, J. Michaels, W. Vogel)
NMFS, Lacey (S. Landino)
WDFW, (P. Swedeen)
Plum Creek Timber Company, (M. Collins, L. Hicks)

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LATE SUCCESSIONAL RESERVES IN WASHINGTON STATE AREAS
PLUM CREEK HCP
ELEVATIONS: 3,000 FT. AND ABOVE