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IV. The Habitat Conservation Plan

A. Minimization and Mitigation for the Northern Spotted Owl in the Five West-side and All East-side Planning Units

Conservation Objective

DNR's conservation objective for the northern spotted owl is to provide habitat that makes a significant contribution to demographic support, maintenance of species distribution, and facilitation of dispersal. Demographic support refers to the contribution of individual territorial spotted owls or clusters of spotted owl sites to the stability and viability of the entire population (Hanson et al. 1993 p. 11). Maintenance of species distribution refers to supporting the continued presence of the spotted owl population in as much of its historic range as possible (Thomas et al. 1990 p. 23; USDI 1992 p. 56). Dispersal is the movement of juvenile, subadult, and adult animals (in this case, spotted owls) from one sub-population to another. For juvenile spotted owls, dispersal is the process of leaving the natal territory to establish a new territory (Thomas et al. 1990 p. 303).

This conservation objective applies to the five west-side planning units and all three east-side planning units. The Olympic Experimental State Forest has different conservation objectives because of its unique mission of learning how to integrate forest production activities and conservation across the landscape. (See Section E in this chapter on the Olympic Experimental State Forest for a discussion of its conservation objectives and strategy for the northern spotted owl. See the section in Chapter I titled Organization of the Planning Area for a discussion of why the Olympic Experimental State Forest is unique.)

Due to differences in the habitat ecology of the spotted owl in western Washington and eastern Washington, the conservation strategies for each side of the Cascades are described separately. The intent of the spotted owl conservation strategy for for the five west-side planning units is twofold. First, the strategy is intended to provide nesting, roosting, and foraging (NRF) habitat and dispersal habitat in strategic areas in order to achieve the conservation objective of providing habitat for demographic support, maintenance of species distribution, and dispersal. Second, in areas designed to provide NRF habitat, the strategy is intended to create a landscape in which active forest management plays a role in the development and maintenance of the structural characteristics that constitute such habitat. To accomplish this, the strategy is composed of a research phase, a transition phase, and an integrated management phase.

The research phase is designed to develop a more precise description of functional spotted owl nesting habitat at the stand level, to develop silvicultural techniques to create such habitat, and to acquire a better understanding of what constitutes a sufficient distribution of nesting structure at the landscape level. Because such information is currently not available,

patches of old forest with a high degree of structural complexity (i.e., forest types known to support nesting spotted owls) will be retained in an unmanaged state during the research phase. These nesting patches, which total approximately 20,000 acres, will exist within the larger spotted owl habitat landscape that will be managed to provide high quality roosting and foraging functions. (See below for a detailed description of the strategy.) Based on current understanding of spotted owl habitat, forest that provides structure for roosting and foraging functions is somewhat less structurally complex than forest that provides the actual nesting component of NRF habitat. The strategy will operate on the hypothesis that active forest management techniques can be applied to develop and maintain roosting and foraging habitat from the outset of the HCP. This hypothesis also applies to the creation and maintenance of dispersal habitat. These assertions will be tested as part of the monitoring component of the HCP. (See the section titled Monitoring in Chapter V for more discussion of this.)

The transition phase is envisioned as the middle phase of the HCP in which results of the research described above are applied within spotted owl habitat areas. During this period, the goal is to begin moving away from a landscape in which old-forest nesting habitat patches are unmanaged to a landscape in which management can be used to create and maintain nesting structure in a distribution that research shows is appropriate. This will be a period of transition because active monitoring will be needed to ensure successful application of research results and to modify silvicultural techniques for local conditions. The end of the transition phase will be marked by DNR's confidence in its ability to provide adequate nesting habitat without maintaining unmanaged nesting habitat patches.

The integrated management phase is the final period of the HCP in which knowledge gained through research, application of this knowledge to larger areas, and monitoring have moved forest management to a point where commercial timber harvest and maintenance of functional spotted owl nesting habitat coexist throughout spotted owl management areas.

The intent of the spotted owl conservation strategy for DNR-managed lands east of the Cascade crest is the same as for the west side. However, on the east slope of the Cascades, spotted owls appear to be able to nest in landscapes in which active management occurs. For eastern Washington, the strategy will start with the assertion that DNR can manage spotted owl NRF habitat. Again, this hypothesis will be tested as part of the monitoring component of the HCP.

Regional and site-specific conservation objectives — i.e., where does the need exist to provide demographic support, contribute to maintenance of species distribution, and provide dispersal linkages; and where do the opportunities exist for DNR-managed lands to contribute habitat to the provision of these functions — have been identified on the basis of data from each planning unit. The specifics of each spotted owl conservation strategy (west-side and east-side) are described separately. The components of the strategy are outlined first, followed by habitat definitions and the basis for those definitions. The section concludes with a discussion of the rationale used to develop the conservation objective and the strategies, a look at current and projected habitat, and a summary of potential benefits and impacts of the strategies to the species.

Conservation Strategy for the Five West-side Planning Units

The west-side and east-side conservation strategies for the northern spotted owl consist of four main components: identification of DNR-managed lands most important to spotted owl conservation; determination of habitat goals for areas established to provide NRF habitat; guidelines for management activities allowed in NRF habitat areas; and guidelines for provision of dispersal habitat. The specifics for the east-side strategy are detailed later; below, each component for the west-side strategy is described in detail. This strategy provides mitigation for the entire approximately 1,180,000 acres of DNR-managed lands covered by the HCP in the five west-side planning units.

IDENTIFICATION OF DNR-MANAGED LANDS MOST IMPORTANT TO SPOTTED OWL CONSERVATION

In order to determine the potential role in spotted owl conservation that could be played by DNR-managed lands within each planning unit, questions were considered, such as presence of habitat, forest type, distribution and pattern of DNR-managed lands with respect to other DNR-managed parcels and other landowners, proximity of DNR-managed lands to federal reserves and existing spotted owl clusters, biological status of the spotted owl population and existing threats in each planning unit, and the regional role of each planning unit for supporting spotted owl conservation in the state. Management recommendations from previous spotted owl conservation planning efforts (USDI 1992; Hanson et al. 1993; FEMAT 1993) were also taken into consideration. Based on the answers to these questions, an assessment of the role of DNR-managed lands for spotted owl conservation was made. DNR-managed lands fell into one of the following categories:

- important for demographic support;
- important to maintain species distribution;
- important for dispersal;
- not important for spotted owl conservation; or
- management for spotted owl habitat on DNR-managed lands alone would not make a significant contribution to owl conservation.

DNR-managed lands that emerged as important for demographic support were those that are intermingled with federal lands designated in the President's Forest Plan (see the section of Chapter II titled Federal Plans and Rules for a discussion of the President's Forest Plan) as Congressional Reserves, Late successional Reserves, Managed Late successional Reserves, or Adaptive Management Areas, as well as those that fall within 2 miles of these reserve designations. Two miles represents the radius of a circle that most closely approximates the median spotted owl home range size in the western Cascades (Hanson et al. 1993). In addition, some DNR-managed lands farther than 2 miles from federal reserves in the Columbia Planning Unit were determined to be important for both maintaining species distribution and demographic support. DNR-managed lands that fell between large federal reserves were determined to be important for dispersal.

Lands identified to provide demographic support and to contribute to maintaining species distribution shall be managed as NRF habitat.

For the purposes of this HCP, NRF refers to habitat that is primarily high quality roosting/foraging habitat with sufficient amounts of nesting structure interspersed so that the entire area can be successfully utilized by reproducing spotted owls. See description of rationale for habitat definitions later in this section. Lands identified to facilitate dispersal shall be managed as dispersal habitat. Stand conditions for each of these habitat types are defined below. DNR-managed lands selected for NRF habitat management and dispersal habitat management are shown for each of the five west-side planning units in Maps IV.1-IV.5.

Approximately 1.6 million acres of DNR-managed lands are covered by the HCP. The five west-side planning units contain approximately 1,180,000 acres of DNR-managed lands. NRF management areas encompass approximately 202,000 acres of DNR-managed lands. NRF areas in the five west-side planning units encompass approximately 163,000 acres. Dispersal management areas encompass approximately 200,000 acres of DNR-managed lands, 116,000 acres of which occur in the five west-side planning units. The provisions of the strategy (described next) will result in the maintenance of at least 50 percent of the forested lands within NRF and dispersal areas in the appropriate habitat type at any one time. Thus, the target conditions will be to maintain at least 101,000 acres of nesting, roosting, and foraging habitat and 100,000 acres of dispersal habitat at any one time in total for both the west- and east-side planning units.

DNR-managed lands that were determined not to have the potential to make a significant contribution to spotted owl conservation are those that are farther than 2 miles from federal reserves and in areas where there are currently no large clusters of spotted owls and little or no habitat, or that are not in key linkage areas where dispersal habitat or support of nonfederal spotted owl sites was needed. In some areas where federal reserves are absent, DNR did not designate specific NRF management areas. In one planning unit where federal reserves are present, DNR did not designate NRF management areas because it was determined that even DNR-managed lands adjacent to the reserves would most likely not make a significant contribution to demographic support of the spotted owl population. (See explanation in the discussion of rationale later in this section.)

DETERMINATION OF NRF HABITAT GOALS ON A LANDSCAPE SCALE FOR LANDS IDENTIFIED FOR A NRF HABITAT ROLE

In areas designated to provide NRF habitat, DNR shall provide a target condition of at least 50 percent of its managed lands measured within each Watershed Administrative Unit (Watershed Administrative Unit has been defined by DNR in cooperation with other agencies, tribes and the public and averages between 10,000 and 50,000 acres in size) as NRF habitat.

Criteria for determining the target amount of habitat for DNR NRF areas in each WAU are discussed below.

The amount of habitat on the combination of DNR NRF areas and federal reserves existing at the time timber harvest is planned for a WAU that contains designated NRF areas will be determined using the best information available. As the HCP is implemented, the amount of habitat on DNR-managed lands shall be field verified through a landscape assessment process. After initial field verification, habitat levels in WAUs containing DNR NRF management areas should be assessed every 10 years. DNR will not be required to field-verify habitat in federal reserves, but will rely on updated federal habitat inventories for lands within federal reserve status. Depending on the habitat conditions that exist at the time a WAU is entered for timber management, on of four possible scenarios would apply:

(a) If the amount of existing NRF habitat in a WAU is equal to or greater than 50 percent of the total area of federal reserves plus DNR-designated NRF areas, then DNR will maintain 50 percent of its designated NRF lands in the WAU as NRF habitat.

(b) If DNR-designated NRF areas by themselves contain less than 50 percent habitat, DNR will develop new habitat up to 50 percent of the area of those lands, regardless of the amount of current habitat on federal reserves plus DNR-designated NRF areas in the WAU.

(c) If the amount of current habitat in the WAU is less than 50 percent of the total area of federal reserves plus DNR-designated NRF areas, and DNR-designated NRF areas by themselves contain greater than 50 percent habitat, DNR will maintain an amount of habitat that is equal to the current amount. For example, if the WAU condition (federal reserves plus DNR-designated NRF areas) were 30 percent habitat, but 65 percent of DNR-managed lands in designated NRF areas were habitat, then DNR would maintain 65 percent of its managed lands in the designated NRF area as NRF habitat.

(d) If there are no federal reserves in a WAU in which DNR-designated NRF areas occur, DNR will maintain 50 percent of its lands designated as NRF management areas in NRF habitat.

In some places the boundary of a WAU divides a DNR-designated NRF area such that a smaller designated NRF area is created in a WAU with no other designated NRF areas (or disjunct from other NRF areas) and no federal reserves. For the purposes of calculating habitat targets and for management, such "orphaned" parcels can be grouped with DNR-designated NRF areas in the adjacent WAU that contains the larger area of designated parcels.

Under scenarios (a), (b), and (d), harvest of habitat can take place in WAUs where there is greater than 50 percent habitat on DNR-managed lands in designated NRF areas. Harvesting shall be designed to leave a specified level of nesting structure in the landscape. The amount, structural criteria, and configuration of nesting habitat are described below.

In places where DNR-managed lands are ecologically incapable of developing or maintaining 50 percent NRF habitat due to poor soils, high elevation, forest type, or other natural factors, the maximum coverage of habitat that those lands can support shall be maintained. For example, if DNR NRF areas within a WAU are only capable of growing 35 percent habitat due to poor soils, then DNR will maintain 35 percent habitat in that WAU throughout the term of the HCP.

MANAGEMENT OF FOREST STANDS WITHIN NRF HABITAT AREAS

During the research phase of the HCP, forest management activities within DNR-designated NRF areas will likely take place in four situations:

(1) in existing NRF habitat that counts toward the target amount for a WAU;

(2) in forest stands that are not yet habitat but are managed with the intent of developing habitat;

(3) in forest stands that are identified for harvest when the WAU has exceeded the target amount of NRF habitat; and

(4) in forest stands that do not count toward the target amount of NRF habitat.

The standards described here apply to the research phase only. New standards shall be developed for the transition and integrated management phases, the content of which will depend on the results of those efforts. New standards shall ensure adequate provision of nesting habitat. The following standards apply to the appropriate situation.

Management in DNR NRF habitat that counts towards the target amount of habitat in a WAU

Management can take place within this type of habitat as long as two conditions are met: adequate nesting habitat remains in the landscape, and forests that are managed for commercial wood production outside nesting habitat areas remain as sub-mature (Hanson et al. 1993; see habitat definitions below) or higher quality habitat after management activities have taken place. The specifics of each condition are as follows.

PROVISION OF NESTING HABITAT

(a) For the North Puget and Columbia planning units, nesting habitat (defined below) shall be provided in two 300-acre nesting patches per approximately 5,000 acres of DNR-designated NRF areas. In the South Puget Planning Unit, one 300-acre patch of nesting habitat shall be provided in the DNR-designated NRF area located directly north of the Mineral Block, and one 300-acre patch shall be located in section 16 of T 20 N, R 11 E; this designation accounts for low acreage of and wide separation between designated NRF areas in the South Puget Planning Unit. Based on a preliminary computer simulation of nest patch placement, there will be 68 nest patches encompassing a total of 20,400 acres[1].

(b) The 300 acres of nesting habitat shall occur within a larger contiguous 500-acre patch, the remaining 200 acres of which shall be composed of sub-mature or higher quality habitat (Hanson et al. 1993; see habitat definitions below). The entire 500-acre patch shall be contained entirely within a circle of 0.7-mile radius. Where 200 acres of sub-mature habitat are not available within the specified arrangement, the next highest quality habitat should be identified. If such a case occurs and there are no known active spotted owl nest sites in the vicinity (see iii below), silvicultural techniques may be applied to speed the development of sub-mature characteristics.

In cases where there are fewer than 1,000 acres of DNR-designated NRF in the WAU in which a nesting patch is located, DNR is obligated to provide only 50 percent total NRF habitat in the WAU. For example, a 640-acre section is the only DNR-designated NRF parcel in a WAU. A 300-acre patch of nesting habitat would constitute 47 percent of the 50 percent requirement in the WAU. DNR would not have to provide an additional 200 acres of sub-mature habitat. The priority in such cases is the establishment and protection of 300 acres of nesting habitat.

(c) If more than 200 acres of sub-mature habitat occurs in the area in which this habitat serves as a buffer, *and* the WAU is over its habitat target, the amount over 200 acres can be harvested. Habitat

[1]Given the spatial distribution of NRF areas, the number of nests patches will likely be slightly higher than results from a strict division of 163,000 acres by 5,000 acres (multiplied by 2) in order to achieve optimal distribution of nest patches.

of equal or better quality that is adjacent to a portion of the 300-acre nest patch or the remainder of the original 200-acre sub-mature buffer that will not be harvested must be immediately available to replace what is harvested - i.e., this provision cannot result in a degradation of habitat quality around the nest patch. If such harvest is planned during the breeding season, the harvest unit will be surveyed for spotted owl occupancy. Survey stations will be established such that an area 0.25 mile beyond the sale-unit boundary is covered by the surveys. Four visits will be conducted in a single year at least one week apart. If a detection is made within the harvest area or within 0.25 mile of it, seasonal restrictions will apply. If no detections are made, the sale unit will be available for harvest for four years.

(d) Nest habitat patches shall consist of the highest quality nesting habitat available in each 5,000-acre block and shall be identified using one of the following methods, listed in order of preference. Identification of nest habitat patches shall occur during the first year of HCP implementation. The U.S. Fish and Wildlife Service and National Marine Fisheries Service will review placement of nest patches at the 1-year review.

i. The location of known status 1 and 2 spotted owl site centers (sites where spotted owl pairs have been located) should be used as a starting point for delineating 300 acres of nesting habitat. When this option is used, habitat that meets the high-quality nesting habitat definition (see subsection titled Habitat Definitions) should be used as the first field screen. If habitat does not meet this definition, the Types A and B habitat definitions should be used next. All available Type A habitat should be included before Type B habitat is counted as part of a 300-acre nest patch.

ii. Where known spotted owl pair sites do not exist within a 5,000-acre block, habitat patches should be identified using the structural characteristics listed in the "high quality nesting habitat" definition described below. DNR forest inventory data can be used to identify these structural characteristics where the inventory data are available.

iii. Where inventory data are not available, existing field-typed habitat data that utilize DNR's Types A, B, and C typing system can be used. Forest stands that meet the Type A or B definitions can be counted toward the 300 acres of nesting habitat. All available Type A habitat should be included before Type B habitat is counted as part of a 300-acre nest patch.

iv. If data sources described above do not provide information to locate all the requisite nest habitat patches, DNR age-class data can be used as a starting point to locate potential habitat patches. The oldest forest stands in any particular 5,000-acre block are most likely to contain the structural characteristics of nesting habitat. Location and quality of habitat patches initially identified by this method shall be field-verified. Again, the high-quality nesting habitat definition should be used as the first field screen. If there is no habitat within a particular 5,000-acre block that meets this definition, then the Type A and Type B definitions shall be used next, with Type A habitat to be counted before Type B habitat is counted.

v. If there are no 300-acre nest patches that meet either the high-quality habitat definition or the Types A or B habitat definitions within a particular 5,000-acre block, the next highest quality 300-acre habitat patches should be identified. If the application of silvicultural techniques to such patches would speed the development of nesting structure where it is currently lacking, these activities are permitted, as long as they occur farther than 0.7 mile from any known spotted owl sites.

(e) The 300-acre nest patches shall be deferred from harvest until DNR can demonstrate the successful application of silvicultural techniques to create functional nesting habitat in managed stands. During the research phase of this HCP, DNR shall conduct the research necessary to determine what constitutes adequate nest structure at both the stand and landscape levels and conduct silvicultural experiments that attempt to create adequate nesting structure. Research may be conducted in cooperation with other landowners and managers. When DNR begins actively managing nestinghabitat stands, the target condition of the landscape shall be consistent with the results of the research described earlier. Development of new management standards for spotted owl nest habitat shall be done in consultation with the USFWS.

MANAGEMENT OF SUB-MATURE HABITAT THAT IS NOT DESIGNATED AS NESTING HABITAT

(a) If any harvest activity occurs in habitat that meets or exceeds the sub-mature definition, no more than 5 percent of the habitat on DNR-designated NRF lands in a WAU can undergo harvest activity in a two-year period. When any additional harvest is planned for habitat in the WAU, the stand or stands which constituted the first 5 percent in which harvest activities took place shall be assessed to ensure that sub-mature habitat characteristics remain. If these characteristics are present, an additional 5 percent of the habitat can be harvested.

(b) If characteristics of sub-mature habitat are not present after management activities have been conducted, no additional NRF habitat may be treated in that WAU until sub-mature quality is attained. In addition, subsequent silvicultural treatments should be modified so that forest stands are not reduced below sub-mature quality for more than two years.

(c) DNR will submit proposed exceptions to the U.S. Fish and Wildlife Service. If the U.S. Fish and Wildlife Service does not agree with the proposal, a multi-agency science team, including staff specialists from DNR, the U.S. Fish and Wildlife Service, and any third party scientist the U.S. Fish and Wildlife Service deems appropriate, shall be convened to resolve any outstanding issues.

Management in DNR NRF habitat in WAUs that contain less than 50 percent NRF habitat

Management can take place in this type of habitat as long as NRF habitat remains after management activities are complete. The standards described in paragraphs (a), (b), and (c) above apply to management within sub-mature habitat in WAUs that are below the target amount of habitat.

Management of stands that are not yet NRF habitat can take place only if management activities do not increase the amount of time that would be

required for the target amount of NRF goal to be attained if all the stands in that WAU were left unmanaged.

Management in DNR NRF habitat in WAUs that contain more than the target amount of NRF habitat

Management can take place in this type of habitat if such management does not lower the total amount of NRF habitat below the target amount and does not reduce the amount and distribution of nesting habitat described earlier. Landscape-specific arrangements of habitat that meet the life-needs of the spotted owl will be determined during the landscape assessment process that is used to implement the HCP. Harvest of habitat that is in excess of the target amount for a WAU should be done in the context of a landscape assessment process. This process may consider the following factors:

- Larger patches of habitat constitute higher quality spotted owl habitat than smaller patches, thus limiting fragmentation of large, contiguous habitat patches is desirable.
- Habitat patches that are contiguous with large habitat patches on federal land have more habitat value than smaller or disjunct patches.
- Older forest may constitute higher quality habitat than younger forest that still meets the habitat definition.
- Planning harvest in excess habitat away from known spotted owl nest sites first and near the vicinity of known nest sites last would minimize impact to the spotted owl population.

In WAUs that are above the habitat target, DNR will avoid harvest of habitat within 0.7 mile of known nest sites during the breeding season. DNR will use any updated information on nest site locations provided by the U.S. Fish and Wildlife Service.

Management of DNR forest stands that do not count toward the target amount of NRF habitat in a WAU

Management can occur in these areas in WAUs that are at or above the target amount of NRF habitat as long as all activities adhere to all other provisions of the HCP and do not lower the total amount of NRF habitat below the target amount and do not reduce the amount and distribution of nesting habitat described earlier. If a spotted owl nest site is discovered during timber sale planning, seasonal harvest restrictions timed to avoid the breeding season shall be observed within a 0.7-mile radius of the nest site.

PROVISION OF DISPERSAL HABITAT

Dispersal habitat shall be maintained on 50 percent of DNR-managed lands selected for a dispersal habitat role. The stand characteristics of dispersal habitat are described in the habitat definition section below. The 50 percent goal shall be measured in DNR-designated dispersal areas on a WAU basis.

MANAGEMENT IN WAUs NOT DESIGNATED TO PROVIDE HABITAT FOR SPOTTED OWLS

When harvesting spotted owl habitat outside of designated NRF areas, DNR will consider recommendations of the the U.S. Fish and Wildlife Service for scheduling potential take of spotted owl site centers during the first decade. This will be done in order to retain sites that may have a valuable short-term contribution to the population. Otherwise, the provi-

sions of the spotted owl strategy do not place any special conditions upon forest stands in WAUS that are not designated to provide habitat for the spotted owl. All other provisions of the HCP shall still apply, as shall Forest Practices regulations that do not pertain specifically to spotted owls as well as relevant policies of the Board of Natural Resources. If a spotted owl nest site is discovered during timber sale planning in a stand not designated to provide spotted owl habitat, seasonal harvest restrictions timed to avoid the breeding season shall be observed with a 70-acre core surrounding the nest site.

OTHER MANAGEMENT CONSIDERATIONS

Salvage Operations and Activities Related to Forest Health

DNR's HCP conservation strategies include commitments to develop and maintain wildlife habitat (in this case, NRF habitat and dispersal habitat for the northern spotted owl) over time in designated amounts and areas. In general, such conservation commitments made in the HCP will take priority over other DNR management considerations. However, these conservation commitments may, in some cases, be inconsistent with activities DNR must consider under state statutes pertaining to salvage (RCW 79.01.795) and forest health (RCW 76.06.040).

For example, salvage operations might be considered by the DNR for reasons such as windthrow, fire, disease, or insect infestation. Activities related to forest health might include risk reduction through underburning, thinning, or harvest to stop spread of disease or insect infestation.

When DNR determines that such potential exists, discussions shall be held with the U.S. Fish and Wildlife Service. If it is determined that such activities would adversely impact the HCP conservation strategies, DNR and the U.S. Fish and Wildlife Service shall identify additional mitigation that would allow the necessary activities to go forward.

In conducting salvage activities, DNR shall, to the extent practicable:

- minimize the harvest of live trees to those necessary to access and complete the salvage activity;
- maximize and clump the retention of large, safe, standing trees to provide future snags; and
- consider opportunities to retain concentration of snags and/or coarse woody debris which may benefit species such as black-backed and three-toed woodpeckers.

Support of Federal Reserves

DNR-managed lands selected to provide demographic support to spotted owl clusters on federal reserves may become less important as habitat on federal reserves develops. DNR may periodically review habitat conditions and any relevant demographic information to reassess the necessity of a contribution from DNR-managed lands. In some areas, it is possible that federal reserves alone will eventually be sufficient to support a self-sustaining spotted owl population. Where such conditions warrant, DNR may approach the U.S. Fish and Wildlife Service to amend the HCP accordingly. Proposals for such changes would be developed by DNR and submitted to the U.S. Fish and Wildlife Service and National Marine Fisheries Service. A multi-agency science team may be convened to resolve questions regarding the biological basis of the proposal.

HABITAT DEFINITIONS

This section defines the habitat types that are referred to in the NRF and dispersal management standards section above. This section is followed by a discussion of the origin and basis of these habitat definitions.

High-quality Nesting Habitat

The following definition is interim in nature due to limitations in the data from which it was derived and will be refined when DNR conducts the appropriate research. (See discussion below titled Basis for Habitat Definitions.) This definition is to be applied as an average condition over a 300-acre nesting habitat patch.

- At least 31 trees per acre are greater than or equal to 21 inches dbh with at least 15 trees, of those 31 trees, per acre greater than or equal to 31 inches dbh.
- At least three trees from the above group of 31 trees have broken tops
- At least 12 snags per acre larger than 21 inches dbh
- A minimum of 70 percent canopy closure[2]
- A minimum of 5 percent ground cover of large woody debris

The 15 trees per acre greater than or equal to 31 inches dbh should be from the largest size classes present. If there are not 15 trees per acre greater than or equal to 31 inches dbh, the next largest available trees per acre should be retained to maintain a total of 31 trees larger than 21 inches dbh per acre.

Type A Spotted Owl Habitat

- A multi-layered, multispecies canopy dominated by large (30 inches dbh or greater) overstory trees (typically 15-75 trees per acre)
- Greater than 70 percent[3] canopy closure
- A high incidence of large trees with various deformities such as large cavities, broken tops, and dwarf mistletoe infection
- More than two large snags per acre, 30 inches dbh or larger
- Large accumulations of fallen trees and other woody debris on the ground

Type B Spotted Owl Habitat

- Few canopy layers, multispecies canopy dominated by large (greater than 20 inches dbh) overstory trees (typically 75-100 trees per acre, but can be fewer if larger trees are present)
- Greater than 70 percent canopy closure
- Some large trees with various deformities
- Large (greater than 20 inches dbh) snags present
- Accumulations of fallen trees and other woody debris on the ground

[2]For all instances in which canopy closure is used in a habitat definition, relative density (RD) will be used as a measurement if and when DNR has established a correlation between RD and canopy closure in spotted owl habitat for its lands. Relative density is defined as the basal area of a stand divided by the square root of the quadratic mean dbh of the stand (Curtis 1982). Foresters prefer this measurement to canopy closure because of repeatability of results and because it uses standard inventory data.

[3]This is a modification from Hanson et al. (1994, Appendix 4), which stated "60-80 percent". See discussion of canopy closure in subsection titled Basis for Habitat Definitions.

The Type A and Type B habitat definitions have been used by DNR spotted owl surveying crews and Washington Department of Fish and Wildlife habitat biologists since March 1991. Both habitats support spotted owl nesting (Hanson et al. 1993 p. 114).

Sub-mature Habitat

The following definition should be applied as average stand conditions. Sub-mature habitat has the following characteristics:

- Forest community dominated by conifers, or in mixed conifer/hardwood forest, the community is composed of at least 30 percent conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)
- At least 70 percent canopy closure
- Tree density of between 115 and 280 trees greater than 4 inches dbh per acre
- Dominant and co-dominant trees at least 85 feet tall
- At least three snags or cavity trees per acre that are at least 20 inches dbh

The Washington Forest Practices Board Spotted Owl Science Advisory Group (Hanson et al. 1993) determined that these characteristics constitute high-quality younger forest habitat for western Washington and reported that sub-mature forests provide roosting and foraging opportunities for spotted owls.

Based on thinking that has developed since the publication of Hanson et al. (1993), DNR has determined that a down woody debris component is also important for high-quality roosting and foraging habitat. Thus, a minimum of 5 percent ground cover of large down woody debris shall also be required for sub-mature habitat. This is an explicit addition to Hanson et el. (1993) definition of sub-mature habitat. (See subsection titled Basis for Habitat Definitions, below.)

Dispersal Habitat

Dispersal habitat has the following minimum characteristics:

- Canopy cover at of least 70 percent
- Quadratic mean diameter of 11 inches dbh for 100 largest trees per acre in a stand
- Top height of at least 85 feet (Top height is the average height of the 40 largest diameter trees per acre.)
- At least four trees per acre from the largest size class retained for future snag and cavity tree recruitment

Higher quality nesting habitat, Type A, Type B, and sub-mature habitat can be counted as dispersal habitat.

BASIS FOR HABITAT DEFINITIONS

Nesting Habitat

The definition of high-quality nesting habitat outlined above is derived from two studies that measured nest tree characteristics and vegetative

structure around spotted owl nest sites in western Washington. One study included paired measurements from 15 nest sites and 15 random sites on the Olympic Peninsula (Hershey 1995), and the other included data from 11 nest sites in the western Cascades (Hamer 1995, unpublished data). This definition was developed as an attempt to replace the vague descriptive language used in the Type A and Type B habitat definitions. However, it should be viewed as an interim definition because of limitations in the data from which it was derived. These limitations stem from small sample size, less than full geographical representation of habitat types in western Washington, and the application of data derived from an unmanaged context to a managed context. This definition should be revised as more data becomes available on the vegetative characteristics of spotted nest stands and more information regarding the ability of spotted owls to nest successfully in a managed landscape. Proposals for such changes would be developed by DNR and submitted to the U.S. Fish and Wildlife Service and National Marine Fisheries Service. A multi-agency science team may be convened to resolve questions regarding the biological basis of the proposal.

TREE SIZE

Hershey (1995) found that mean nest tree size was 58 inches dbh; minimum nest tree size was 23 inches dbh and maximum size was 176 inches dbh. Hamer (1995, unpublished data) found that mean nest tree size was 74 inches dbh with a minimum of 47 inches dbh and a maximum of 115 inches dbh. (See Table IV.1.) Given that nest trees in these studies were so large, the definition for nesting habitat reflects the importance of retaining large trees in nest stands. The number and size class of large trees reflects the mean number of trees in a 21- to 31-inch dbh size class and a greater than 31-inch dbh size class found in nest stands in each study (Table IV.2). It should be noted that Hershey (1995) found no statistically significant difference in tree density in either the 21- to 31-inch-dbh and or the greater than 31-inch dbh size classes in nest plots versus random plots. (See footnotes in Table IV.2.)

SNAGS

The requirement of 12 snags per acre greater than 21 inches dbh is derived from taking the arithmetic mean of the sum of means from the 21 to 31-inch-dbh size class and the greater than 31-inch-dbh size class from each study. (See Table IV.2.) Snags are important both for nest trees and for prey. Seven of the 26 nest trees in both of these studies were snags. Carey (1995) found that the presence of large snags was the best predictor of abundance of northern flying squirrels, which is a principal prey species for spotted owls in western Washington. (See Section A of Chapter III on species ecology of the northern spotted owl.)

BROKEN-TOP TREES

The requirement for broken-top trees comes from the mean number of such trees observed in Hershey's study. Hamer did not measure density of broken-top trees. Trees with side or top cavities were used as nest trees in both study areas, however. (See Table IV.1.) These cavities are usually formed in trees with broken and secondary leaders and in trees from which large branches were broken.

CANOPY CLOSURE

A minimum of 70 percent canopy closure is consistent with a range of canopy closures defined by one standard deviation below the mean observed in both Hamer's (1989) and Hershey's (1995) studies. It is also consistent with recommendations of Hanson et al. (1993) on the basis of their review of the literature. DNR is in the process of collecting data to relate canopy closure to relative density in spotted owl habitat on its lands.

Table IV.1: Spotted owl nest tree characteristics in western Washington

dbh = diameter at breast height; s.e. = standard error; $\bar{x}$ = mean; n = number in sample

	Olympic Peninsula (Source: Hershey 1995)	**Western Washington Cascades** (Source: Hamer 1995, unpublished data)
Nest tree diameter (inches dbh)	$\bar{x}$ = 58 range = 23 to 176 s.e. = 9.7 n = 15	$\bar{x}$ = 74 range = 47 to 115 s.e. = 7.8 n = 10
Nest tree height (feet)	live trees $\bar{x}$ = 146 range = 99 to 186 n = 11 snags $\bar{x}$ = 57 range = 34 to 77 n = 4	live trees $\bar{x}$ = 194 range = 115 to 206 n = 7 snags $\bar{x}$ = 104 range 49 to 180 n = 3
Tree species	Douglas fir = 5 western redcedar = 5 western hemlock = 5	Douglas fir = 1 western redcedar = 8 western hemlock = 1
Nest structure	top cavities = 4 live tree = 1 snag = 3 side cavities = 10 live tree = 9 snag = 1 platform nests = 1	top cavities = 1 live tree = 0 snag = 1 side cavities = 9 live tree = 7 snag = 2 platform nests = 0

Table IV.2: Spotted owl nest stand characteristics in western Washington

dbh = diameter at breast height; s.e. = standard error; $\bar{x}$ = mean; n = number in sample; sd = standard deviation; p = probability that the difference is because of random characteristics within the population

	Olympic Peninsula (Source: Hershey 1995)[1]						Western Washington Cascades (Source: Hamer 1995, unpublished)[2]					
Tree density by size class (size in inches dbh, density in trees per acre)	Size class	$\bar{x}$	min	max	s.e.	sd	Size class	$\bar{x}$	min	max	s.e.	sd
	4.0-11.0	90	12	297	22	85	4-11	80	32	131	11	38
	11.1-21.0[3]	45	19	112	8	31	11-21	27	18	53	3.3	11
	21.1-31.0	16	5	31	1.7	7	21-31	16	10	24	1.5	5
	≥31	14	1.6	23	1.8	7	≥31	16	10	26	1.2	4
Tree density by height class (height in feet, density in trees per acre)	Height class	$\bar{x}$	min	max	s.e.	sd						
	25-49	40	7	110	8.3	32						
	50-75	34	10	120	8.5	33						
	76-100[4]	30	7	84	7.1	27						
	101-125[5]	25	8	78	5.3	20						
	126-150	17	8	44	2.3	9						
	≥150	11	0	23	2.0	8						
Snag density by size class (snags in inches dbh, density in snags per acre)	Size class	$\bar{x}$	min	max	s.e.	sd	Size class	$\bar{x}$	min	max	s.e.	sd
	4.0-11.0[6]	13	2.0	44	3.7	14	4-11	13	2	44	3.6	12
	11.1-21.0	4	0.8	8.5	0.6	2.3	11.21	10	2	18	1.3	4
	21.1-31.0	3.6	0.8	8.5	0.6	2.3	21-31	8	2	16	1.5	5
	≥31	3.3	0.0	9.7	0.8	3.0	≥31	8	4	12	0.8	3
Density of tree 21 in. dbh with broken tops and secondary leaders (trees per acre)		$\bar{x}$	min	max	s.e.							
		3.0	0	17	0.56							
Canopy closure		$\bar{x}$	min	max	s.e.	sd		$\bar{x}$	min	max	s.e.	sd
		78.8[7]	68.3	87.1	1.43	5.5		83	62	92	2.6	8.6

[1]Vegetation data around 15 nest sites were collected using five 0.1-ha plots, the first plot centered on the nest tree and the other four placed at four cardinal directions from nest tree. Snag data were collected using five 0.2-ha plots that surrounded the 0.1-ha plots. Vegetation was sampled around random sites as well. Random plots were chosen within a home range distance of nest sites and within forest stands in which dominant or co-dominant trees were at least 21 inches dbh. Data from random sites are not shown. Where there was a statistically significant difference between nest stands and random stands, data are shown in a footnote.

[2]Hamer's data are from the Mount Baker-Snoqualmie National Forest. Vegetation characteristics are based on 25-m-radius plots around 11 nest sites. Some of this data was originally published in USDI 1992. It was reanalyzed by Hamer for the purposes of this HCP in 1995.

[3]There was a significant difference between the mean density of trees around nest sites versus random sites in this size class. For random plots in the 11-21-inch-dbh size class the mean density was 29 trees per acre, p = 0.0467 (Hershey 1995). There were no significant differences between nest sites and random sites for any other size class.

[4]Mean density of trees in this height class at random sites is 16.3, p = 0.0236.

[5]Mean density of trees in this size class at random sites is 14.2, p = 0.0226.

[6]Mean density of snags at random sites in this size class is 7, p = 0.0402.

[7]Mean canopy closure for random sites is 74.4, s.e. = 1.27, p = 0.0033.

DOWN WOODY DEBRIS

Down wood is essential for small mammal communities (Maser and Trappe 1984; Harmon et al. 1986). Carey and Johnson (1995) found that the abundance of small mammal species was related to the amount of dead and down wood in both managed and naturally regenerated stands. From their empirical observations, they recommend that retention of 15 to 20 percent cover of coarse woody debris would allow most small mammal species to reach their potential abundances. Coverage of less than 10 percent probably would not allow these communities to reach their potential abundances (Carey and Johnson 1995 p. 347). Attaining an adequate level of large woody debris for small mammal communities is an important consideration for spotted owl nesting habitat. However, it is not clear whether providing for full potential abundance of small mammal communities is necessary given that the spotted owl's primary prey is the northern flying squirrel, which is an arboreal rodent. Down woody debris is also associated with species of fungi that are the primary food source for flying squirrels (Carey 1995). Again, the amount of woody debris cover needed to adequately provide this function is not known. A 5 to 10 percent range was chosen as the amount of down woody debris cover based on the reasoning that if 15 percent cover supported small mammal populations at their full potential abundance, the middle two-thirds of a range between 0 and 15 percent would likely provide for adequate spotted owl prey populations. This is clearly a management hypothesis and will be tested as part of the research that will be conducted to define more precisely spotted owl nest stand characteristics.

CONFIGURATION

The recommendation for arranging nesting habitat in a 300-acre nest patch within a larger 500-acre patch of suitable habitat is based on studies that demonstrate increasing probability of spotted owl occupancy with increasing amount of habitat close to site centers and studies that show concentrated use of habitat within 0.7 mile of site centers. In a study of 61 spotted owl sites on the east slope of the Cascades, Irwin and Martin (1992) found that spotted owl sites that were occupied either one or two years of a two-year survey had an average of 252 acres (s.d. = 20) of suitable habitat within a 0.5 mile circle in managed stands and 316 acres (s.d. = 20) in a 0.5 mile circle in unmanaged stands. There was a strong statistical relationship between the amount of habitat found at sites with 0, 1, or 2 years of occupancy at 0.5, 1.0, 1.5, and 2.0 miles from the site center with the strongest relationship occurring at 0.5 mile. Data on the amount of habitat found within 0.5 mile of occupied sites was used in a logistic regression analysis to predict occupancy. Their analysis predicted a 90 percent chance of pair site occupancy when there were 300 acres of suitable habitat within 0.5 mile of a site center. This study provided predictive abilities and did not establish minimum amounts of habitat needed by owls. As stated above, this study was conducted on the east side of the Cascade Crest where owl responses to habitat quality and quantity are different from forests on the west side of the Cascade Crest. DNR believes that patches of this size, in combination with surrounding sub-mature forest will provide the necessary habitat to support nesting owls in proximity to federal lands.

Irwin (1993) tracked the use of habitat within annual home ranges of 19 radio-tagged spotted owls and found that more than 60 percent of the area used annually was within a 700-acre area. (See also Hanson et al. 1993 p. 38-39.) In addition, Hanson et al. (1993) recommended that the area within 0.7 mile of a spotted owl activity center should be considered an area of exclusive use for that site because of data demonstrating concentrated use of habitat closer to site centers than farther away (Forsman et al. 1984),

and because this area is used heavily by juvenile spotted owls during their first summer (Hanson et al. 1993 p. 33). Based on this information, it is reasonable to arrange habitat in contiguous 500-acre patches (300 acres of high-quality nesting habitat and 200 acres of at least sub-mature habitat) within a 0.7-mile-radius circle.

The distribution of one nesting habitat patch per 5,000 acres of DNR-designated NRF areas approximates a distribution of one nesting core per annual home range. Two nesting habitat patches per 5,000 acres of DNR-designated NRF area are provided to buffer against potential catastrophic loss and to increase the likelihood that suitable nesting patches will be found by dispersing juveniles.

Sub-mature Habitat

Sub-mature forest is a younger forest habitat category defined by Hanson et al. (1993). Sub-mature habitat includes mid-seral forest (non-late successional or old growth) that has the structural characteristics necessary to provide roosting and foraging functions. Foraging habitat is associated with healthy prey populations of small forest floor mammals and northern flying squirrels, though neither of these is as abundant as in older forests (Hanson et al. 1993 p. 53; Carey 1995; Carey and Johnson 1995). Roosting habitat is associated with the presence of potential perches at various vertical positions throughout the forest canopy. Sub-mature habitat corresponds with Type C habitat definition that has been used by DNR and the Washington Department of Fish and Wildlife for habitat typing in Washington. Sub-mature habitat is used infrequently for nesting by spotted owls (Hanson et al. 1993, Appendix 3, Appendix 5). Refer to Hanson et al. (1993 p. 55-59) for more information about the data they used to develop each component of the sub-mature habitat definition.

Hanson et al. (1993) proposed their spotted owl habitat definitions as working hypotheses and recommended that annual data reviews be conducted in order to revise these definitions as new pertinent information became available (Hanson et al. 1993 p. 50). Based on this recommendation, DNR is treating its use of the sub-mature habitat definition in this HCP as a working hypothesis and shall incorporate new information to revise the definition. The incorporation of a down woody debris component is an example of how DNR intends to build on the sub-mature habitat definition.

DNR added a down woody debris component to the original definition of sub-mature habitat because of the likelihood that there is an association between the presence of down woody material and abundant spotted owl prey populations as discusssed earlier. While a threshold of adequate versus inadequate amounts of down woody debris specifically for spotted owl habitat cannot be established based on existing data, the inclusion of a down wood component for sub-mature habitat is consistent with DNR's intent to provide high quality roosting and foraging habitat. Old-forest habitat is the habitat type selected by spotted owls over younger habitat types for both roosting and foraging and nesting functions (see Section A on spotted owl ecology in Chapter III) and is characterized by the presence of abundant down woody debris (Spies and Franklin 1991; Carey and Johnson 1995). Thus, during the research phase of this HCP, DNR will include a down woody debris component in both the nesting and the sub-mature habitat definitions until more data is available regarding the amount of down wood required to provide adequate foraging opportunities for spotted owls in a managed landscape.

Dispersal Habitat

Definitions of dispersal habitat based on an understanding of stand conditions and landscape patterns that relate to high rates of successful juvenile spotted owl dispersal are lacking. The model developed by Thomas et al. (1990) and adopted by the Northern Spotted Owl Recovery Team (USDI 1992) was based on range-wide conditions thought to support roosting adults. This approach, commonly referred to as the 50-11-40 rule, recommended managing areas outside of designated reserves such that 50 percent of forested lands in each quarter township would have an average canopy closure of 40 percent and trees would average 11 inches dbh. Habitat conservation plans prepared for the Murray Pacific Corporation in western Washington by Beak Consultants, Inc. of Kirkland, Washington (1993), and the Weyerhaeuser Corporation's Millicoma Tree Farm (1994) in coastal Oregon use more specific models to accomplish the same goal as the model proposed by Thomas et al. (1990). Both plans call for monitoring of the success of silvicultural prescriptions in attaining the desired stand conditions, but neither plan will monitor actual use of designated dispersal stands by dispersing juvenile spotted owls.

The Murray Pacific HCP differs from the 50-11-40 rule in that it proposes specific tree density and diameter criteria (130 trees per acre that are at least 10 inches dbh, with tree density not to exceed 300 trees per acre) to provide trees of adequate size for roosting and a canopy closure of 70 percent (versus 40 percent in the Thomas definition) that allows adequate space under the canopy for spotted owls to move in and provides adequate thermal cover. Beak (1993) considered 40 percent canopy closure inadequate for dispersal habitat for managed stands in western Washington because the tree limbs would be close to the ground and the understory vegetation would be dense. Both these conditions would likely inhibit successful foraging. The Murray Pacific HCP also provides a component of snags, live trees, and dead wood to provide foraging opportunities. This plan is designed for site conditions on the Murray Pacific Tree Farm in the western Washington Cascades.

The Weyerhaeuser Millicoma HCP also specifies tree density and size criteria, using 120 trees per acre that are at least 10 inches dbh and a maximum density of 300 trees per acre.

DNR recognizes the lack of data relating actual stand conditions and landscape patterns to successful spotted owl dispersal. For the purposes of this HCP, an interim definition will be adopted that will be replaced as better data become available. DNR is in the process of analyzing existing data for:

(1) use versus availability of habitat types by roosting adult spotted owls;

(2) habitat associations of northern flying squirrels; and

(3) habitat typing of stands used by successfully dispersed juvenile spotted owls in western Washington.

The results of this analysis will be used to derive a more precise definition of dispersal habitat. In the interim, DNR will adopt an approach similar to the model developed by Beak Consultants for Murray Pacific. The basis for each component of DNR's definition of dispersal habitat is as follows.

CANOPY COVER

For western Washington, a canopy cover of 70 percent is more likely to allow for sufficient maneuverability and thermal cover than a canopy closure of 40 percent (Beak Consultants 1993).

CANOPY HEIGHT

A top height of 85 feet should provide an adequate canopy lift, or area under the canopy that is free of obstruction from lower limbs, so as to not impede spotted owl flight, and thus enhance foraging activities.

GREEN TREE RETENTION

Green tree retention is intended for the eventual recruitment of snags and cavity trees. Snags or cavity trees are required for high densities of flying squirrels (Hanson et al. 1993; Carey 1995), a principal prey species of spotted owls in western Washington (Carey et al. 1992).

DOWN WOODY DEBRIS

The definition of dispersal habitat does not currently contain provisions for down woody debris. There are currently no data upon which to base a recommendation for down wood in dispersal habitat. However, given that one of the functions of dispersal habitat is to provide foraging opportunities, down woody debris would provide important habitat for spotted owl prey species. A down wood component shall be incorporated into the dispersal habitat requirements if and when research demonstrates its necessity or there is data upon which to base a reasonable management hypothesis.

Conservation Strategy for the Three East-side Planning Units

The conservation strategy for spotted owls on the east slopes of the Cascades is built on the same principles as the strategy for the five west-side planning units. Differences in the strategies arise from differences in forest ecology and spotted owl habitat ecology on the east and west sides of the Cascades. The outline of components is the same for both strategies, but the specifics in each component differ. (The rationale for both strategies follows the discussion of east-side habitat definitions and their basis.) The specifics for each component in the east-side strategy are described below. This strategy provides mitigation for the entire approximately 229,000 acres of DNR-managed lands covered by the HCP in the three east-side planning units.

IDENTIFICATION OF DNR-MANAGED LANDS MOST IMPORTANT TO SPOTTED OWL CONSERVATION

The process and criteria for determining what if any role DNR-managed lands could play in spotted owl conservation on the east side were similar to that used for lands on the west side. The only difference is that lands on the east-side within 1.8 miles of federal reserves were considered important for demographic support instead of within 2 miles as in western Washington. This difference reflects the difference in the radius of circles that approximate a median annual spotted owl home range on the eastern and western sides of the Washington Cascades (Hanson et al. 1993). Some lands selected to serve a demographic support function are located farther than 1.8 miles from a federal reserve. These lands are directly adjacent to the Yakama Indian Reservation and provide support for a cluster of spotted owls currently centered on a combination of DNR-managed lands, the Yakama Reservation, and federal reserve lands.

Approximately 229,000 acres of DNR-managed lands are covered by the HCP in the three east-side planning units. DNR NRF areas encompass approximately 39,000 acres in the three east-side planning units. Dispersal areas encompass approximately 85,000 acres of DNR-managed lands in eastern Washington. Lands selected for NRF and dispersal management are shown in Maps IV.6-IV.8.

DETERMINATION OF NRF HABITAT GOALS ON A LANDSCAPE SCALE FOR LANDS IDENTIFIED FOR A NRF HABITAT ROLE

The steps used to determine habitat goals for DNR designated NRF areas are the same as described earlier for the west-side strategy.

MANAGEMENT OF FOREST STANDS WITHIN NRF HABITAT AREAS

NRF habitat in eastern Washington is defined as sub-mature or higher quality forest. (See habitat definition below.) Forest management activities within DNR-designated NRF areas will take place in four different situations:

(1) in existing NRF habitat that counts toward the target amount for a WAU;

(2) in forest stands that are not yet habitat but are managed with the intent of developing habitat;

(3) in forest stands that are identified for harvest when the WAU has exceeded the target amount of NRF habitat; and

(4) in forest stands that do not count toward the target amount of NRF habitat.

Management in DNR NRF habitat that counts toward the target amount of habitat in a WAU

Management can take place within this type of habitat under the following conditions:

- The structural characteristics of sub-mature quality or higher are retained.

- No more than 5 percent of the NRF habitat within a WAU should be modified in a two-year period. Before the same WAU can be entered for any management activity that either degrades old-forest habitat to sub-mature habitat or results in the removal of commercial volumes of timber from sub-mature habitat, the original area that received such management treatment should be assessed to determine that the managed stands meet the definition of sub-mature habitat. After it has been determined that the managed stands meet the definition, an additional 5 percent old-forest or sub-mature habitat can be managed for commercial wood production.

- If the characteristics of sub-mature habitat are not present, no additional management within NRF habitat in the WAU can take place until the managed stands have again acquired sub-mature characteristics. Any future management activity should be modified so that forest stands are not reduced below sub-mature quality for more than two years.

Management in DNR NRF habitat in WAUs that contain less than 50 percent NRF habitat

Management can take place in this type of habitat as long as NRF habitat remains after management activities are complete. The standards described immediately above for management of sub-mature habitat apply in WAUs below the target condition as well. Management of stands that are not yet NRF habitat can take place only if management activities do not increase the amount of time that would be required for the target amount of NRF to be attained if all the stands in that WAU were left unmanaged.

Management in DNR NRF habitat in WAUs that contain more than the target amount of NRF habitat

Management can take place in this type of habitat if such management does not lower the total amount of NRF habitat below the target amount. As in western Washington, landscape-specific arrangements of habitat that meet the life needs of the spotted owl will be determined through a landscape assessment process that is used to implement the HCP. Harvest of excess habitat should be done in this context. This process may consider the following factors:

- Larger patches of habitat constitute higher quality spotted owl habitat than smaller patches; thus, limiting fragmentation of large, contiguous habitat patches is desirable.
- Habitat patches that are contiguous with large habitat patches on federal land have more habitat value than smaller or disjunct patches.
- Older forest may constitute higher quality habitat than younger forest that still meets the habitat definition.
- Planning harvest in excess habitat away from known spotted nest sites first and in the vicinity of known nest sites last would minimize impact to the spotted owl population.

In WAUs that are above the habitat target, DNR will avoid harvest of habitat within 0.7 mile of known nest sites during the breeding season. DNR will consider any updated information on nest site locations provided by the U.S. Fish and Wildlife Service.

Management of DNR forest stands that do not count towards the target amount of NRF habitat in a WAU

Management can occur in these areas in WAUs that are at or above the target amount of NRF habitat as long as all activities adhere to all other provisions of the HCP and do not lower the total amount of NRF habitat below the target amount.

PROVISION OF DISPERSAL HABITAT

Dispersal habitat shall be provided in designated areas according to the definition described below. Fifty percent of DNR-designated dispersal areas within a quarter township shall be maintained in dispersal habitat conditions. In some cases, the location of quarter township lines results in a configuration of DNR-designated dispersal areas that are too small to allow practical management activities to occur. Where such situations arise, DNR-designated dispersal areas can be grouped with adjacent DNR dispersal areas in adjacent quarter townships.

MANAGEMENT IN WAUs NOT DESIGNATED TO PROVIDE HABITAT FOR SPOTTED OWLS

When harvesting spotted owl habitat outside of designated NRF areas, DNR will consider recommendations of the the U.S. Fish and Wildlife Service for scheduling potential take of spotted owl site centers during the first decade. This will be done in order to retain sites that may have a valuable short-term contribution to the population. Otherwise, the provisions of the spotted owl strategy do not place any special conditions upon forest stands in WAUs that are not designated to provide habitat for the spotted owl. Mitigation for other listed species shall still apply, as shall Forest Practices regulations that do not pertain specifically to spotted owls as well as relevant policies of the Board of Natural Resources. If a spotted owl nest site is discovered during timber sale planning in a stand not designated to provide spotted owl habitat, seasonal harvest restrictions timed to avoid the breeding season shall be observed within a 70-acre core surrounding the nest site.

OTHER MANAGEMENT CONSIDERATIONS

Salvage Operations and Activities Related to Forest Health

DNR's HCP conservation strategies include commitments to develop and maintain wildlife habitat (in this case, NRF habitat and dispersal habitat for the northern spotted owl) over time in designated amounts and areas. In general, such conservation commitments made in the HCP will take priority over other DNR management considerations. However, these conservation commitments may, in some cases, be inconsistent with activities DNR must consider under state statutes pertaining to salvage (RCW 79.01.795) and forest health (RCW 76.06.040).

For example, salvage operations might be considered by DNR for reasons such as windthrow, fire, disease, or insect infestation. Activities related to forest health might include risk reduction through underburning, thinning, or harvest to stop spread of disease or insect infestation.

When DNR determines that such potential exists, discussions shall be held with the U.S. Fish and Wildlife Service. If it is determined that such activities would adversely impact the HCP conservation strategies, DNR and the the U.S. Fish and Wildlife Service shall identify additional mitigation that would allow the necessary activities to go forward.

In conducting salvage activities, DNR shall, to the extent practicable:

- minimize the harvest of live trees to those necessary to access and complete the salvage activity; and
- maximize and clump the retention of large, safe, standing trees to provide future snags.

HABITAT DEFINITIONS

This section defines the habitat types that are referred to in the NRF and dispersal management standards section above. This section is followed by a discussion of the origin and basis of these habitat definitions.

Nesting, Roosting, and Foraging Habitat

Nesting, roosting, and foraging functions are provided by sub-mature, mature, and old-growth forest types in eastern Washington (Hanson et al. 1993). Both Type A and sub-mature habitat provide nesting habitat. The Type A definition is included as a reference point for the range of habitat qualities that exist in eastern Washington. The management standards described above use the sub-mature definition as the minimum standard for spotted owl nesting habitat to be met within NRF management areas.

Type A Spotted Owl Habitat

Nesting, roosting, and foraging habitat in eastern Washington generally occurs in grand fir, Douglas fir, and ponderosa pine forest zones (Franklin and Dyrness 1973). Forest stands of Type A habitat are mature habitat that has naturally regenerated following windthrow or fire. These stands have the following characteristics:

- Multi-layered, multispecies canopy dominated by overstory trees that exceed 20 inches dbh (typically 35-100 trees per acre)
- At least 75 percent canopy closure
- Some dominant trees have mistletoe brooms, cavities, or broken tops
- Three snags per acre greater than or equal to 20 inches dbh
- Down woody debris that is greater than or equal to 20 inches dbh plus accumulations of other woody debris

Sub-mature habitat

This definition should be applied as average conditions over a stand. Sub-mature habitat has the following characteristics:

- Forest community composed of at least 40 percent Douglas fir or grand fir
- Canopy closure of at least 70 percent
- Tree density of between 110 and 260 trees per acre
- Either tree height or vertical diversity (one characteristic but not both needs to be present)
  - dominant and co-dominant trees at least 90 feet tall

    or

  - two or more canopy layers with numerous intermediate trees and low perches
- Either snags/cavity trees or mistletoe infection (one characteristic but not both needs to be present):
  - Three or more snags or cavity trees per acre that are equal to or greater than 20 inches dbh

    or

  - a moderate to high infection of mistletoe[4]
- Five percent ground cover of dead and down wood averaged over a stand

Dispersal Habitat

This is an interim definition of dispersal habitat. (See subsection below titled Basis for Habitat Definitions.)

- At least 50 percent canopy closure
- Overstory tree density of at least 40 trees per acre that are at least 11 inches dbh

[4]The Washington Forest Practices Board Spotted Owl Science Advisory Group recommended combining tree level indices of mistletoe infection (Baranyay and Safranyik 1970; Hawksworth 1977) with a stand level index (Roe and Amman 1970). In the tree level index, the tree canopy is visually divided into three vertical layers. Each layer is assigned a rating depending on the level of infection: 0 = no visible infection; 1 = less than half of the branches infected; 2 = more than half of the branches infected; and 3 = more than half of the branches infected and large brooms are present. The stand level index rating system is based on the number of trees in the stand that are infected: 1 = no trees infected; 2 = less than one-third of the trees infected; 3 = between one-third and two-thirds of the trees infected; 4 = more than two-thirds of the trees infected. The stand-level and tree-level ratings are then combined in a matrix to get an overall ranking. See Table IV.3 for the matrix. The Spotted Owl Science Advisory Group recommends that this system be field-verified and modified if necessary (Hanson et al. 1993 p.106-107).

Table IV.3: Recommended method for estimating habitat quality for spotted owls using tree- and stand-level indices of mistletoe infection

(Source: Reproduced from Hanson et al. 1993 p. 107)

	Stand-level infection index			
Tree-level infection index	**1 (no trees)**	**2 (< 1/3 of trees)**	**3 (1/3 - 2/3 of trees)**	**4 (> 2/3 of trees)**
0 (none)	None	None	Light	None
1 (<1/2 of branches)	None	Light	Moderate	Moderate
2 (>1/2 of branches)	None	Moderate	Heavy	Heavy
3 (>1/2 of branches, large brooms present)	None	Moderate	Heavy	Heavy

- Top height of at least 60 feet
- Retention of four green trees per acre from the largest size class present for recruitment of snags and cavity trees
- At least 50 percent of DNR-managed lands designated for a dispersal function on a quarter township basis will be maintained in the stand conditions described above

BASIS FOR HABITAT DEFINITIONS

Sub-mature Habitat

Sub-mature habitat in eastern Washington includes both even- and multi-aged stands. The characteristics of these stands result from a history of disturbance by fire, wind, insects, and disease and from selective forest management practices (Hanson et al. 1993 p. 63). Sub-mature forest has been documented to support successful nesting (Buchanan 1991; Buchanan et al. 1993, 1995; Hanson et al. 1993). See Hanson et al. (1993 p. 63-68) for an explanation of data supporting each habitat component.

Hanson et al. (1993) proposed their spotted owl habitat definitions as working hypotheses and recommended that annual data reviews be conducted in order to revise these definitions as new pertinent information became available (Hanson et al. 1993 p. 50). Based on this recommendation, DNR is treating its use of the sub-mature habitat definition in this HCP as a working hypothesis and shall incorporate new information to refine the definition.

Dispersal Habitat

As with west-side forests, an understanding of dispersal habitat based on use of stands by successfully dispersing juveniles is also lacking for forests on the east side of the Cascades. DNR's research strategy for developing more precise dispersal habitat definitions includes developing one or more region-specific definitions for the eastern Washington Cascades. The basis for devising the definitions is described in the components below.

CANOPY CLOSURE

Data from several radio-telemetry studies indicate that forest stands with a canopy closure of less than 50 percent are rarely used by spotted owls for roosting and foraging (Hanson et al. 1993 p. 65). DNR is in the process of collecting data to relate canopy closure to relative density for forests in eastern Washington.

OVERSTORY TREE DENSITY

Providing 40 trees per acre that are at least 11 inches dbh should contribute at least 50 percent canopy cover, ensure there are enough trees large enough to supply hiding cover, and include a large component of smaller trees in the stand.

STAND HEIGHT

Top height is a reliable and repeatable measure of stand height. Based on observations of stand conditions on DNR-managed lands in eastern Washington, conifers reach 60 feet in 40 to 70, years depending on site conditions. Trees in a stand at this stage of development have approximately 30 to 50 percent crown ratio. In other words, a 60-foot tree has between 30 and 42 feet of space between the ground and the first live branches. A stand with 30 to 42 feet of canopy lift should provide adequate flying space for juvenile spotted owls under the canopy.

GREEN TREE RETENTION

Retaining green trees is intended to provide for eventual recruitment of snags into dispersal stands. Snags are important for spotted owl prey species, particularly northern flying squirrels. Flying squirrels use cavities in snags as nests (Weigl and Osgood 1974). Research on snag requirements for northern flying squirrels has been conducted in western Washington but not in eastern Washington. However, snags are a documented component of spotted owl home ranges and are likely important habitat for prey species in eastern Washington (Hanson et al. 1993 p. 67).

UNIT AREA

DNR believes that a quarter township is an appropriate unit for calculating 50 percent dispersal habitat coverage in eastern Washington rather than using an entire WAU as in western Washington. The quarter township unit was recommended by Thomas et al. (1990) in their 50-11-40 rule and is smaller than a WAU. In western Washington, in addition to the stands managed directly for dispersal habitat, the conservation of riparian zones and forest stands designated for protection of marbled murrelets will provide a widespread network of older forest. This network will be absent on the east side. Thus, a smaller unit of habitat measurement is needed to reduce the potential gaps between dispersal stands.

Rationale for the Spotted Owl Conservation Objective and Strategies

DEMOGRAPHIC SUPPORT

In general, demographic support is accomplished by providing enough nesting, roosting, and foraging habitat to support one or more breeding pairs of spotted owls. Evidence from empirical studies and population modeling shows that larger clusters of breeding spotted owls — 15 to 25 pairs — have a higher likelihood of persisting in the face of random demographic, environmental, and genetic events than do smaller clusters or single pairs (Thomas et al. 1990; Lamberson et al. 1992, 1994; see also the spotted owl section in Chapter III). Thus providing habitat in or adjacent to areas currently occupied by large clusters or in areas capable of becoming occupied by large clusters of territorial spotted owls is more likely to contribute to maintaining the spotted owl population than providing habitat for dispersed single territories or small clusters.

Most of the remaining late successional and old-growth forest habitat in Washington is on federal land (USDA and USDI 1994a). Almost all of the remaining large clusters of territorial spotted owl sites are centered on federal land. However, many of the spotted owls whose sites are centered on federal land use nonfederal land to meet part of their habitat needs. There are 193 site centers on federal reserves designated under the President's Forest Plan that have DNR-managed land in some portion of their circle. Of these, 171 are territorial sites (WDFW 1995b). In order for existing sub-populations that are centered on federal land to persist, the sites near nonfederal lands need to be supported.

In addition, although the reserve system described in the President's Forest Plan was designed to accommodate large clusters of spotted owls, in many places, only small clusters exist now. Many of the federal reserves currently lack adequate amounts of suitable spotted owl habitat to support large clusters. In the eastern Washington Cascades, 16 of the 23 Late successional Reserves currently contain less than 40 percent suitable spotted owl habitat. The average amount of suitable habitat for these Late successional Reserves is 33 percent. In the western Washington Cascades, four of 22 Late successional Reserves have less than 40 percent habitat, while 10 have between 40 and 50 percent suitable habitat. The average habitat coverage for western Washington Cascades Late successional Reserves is 47 percent (USDA and USDI 1994a, Appendix G, p. 13-14).

For reasons outlined in the preceding paragraphs, DNR designed the main component of its spotted owl conservation strategies to provide NRF habitat on its managed lands that are intermingled with or within 1.8 miles of federal Congressional Reserves, Late successional Reserves, Managed Late successional Reserves, and Adaptive Management Areas in the eastern Washington Cascades or within 2 miles of these reserve designations in western Washington. DNR-managed lands in these areas will provide habitat that is important for spotted owls occupying site centers currently located on federal reserves but that use nonfederal habitat. The lands will also provide habitat to assist in supporting the development of larger clusters of spotted owl territories where smaller clusters exist now and sufficient habitat on federal lands is lacking, but the potential to support larger clusters clearly exists.

The 50 percent habitat level was chosen as a reasonable landscape coverage of nesting, roosting, and foraging habitat based on the median amount of suitable habitat found within median annual home ranges of spotted owl pairs in both eastern and western Washington (Hanson et al. 1993) and on

studies of spotted owl abundance and amount of older forest habitat in the landscape. The median amount of late successional habitat found in the median annual pair home ranges in western Washington was 44 percent (n = 7) (Hanson et al 1993 p. 20-21). In these telemetry studies, late successional habitat was used in greater proportion than its abundance. In eastern Washington, the median amount of late successional habitat was 50 percent (n = 4) (Hanson et al. 1993 p. 21). In addition, Bart and Forsman (1992) found that levels of occupancy and reproductive success increased with an increasing amount of old growth in the landscape; spotted owl density and reproductive output were higher in areas with greater than 60 percent older forest than in areas with less than 20 percent forest. However, there was no significant difference in these variables in areas having between 50 percent and 60 percent older forest in the landscape (Bart 1995). Given that the spotted owl population is likely in a state of demographic decline (Burnham et al. 1994, see also the spotted owl section in Chapter III), maintaining habitat levels near the amount considered by the U.S. Fish and Wildlife Service to harm an individual — 40 percent of median home range-size circles — could likely lead to long-term negative consequences to the population. In other words, it could be argued that if the population is in a state of decline, maintaining the status quo would maintain the decline.

DNR chose not to provide specific spotted owl habitat conservation measures for demographic support to the population on the northeastern portion of the Olympic Peninsula (Straits Planning Unit). The reasons for this decision are two fold. First, the results of demographic modeling performed and analyzed by the federal Reanalysis Team (Holthausen et al. 1994) suggest that remaining habitat on nonfederal lands on the northeastern portion of the Olympic Peninsula is not crucial to maintaining the spotted owl population on the Olympic Peninsula as a whole. Holthausen et al. (1994) thought that nonfederal lands on the western side of the peninsula could make a potentially higher positive contribution to the population. The Olympic Experimental State Forest will contribute NRF habitat to support the Olympic Peninsula population in this area. (See a later section in this chapter on the Spotted Owl Strategy for the Olympic Experimental State Forest.) Second, DNR will likely provide older forest habitat in the Straits Planning Unit that is suitable for spotted owls as part of the riparian and marbled murrelet conservation strategies. Given the less important role for nonfederal lands for spotted owl conservation in the Straits Planning Unit, DNR feels that the indirect contributions from these other conservation strategies will provide benefits appropriate for that area.

DNR also chose not to provide specific spotted owl habitat conservation measures for the purposes of demographic support in its South Coast Planning Unit, which encompasses most of southwest Washington. The results of the federal Reanalysis Team's report (Holthausen et al. 1994) were again important in this decision. The federal Northern Spotted Owl Recovery Team (USDI 1992) identified nonfederal lands as important for supporting several clusters of spotted owls that would provide a demographic link between the Cascades and the Olympic Peninsula. In analyzing the Recovery Team's proposal, the Reanalysis Team found that the development of 370,000 acres of high-quality habitat in southwest Washington would not make a measurable difference in the stability of the Olympic Peninsula population, given that the population was already nearly stable. DNR manages approximately 239,000 acres of forest land in the South Coast planning unit, so even if the agency dedicated 100 percent of its acreage to NRF, the Reanalysis Team's report indicates that this contribution would not play an important role in the long-term persistence of spotted owls on the Olympic Peninsula as hypothesized by the Recovery Team.

MAINTENANCE OF SPECIES DISTRIBUTION

Maintaining the distribution of the spotted owl population throughout the range of ecological conditions and geographic locations in which the spotted owl has historically resided is important to conservation of the species because it reduces the risk of widespread extirpation (USDI 1992). The Northern Spotted Owl Recovery Team (USDI 1992) cited four ways in which a well-distributed population reduces the risk of extirpation. The first is that any substantial reduction in the range would lower the number of local populations contributing to the whole population (the metapopulation). The fewer local populations, the higher the chance that large portions of the metapopulation could become extinct, and thus the higher chances that the entire population could become extinct. Second, range reduction reduces the kinds of environments (i.e., forest types) that the spotted owl inhabits, thus subjecting the population to extirpation from random environmental events such as rapid change in climatic conditions or catastrophic loss of habitat from fires, insects, disease, or volcanic eruption. With a well-distributed population, it is unlikely that the entire population would be lost to a small number of such random environmental events. Third, the elevational and geographic fringes of a species' range are often where a species makes the most rapid adaptations to different environments. Thus losing the population at these fringes could inhibit the spotted owl's evolutionary capabilities. Fourth, the geographical and elevational fringes of the range may prove to be important in the face of climate change. The northern part of the range and higher elevation habitats would be important if climate change produced a warmer regional climate in the Pacific Northwest. If however, climate change produced local cooling pockets in the Pacific Northwest (Smith 1990), lower elevation habitats and the southern portion of the spotted owl's range would become important to the owl's survival as a species. Maintaining species distribution thus requires that clusters of breeding owls are maintained throughout the range of ecological conditions and geographic extent and that connectivity is maintained between sub-populations throughout the range.

DNR's strategy in western Washington contributes to the maintenance of species distribution in two ways. First, most habitat on federal lands is in the mid- to high-elevation zones of spotted owl use. DNR-managed lands occupy more mid- to low-elevation zones. By providing NRF habitat within 2 miles of federal reserves, DNR-managed lands will be providing habitat across a wider elevation gradient than would be present if habitat were maintained only on federal reserves. Second, DNR is providing large blocks of NRF habitat beyond the 2-mile band surrounding federal reserves in two areas that were identified by the Northern Spotted Owl Recovery Team (USDI 1992) as important for maintenance of species distribution. The Siouxon Creek area (in the Columbia Planning Unit) supports spotted owl cluster in under-represented low-elevation habitat. The Columbia River Gorge area south of the Gifford Pinchot National Forest (also in the Columbia Planning Unit) provides an important link between Washington and Oregon spotted owl populations.

The federal Reanalysis Team (Holthausen et al. 1994) recognized that maintaining and developing habitat in southwest Washington could have significant effects on maintaining species distribution, though they did not analyze this aspect. Given that southwest Washington constitutes a large geographical region within the historic range of the spotted owl, it is important for the reasons described above. However, without commitment on the part of surrounding private landowners to develop and maintain NRF habitat, it is not practical for DNR alone, given its trust responsibilities, to develop enough habitat to support large clusters of spotted owl sites.

Some positive benefit to the spotted owl may occur incidentally as a result of the riparian and marbled murrelet conservation strategies in this area.

DISPERSAL

The spotted owl population is comprised of semi-isolated sub-populations or local populations that are connected through dispersing juveniles and, possibly, non-territorial single owls. (See Section A of Chapter III on the spotted owl.) The maintenance of the whole population is dependent on successful movement of owls from sub-populations that are stable or increasing in size to sub-populations that are decreasing in size or to areas where a small sub-population may have been extirpated (USDI 1992). Interaction among clusters of spotted owls also ensures genetic integrity of the population. Dispersal is facilitated by managing forests that provide adequate food and cover for juveniles as they travel between their natal area and suitable, unoccupied habitat (Thomas et al. 1990). Because juvenile spotted owls disperse in random directions (Miller 1989), the conditions that allow for successful dispersal need to be present across large landscapes rather than restricted to selected corridors (Thomas et al. 1990). DNR's strategy includes providing dispersal habitat in areas that are crucial for movement of juveniles between spotted owl sub-populations.

DNR designated its managed forest lands for dispersal habitat in areas that were farther than 2 miles from federal reserves in western Washington or farther than 1.8 miles from federal reserves in eastern Washington, but where connectivity between federal reserves is important. In one place, dispersal habitat is designated to provide connectivity between the Yakama Indian Reservation and a federal reserve.

Current Habitat and Projected Habitat Growth in Nesting, Roosting, and Foraging and Dispersal Management Areas

Designated NRF areas under the HCP encompass approximately 202,000 acres of DNR-managed lands. Designated dispersal habitat areas encompass approximately 200,000 acres. A summary of acreages by planning unit is provided in Table IV.4. On the basis of estimates of current habitat and the criteria for deciding how much habitat to maintain in each WAU, the HCP will result in the retention of approximately 102,000 acres of spotted owl NRF habitat within NRF management areas and approximately 100,000 acres of dispersal habitat.

Although age class does not necessarily equate to habitat, age-class distribution has been used as a surrogate for projected habitat growth over the next 100 years in the five west-side planning units as shown in Figures IV.1-IV.5 Forest that are 70 years and older can contain structural elements of spotted owl habitat. Because so many of the forests on DNR-managed lands in the east-side planning units are in uneven-aged stands, it is not possible to use age-class distribution as a surrogate for habitat growth there.

These figures represent the outcome from one possible set of harvest scenarios modeled by DNR. The other HCP strategies were included in the modeling.

Table IV.4: Summaries of current spotted owl habitat conditions by planning unit

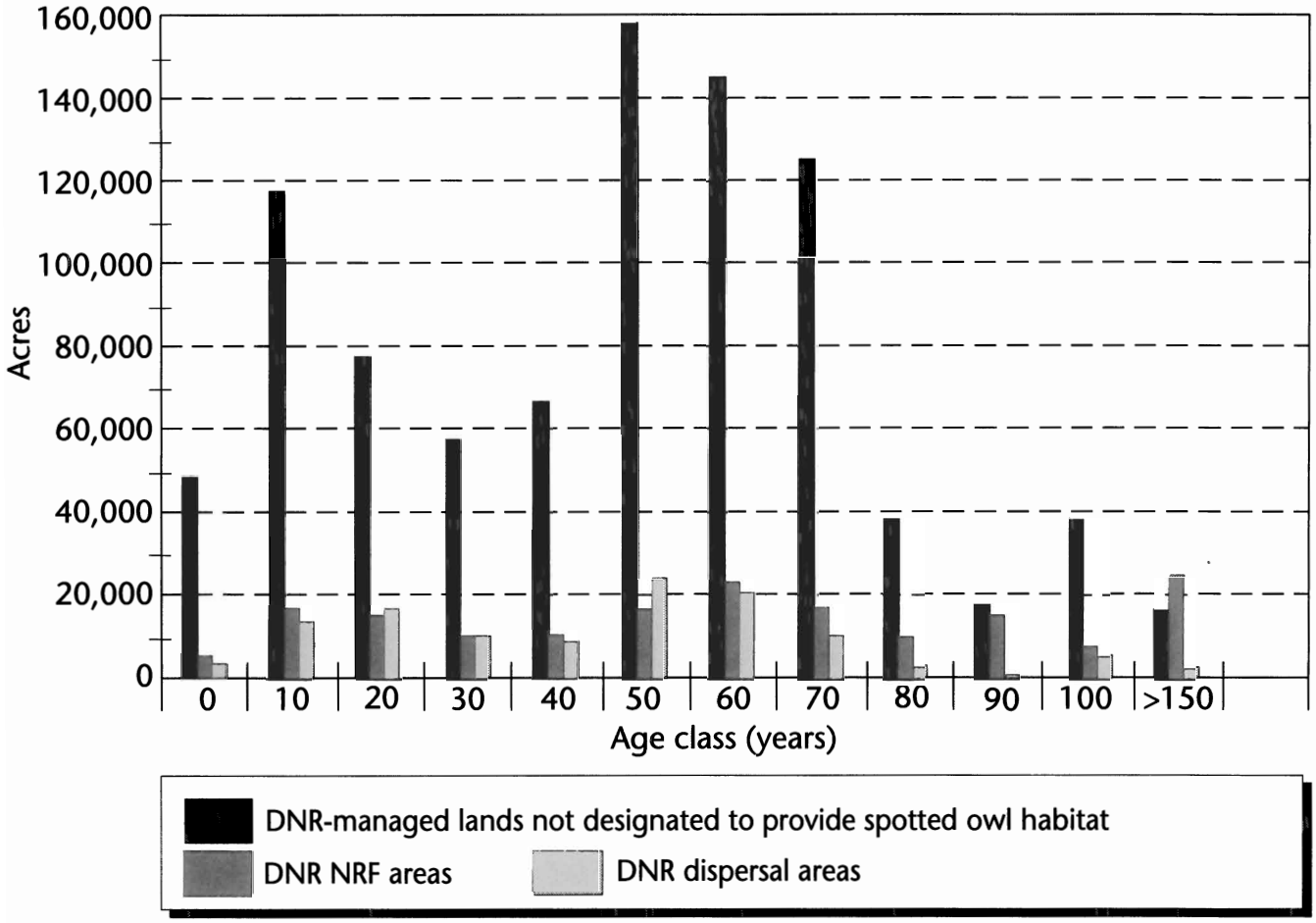
Planning unit	Acres of DNR-designated NRF areas[1]	Percent DNR-designated NRF areas currently in habitat (acres)	Acres of DNR-designated dispersal areas	Percent DNR-designated dispersal areas currently in potential dispersal habitat[2] (acres)
North Puget	107,599	48 (51,494)	22,234	51 (11,515)
South Puget	2,648	58 (1,535)	66,588	55 (56,534)
Columbia	52,996	60 (31,925)	27,029	82 (22,172)
Straits	0	0	0	0
South Coast	0	0	0	0
Chelan	5,647	54 (3,064)	0	0
Yakima	13,567	35 (4,714)	8,332	no data
Klickitat	19,939	58 (11,653)	76,726	no data
Totals	**202,397**	**51 (104,384)**	**200,909**	—

[1] Includes 14,765 acres of Natural Area Preserves (NAP) and Natural Resource Conservation Areas (NRCA). See Chapter I for an explanation of how these lands are treated in the HCP. The North Puget Planning Unit contains 13,108 acres of NAP and NRCA lands in NRF areas.

[2] Potential dispersal habitat was estimated assuming that forest stands that are 40 years old or older would have characteristics of dispersal habitat for western Washington. This estimate does not take into account the spatial arrangement specified in the management standards for dispersal habitat.

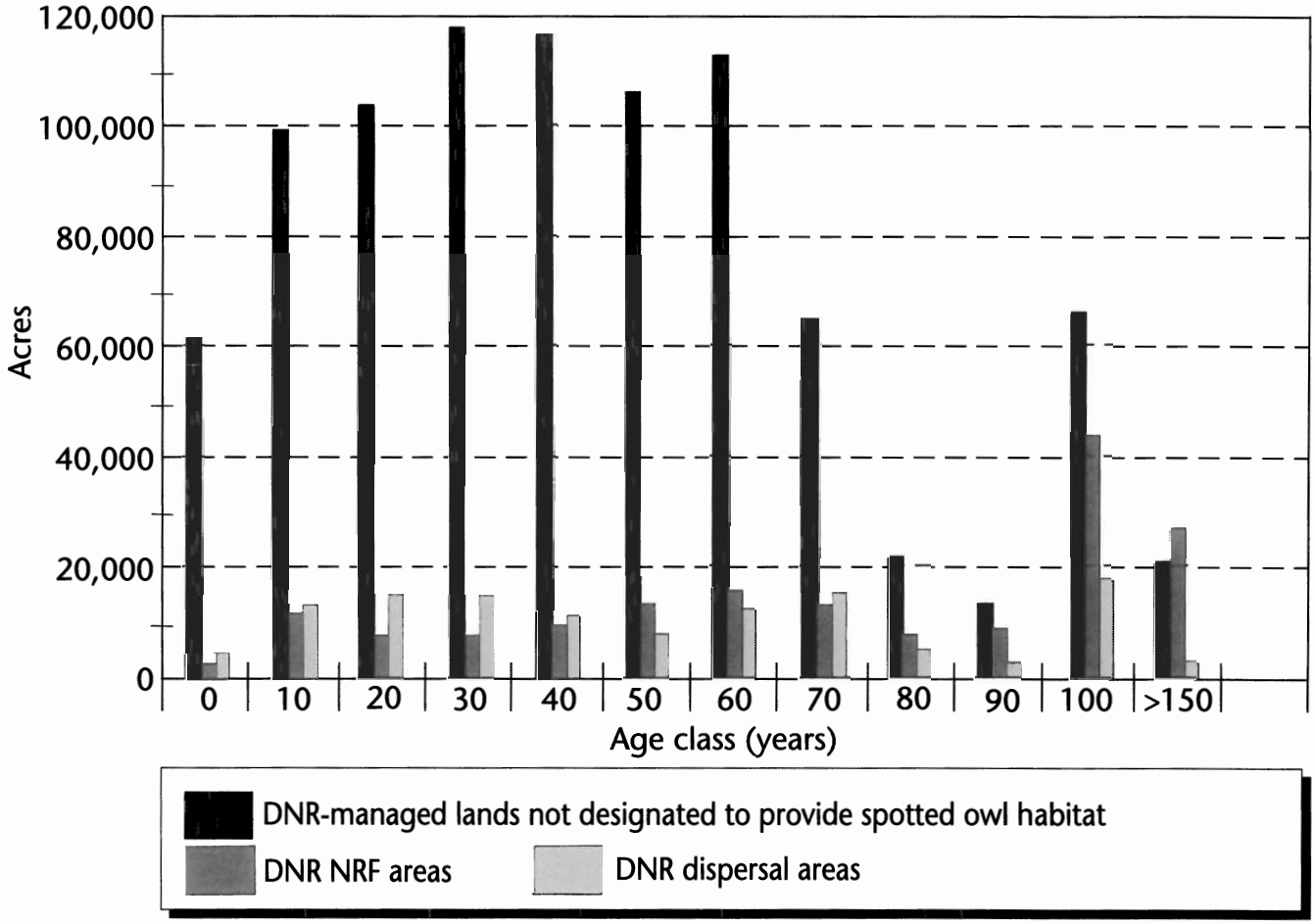
NRF = nesting, roosting, and foraging habitat

Figure IV.1: Age-class distribution in the five west-side planning units in 1996



NRF = nesting, roosting, and foraging

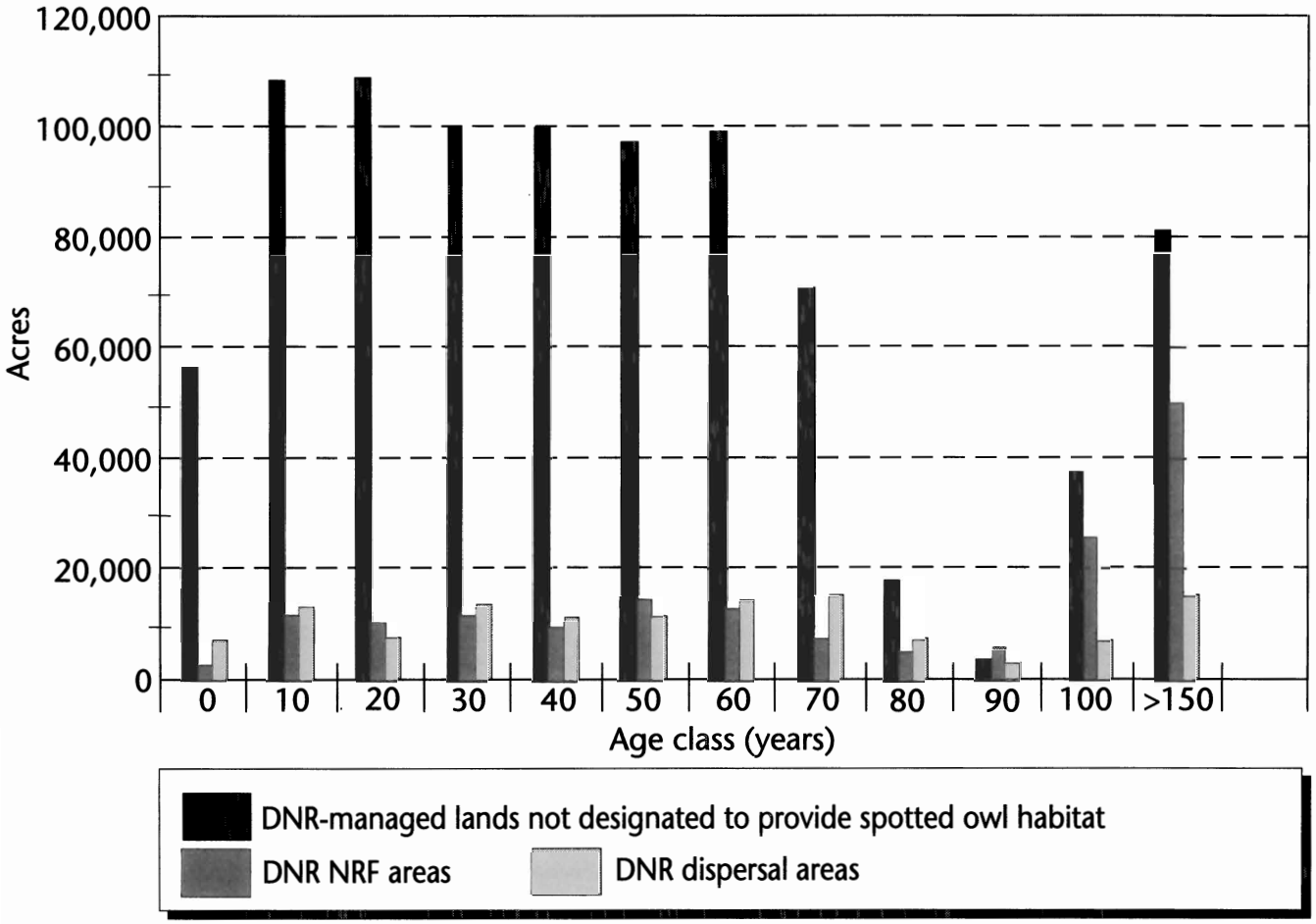
Figure IV.2: Projected age-class distribution in the five west-side planning units in 2046



Note: This represents the outcome from one possible set of harvest scenarios modeled by DNR. The other HCP conservation strategies were included in the modeling.

NRF = nesting, roosting, and foraging habitat

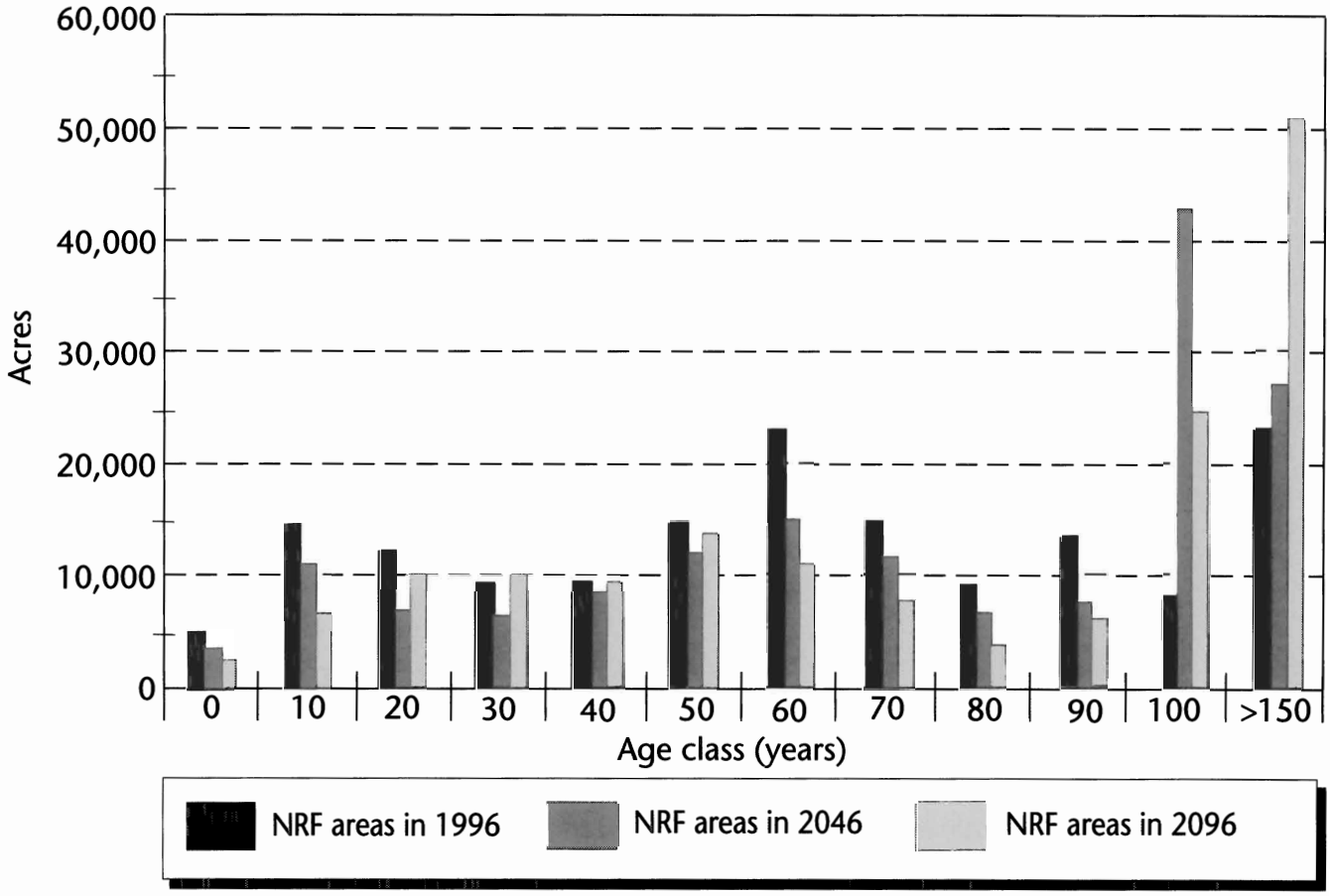
Figure IV.3: Projected age-class distribution in the five west-side planning units in 2096



Note: This represents the outcome from one possible set of harvest scenarios modeled by DNR. The other HCP conservation strategies were included in the modeling.

NRF = nesting, roosting, and foraging habitat

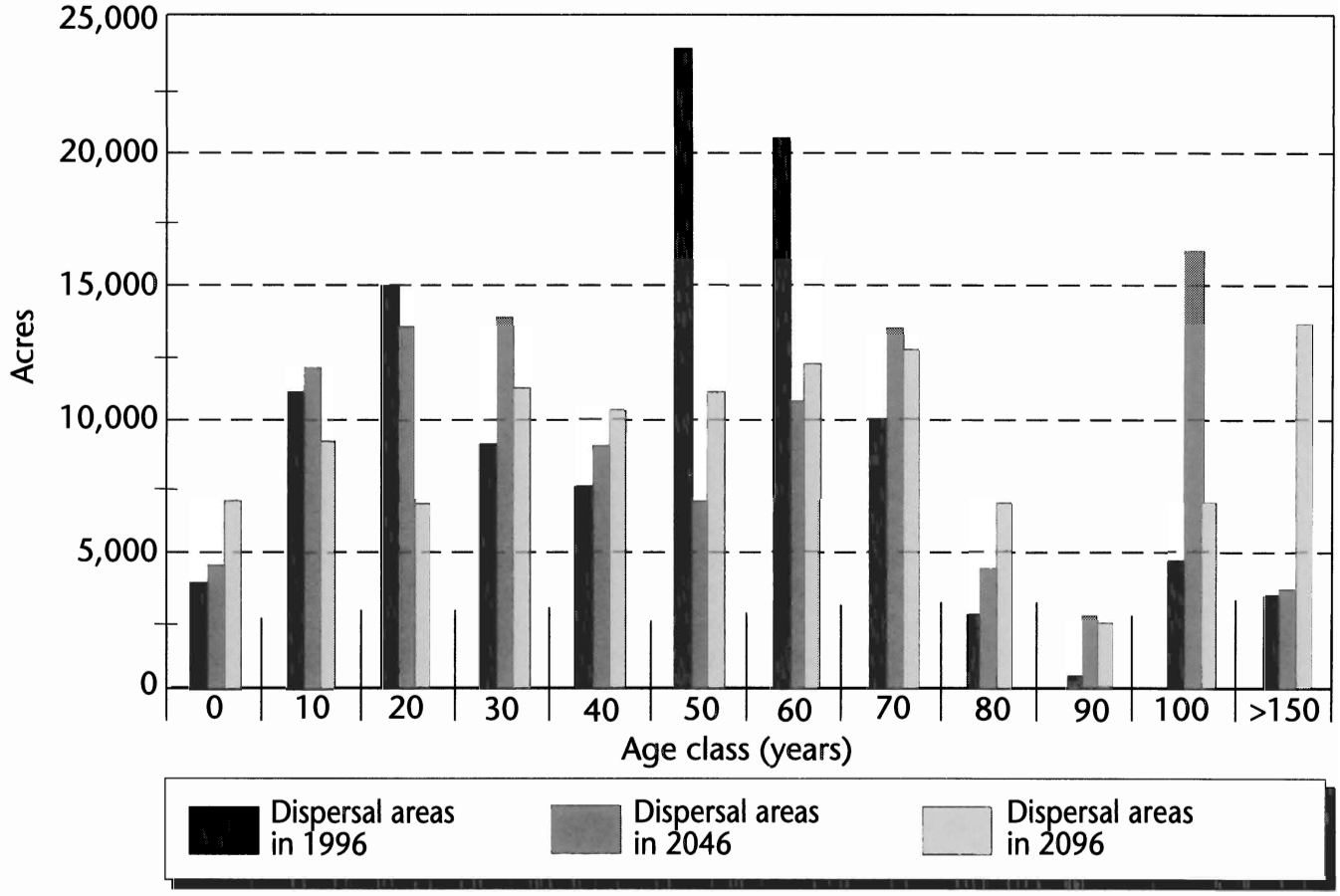
Figure IV.4: Projected age-class distribution in DNR NRF areas in the five west-side planning units from 1996 to 2096



Note: This represents the outcome from one possible set of harvest scenarios modeled by DNR. The other HCP conservation strategies were included in the modeling.

NRF = nesting, roosting, and foraging habitat

Figure IV.5: Projected age-class distribution in DNR dispersal areas in the five west-side planning units from 1996 to 2096



Note: This represents the outcome from one possible set of harvest scenarios modeled by DNR. The other HCP conservation strategies were included in the modeling.

Potential Benefits and Impacts to Spotted Owls

BENEFITS

The primary benefits of the HCP for spotted owls are:

(1) provision of NRF habitat in areas that make a significant contribution to the demographic support of the spotted owl population by supporting the federal reserve system established under the President's Forest Plan;

(2) provision of NRF habitat in areas that make a contribution to maintaining species distribution by maintaining habitat in a broader elevational and geographic range than would be provided by federal reserves alone; and

(3) provision of dispersal habitat in areas that are important for movement of dispersing juveniles between population clusters.

DNR currently manages its lands following the rescinded U.S. Fish Wildlife Service spotted owl take guidelines. Under this approach, DNR and other nonfederal landowners generally harvest suitable spotted owl habitat within regulatory spotted owl circles as long as the overall habitat level remains at or above 40 percent of the area of the circle. The result of this approach is that the amount of habitat available at individual spotted owl sites tends to move toward the 40 percent level with no incentive to develop new habitat in circles that are at or below the 40 percent level. Habitat that is lost due to attrition, natural disturbance or human-caused processes (e.g., loss of habitat functionality from increased fragmentation and edge effects) will not likely be replaced. Furthermore, harvest can occur in suitable, but unoccupied habitat, thus any opportunity for future occupancy by dispersing juvenile spotted owls is lost. Finally, there is no long-term planning at a landscape level that assesses where habitat is needed to support the population. The trend for nonfederal landscapes then is decreasing amounts of habitat and increasing fragmentation of remaining habitat.

This HCP moves away from the above circle-by-circle approach to a landscape-based plan that will provide at least 101,000 acres of NRF habitat in support of large and medium clusters of spotted owls that are located mainly on federal lands. The HCP provides habitat based on landscape condition that takes into account the amount of habitat both in DNR-designated NRF areas and adjacent or nearby federal reserves within any WAU in which DNR-designated NRF areas exist. At least 50 percent of the DNR-managed lands within a NRF area will provide habitat at a spatial scale that also allows spotted owls to use habitat on adjacent or nearby federal lands. In WAUs in which DNR NRF areas currently contain more than 50 percent habitat and federal reserves have less than 50 percent, DNR NRF lands will be maintained at current habitat levels to compensate for the inadequate habitat conditions on federal reserve lands.

In addition to providing demographic support within a median home-range radius of federal reserves, DNR NRF areas in the Siouxon and Columbia Gorge blocks in the Columbia Planning Unit provide large contiguous blocks of habitat that by themselves support medium-size clusters of spotted owl sites. The Siouxon block is important for providing low-elevation habitat in the western Cascades and for providing a potential link between the Oregon and Washington populations across the Columbia River (USDI 1992 p. 120). DNR-designated NRF lands in the Columbia Gorge area also provide an important link between Washington and Oregon spotted owl populations.

Both areas are thus important to maintaining species distribution by providing habitat at broader elevational ranges than on federal reserves alone and by providing habitat in areas where spotted owl clusters are needed to maintain population connectivity.

The third benefit to the spotted owl population from the DNR's HCP is the provision of 100,000 acres of dispersal habitat at any one time in areas where dispersal landscapes are needed for movement of juveniles among federal reserves. DNR management without an HCP makes no explicit provision for dispersal habitat. Landscape patterns that result from timber harvest can thus leave wide gaps between forest stands that provide adequate cover and structure to support dispersing spotted owls.

IMPACTS

There are currently 283 spotted owl site centers in the area covered by the HCP whose regulatory circles include some DNR-managed lands. This does not include the Olympic Experimental State Forest Planning Unit, which is discussed separately in a later section in this chapter. Of these spotted owl site centers, 226 are confirmed territorial pair or single sites[5]. Fifty-one of these territorial sites are located on DNR-managed lands. There are approximately 298,000 acres of DNR-managed lands within the 226 territorial spotted owl circles, 122,000 acres (40.1 percent) of which are estimated to be suitable habitat. Figure IV.6 shows the amounts of habitat on DNR-managed lands that contribute to spotted owl sites in the area covered by the HCP.

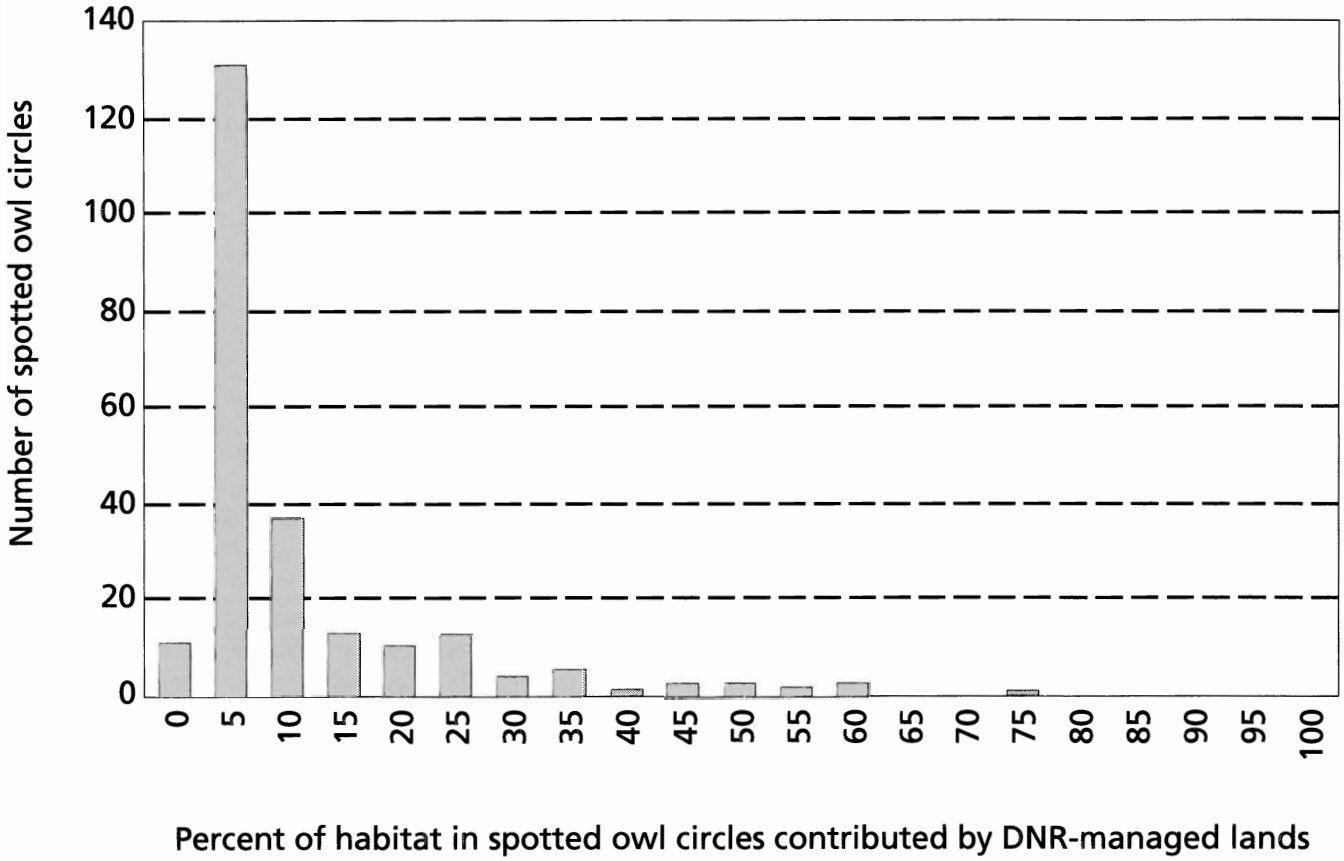
Under the provisions of the HCP, DNR will no longer manage forests specifically for spotted owl habitat in 112 of the 226 territorial spotted owl circles which include DNR-managed lands. These 112 site centers are outside DNR NRF areas. DNR-managed lands contribute habitat that amounts to 1 percent or less of the area of the regulatory spotted owl circle at 24 of these sites. Seventeen of the 112 circles have more than 40 percent of their area in habitat on federal reserves. (For a more specific discussion of impacts to these site centers, see the Draft Environmental Impact Statement that accompanies this HCP.)

Of the total 226 known territorial spotted owl circles that include DNR-managed lands, designated NRF areas will continue to contribute habitat to 114 of them. Currently, DNR-managed lands within NRF areas are contributing 66,400 acres of habitat to territorial spotted owl circles. Under the HCP, DNR-designated NRF areas will have a minimum of 101,000 acres of spotted owl NRF habitat at any one time. There are 54 WAUs in which DNR will be developing a total of 14,100 acres of habitat in designated NRF areas where there is now less than 50 percent NRF habitat. As habitat conditions improve over time on both federal reserve lands and in DNR NRF areas, DNR expects these NRF areas to contribute habitat to new spotted owl territories.

Under the provisions of the HCP, DNR will incidentally provide older forests that may meet some of the habitat needs for spotted owls outside of NRF areas. This older habitat will occur in riparian management areas, in potential marbled murrelet habitat that is deferred from harvest during the interim marbled murrelet strategy, and in forest stands that are protected from harvest because they are occupied by marbled murrelets.

[5]Territorial pair or single sites are designated status 1 (pair or reproductive), status 2 (presence of two adult territorial spotted owls, pair status unconfirmed), or status 3 (territorial single) sites using the terminology employed by the Washington Department of Fish and Wildlife in its spotted owl database. Status 4 sites are those at which a spotted owl has been detected, but occupancy of that site is unconfirmed.

Figure IV.6: Contribution of habitat from DNR-managed lands to known spotted owl circles in the five west-side and all east-side planning units



39 B. MINIMIZATION AND MITIGATION FOR THE MARBLED MURRELET IN THE FIVE WEST-SIDE AND THE OLYMPIC EXPERIMENTAL STATE FOREST PLANNING UNITS

39 Conservation Objective

39 Interim Conservation Strategy

40 Habitat Definitions

42 Possible Components of a Credible Long-term Conservation Strategy

44 Potential Benefits and Impacts to Marbled Murrelets

B. Minimization and Mitigation for the Marbled Murrelet in the Five West-side and the Olympic Experimental State Forest Planning Units

Conservation Objective

DNR's objective is to develop a long-term conservation strategy for the habitat of the marbled murrelet that will provide minimization and mitigation for any incidental take of this species. However, attempts to develop such a strategy at this time were unsuccessful because of lack of knowledge about the bird's habitat needs. Instead, this proposal calls for implementation of an interim approach that will lead to a long-term strategy. This approach covers DNR-managed lands in the five west-side planning units and the Olympic Experimental State Forest; the marbled murrelet is not known to inhabit the east-side planning units.

While the amount of scientific information that is available for this species has increased dramatically in recent years, it is still extremely limited. Additionally, no recovery plan for this species has been adopted by the federal government, although a draft proposal has been recently released. A final rule for critical habitat has been published. (See the discussion of these proposals in Chapter II.)

Such factors severely limit a land manager's ability to determine the measures that might best address the marbled murrelet's situation. For example, while it is easy to assume that protection of occupied sites must be a part of any credible long-term strategy, no one knows how to do this with any certainty of success. Consider the following questions:

> Are all occupied sites equally important, or is it possible that murrelets at some sites, such as those below a certain size or farther than some distance from marine waters do not successfully reproduce, making these areas less important to the population?
>
> Once the occupied sites appropriate for protection are identified, exactly what must be done to ensure their longevity? For example, what size protected area is required?
>
> Must a site be a "no entry" area, or can some management activities take place? Must the area be buffered and, if so, how?

Such basic questions remain unanswered for many of the issues that must be considered in a credible long-term strategy. This situation has led DNR to develop an interim approach designed to protect the marbled murrelet on DNR-managed trust lands in the area covered by the HCP while participating in collection of the information needed to develop a long-term conservation strategy.

Interim Conservation Strategy

Step 1. DNR shall identify and defer harvest of any part of a suitable habitat block (see Habitat Definitions below) while conducting Step 2.

Step 2. Within each west-side planning unit and the Olympic Experimental State Forest, DNR shall conduct a two-year habitat relationship study to determine the relative importance, based on murrelet occupancy, of the various habitat types within that particular planning unit.

Step 3. Following completion of the habitat relationship study in each planning unit, marginal habitat types that would be expected to contain a maximum of 5 percent of the occupied sites on DNR-managed lands within each planning unit shall be identified and made available for harvest. However, no know occupied sites will be released; they shall all be protected.

Step 4. In each planning unit, all acreage constituting the higher quality habitat types (i.e., those not identified as available for harvest under Step 3) shall be included in an inventory survey, using Pacific Seabird or other protocol approved by the U.S. Fish and Wildlife Service if available, to locate occupied sites. Outside of Southwest Washington[1], surveyed, unoccupied habitat will be released for harvest if it is not within 0.5 mile of an occupied site and after harvest, at least 50 percent of the suitable marbled murrelet habitat on DNR-managed lands in the WAU would remain. Within Southwest Washington[1], surveyed, unoccupied habitat will **not** be released for harvest unless (a) the long-term plan (see Step 5 below) for the applicable planning units has been completed or, (b) at least 12 months have passed since the initiation of negotiations of the draft long-term plan without completion of those negotiations.

Step 5. After Steps 1-4 are completed for each planning unit, the information obtained during these and other research efforts shall be used to develop a long-term conservation strategy for marbled murrelet habitat on DNR-managed HCP lands within that planning unit. The habitat relationship study, inventory survey, and development of the long-term strategy will occur consecutively within each planning unit - i.e., there will be no time gaps between Steps 2, 3, and 4. Negotiation of the draft long-term conservation strategy for a planning unit will commence with the U.S. Fish and Wildlife Service within 12 months of completion of the inventory surveys for that planning unit. All decisions made in Steps 1-4 above shall be reviewed as part of this process. (For example, it may be that some of the marginal habitat or surveyed unoccupied habitat made available for harvest in Step 3 or Step 4 will be identified as important to protect in the long-term strategy.) Once all individual planning unit plans are complete, a comprehensive review shall be conducted and modifications made if required. DNR will submit its proposal for long-term strategies to the U.S. Fish and Wildlife Service for approval. DNR may convene a multi-agency science team to resolve issues of disagreement over the proposal.

Notes:

(1) While the habitat relationship and inventory surveys described in Steps 1 and 2 above are being conducted, DNR shall participate in cooperative regional research efforts to the extent possible with available funding. Information regarding prioritization of research is included in the federal Draft Recovery Plan (USDI 1995).

(2) Any occupied site identified prior to or during any of the process outlined above shall be protected until the long-term plan is developed and implemented.

[1]For the purposes of the marbled murrelet strategy, Southwest Washington is defined as that portion of the Columbia Planning Unit west of Interstate 5 and that portion of the South Coast Planning Unit that is located south of Highway 8.

Habitat Definitions

For the purposes of DNR's mitigation for the marbled murrelet, terms in italics have special meanings that are defined in this subsection. Suitable marbled murrelet habitat is referred to as a *suitable habitat block*. This

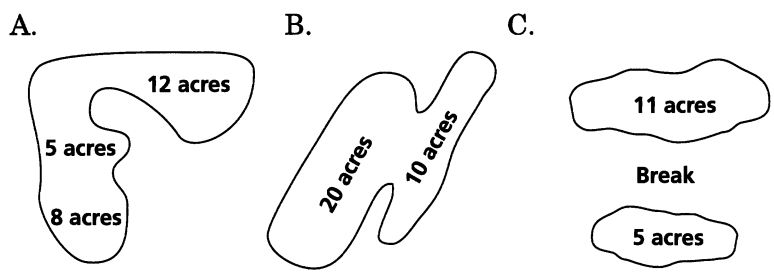
term is used to avoid the word "stand". A single silvicultural "stand" may include areas that do contain the features thought to be important to marbled murrelets as well as areas that do not contain such features. Likewise, a single contiguous area of forest containing structures important to murrelets (i.e., a single suitable habitat block) might consist of all or parts of several silvicultural stands. A suitable habitat block is defined as a *contiguous forested area* meeting all of the following three criteria:

(a) *at least five acres in size* and

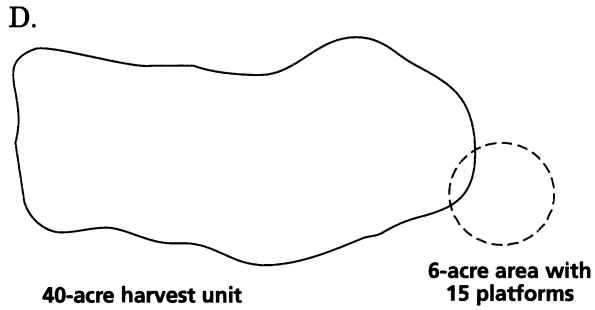
(b) containing an average of *at least two potential nesting platforms* per acre and

(c) *within 50 miles of marine waters.*

Contiguous forested area — Once a 5-acre area whose characteristics meet the other criteria is identified, all adjoining acres that also contain such criteria would be included in the suitable habitat block until there is a 300-foot or wider "break" (an area that does not meet the criteria) that completely encircles the block. Examples: In diagram A, the 5-acre, 8-acre, and 12-acre areas are part of the same suitable habitat block. Likewise, in diagram B, the 10-acre and 20-acre areas are part of the same suitable habitat block. However, in diagram C, the 5-acre and 11-acre areas are two separate suitable habitat blocks because they are separated by a 300-foot or wider break.



At least five acres in size — This refers to the size of the suitable habitat block, not to the area of the silvicultural stand or harvest unit that the block is a part of. For example: In diagram D, a 40-acre harvest unit includes part (2 acres) of a 6-acre area that contains 15 platforms. There is a suitable habitat block here because there is a 5-acre or larger area that has an average of at least two platforms per acre. The 2 acres that are part of the 6-acre area are considered suitable habitat. The point being stressed here is that the entire harvest unit should not be evaluated as a whole and considered non-suitable because it does not contain at least 80 platforms. Rather, any suitable habitat blocks wholly or partially contained in the harvest unit must be recognized and protected, or the sale can be redrawn to omit the suitable habitat block.



At least two potential nesting platforms — Nesting platforms are defined as any large limb or other structure, such as a mistletoe broom, at least 50 feet above ground and at least 7 inches in diameter. Platforms are counted only in conifer trees and only if located within the live crown. When trained staff are counting platforms for the number per acre calculation, all platforms fitting this description should be included. Structures should not be excluded from the count because of some perceived usability/non-usability factor such as orientation of the platform, overhead cover of the platform, etc. This follows the method used in collecting the original data from which the two platforms-per-acre figure was obtained (Hamer et al. 1994).

Within 50 miles of marine waters — Distance should be considered from the Pacific coast, from Puget Sound, or from Rice Island (located in the Columbia River upstream from the Astoria bridge), whichever is closest to the site.

Following the completion of the habitat relationship surveys, the habitat definitions may need revision based on new information.

Possible Components of a Credible Long-term Conservation Strategy

This section describes a possible process for developing the long-term conservation strategy for marbled murrelets. This discussion is based on current information that may be subject to change. Because a long-term strategy for the murrelet's habitat does not have to be undertaken until after the habitat relationship models are developed and additional research is completed, detailed management and protection guidelines do not have to be devised immediately. Instead, this subsection discusses the general factors that would likely be considered in developing the long-term strategy and provides an idea of the kinds of approaches expected to be included.

As reviewed in Section B of Chapter III on marbled murrelet ecology, current research indicates that several primary biological factors influencing marbled murrelet populations should be addressed when developing plans to protect occupied sites. Habitat loss appears to be the major cause of population declines (Ralph et al. 1995; USDI 1995; USDI 1992). Additional incremental losses of nesting habitat due to windthrow, fire, and other natural processes will be a persistent problem, even with the benefits of an HCP. Research also indicates that predation at nest sites may be reducing nest success and adult survivorship (USDI 1995; Beissinger 1995; Nelson and Hamer 1995). Furthermore, disturbances at nest sites during the breeding season are known to reduce reproductive success of other alcids, and marbled murrelet nest success is suspected to be affected by forest management activities during certain stages of the nesting cycle (Cummins et al. 1993; Federal Register v. 57, no. 191, p. 45328).

Marbled murrelets are highly social birds, nest semi-colonially, and probably show a high fidelity to nesting areas (Divoky and Horton 1995). Their ability to colonize new habitat or currently suitable unoccupied habitat has not been determined. Due to their dependence on both forest and marine habitats, catastrophic events occurring in either environment (fire, windthrow, clearcut harvesting, oil spills, El Niño) can have significant negative effects on the population. Therefore, protecting multiple colonies within a reasonable distance of each other in each Watershed Analysis Unit and maintaining a well-dispersed population will help overcome and minimize these effects.

On the basis of these current premises, the primary factors and obstacles that may need to be considered when implementing protection strategies for occupied sites will likely include:

- developing a method for defining the perimeter of the breeding area for each occupied site;
- providing sufficient habitat for breeding areas;
- examining the entire landscape within a planning unit to determine which sites are most in need of protection and to consider landscape-level problems;
- reducing fragmentation of remaining nesting habitat;
- providing interior forest conditions;
- providing buffers to minimize the effects of windthrow and microclimate changes within the habitat, to help increase the amount of interior forest provided, and to reduce the amount of edge which has been associated with certain predator species;
- minimizing disturbance at breeding sites during the nesting season;
- preventing the isolation of breeding colonies and maintaining a well-distributed population; and
- protecting all occupied sites in certain critical planning units that have small populations and little remaining habitat.

The first step in developing a long-term conservation strategy for murrelets will be to assemble a planning team that includes biologists with expertise in the biology and ecology of marbled murrelets, silviculturalists, geographic information system (GIS) specialists, foresters, and planning staff familiar with other components of the HCP. The team will review current literature about marbled murrelets and the survey and research data collected by DNR from each planning unit. The GIS staff will provide maps that depict the size and location of occupied sites on DNR-managed lands and on adjacent ownerships and the location and extent of suitable habitat.

Using this information, the planning team will develop long-term conservation objectives for the protection of occupied sites. These conservation objectives will likely be general in nature but based on current information about the habitat needs of the marbled murrelet. The conservation objectives will likely direct a strategy that will be useful in protecting and maintaining habitat, decreasing the risk of loss of suitable habitat, maintaining or increasing the reproductive success of the marbled murrelet, and increasing adult survivorship. DNR expects to apply the long-term conservation objectives and strategy to each occupied site being protected through site-specific implementation procedures.

Because the long-term conservation objectives and the overall strategy will have already been developed, the site-specific implementation procedures are meant to be relatively easy to prepare. For example, DNR envisions that the implementation procedures for each site could be developed in a few days. A day or two would be spent at the site identifying the current problems, setting future objectives for nesting habitat condition, and outlining the specific silvicultural and forest methods and prescriptions that will be used to achieve the desired objectives. Another two days would be

needed to draft the implementation procedures for that site. With such site-specific procedures, nesting habitat conditions for the marbled murrelets on DNR-managed lands will likely improve over time, minimizing and mitigating any take involved in the HCP and contributing to recovery efforts.

While these site-specific implementation procedures are being developed, the team would also make landscape-level management decisions regarding protection of occupied sites. Preventing the isolation of breeding colonies and maintaining a well-distributed population will entail considering the location of occupied sites on adjacent ownerships. Developing landscape-wide management plans in cooperation with adjacent landowners for each planning unit as outlined in the federal Draft Recovery Plan for the Marbled Murrelet (USDI 1995) will be desirable. An optimal outcome of such plans would be to have occupied sites in each Watershed Analysis Unit. If one occupied site were lost, additional habitat for these birds would be available within a reasonable distance, facilitating replacement and establishment of new colonies as the population grows.

The long-term conservation strategy developed by DNR would likely include information on the location of occupied sites, the distribution of habitat in each planning unit, current research results, landscape-level analysis and considerations, and the site-specific management plans developed by DNR. The long term strategy would address such factors as developing habitat where gaps exist, developing or maintaining replacement habitat, and would protect the vast majority of occupied sites. This process should result in a comprehensive, detailed landscape-level plan that would help meet the recovery objectives of the U.S. Fish and Wildlife Service, contribute to the conservation efforts of the President's Northwest Forest Plan, and make a significant contribution to maintaining and protecting marbled murrelet populations in western Washington over the life of the HCP.

Potential Benefits and Impacts to Marbled Murrelets

The marbled murrelet conservation strategy will result in improved conditions for the murrelet over time. All suitable habitat and occupied sites will be retained in the short term through harvest deferral. Known occupied sites will be protected. Surveys will be conducted of all habitat expected to contain up to 95 percent of the occupied sites. This information and additional research about the murrelet's habitat needs will be used to develop a long-term conservation strategy that will conserve the bird's habitat.

However, some specific adverse impacts may also occur. It is impossible at this time to describe completely the potential impacts, positive or negative, of the long-term strategy that will ultimately result from this short-term strategy. In the interim period, adverse impacts to marbled murrelets might occur in the following circumstances:

- If the habitat definition initially used to determine the deferral of proposed harvest areas fails to capture all occupied sites. However, the definition recommended for use is a very conservative one and should minimize adverse impacts. There will likely be a small impact to the population from not including potential habitat on DNR-managed lands beyond 50 miles from marine waters.

- As a consequence of harvest of marginal habitat, which will be released upon completion of the habitat relationship studies in each planning unit. The most marginal habitat will be available for harvest without further survey, except for known occupied sites,

all of which will be protected. Data from the habitat relationship studies will be used to ensure that no more than 5 percent of the occupied sites in each planning unit would be expected to occur in the areas released for harvest. This should expose much less than 5 percent of the individual birds to adverse impacts because (a) only a portion of the released area would be expected to be harvested prior to the development of the long-term strategy, and (b) DNR assumes that the number of birds using the more marginal sites is proportionally lower than the number using better quality sites.

- As a consequence of harvest of surveyed unoccupied habitat, if that habitat were later determined to be critical to the survival and recovery of the species.

- If, due to survey error, occupied sites go undetected and are not considered for protection.

47 C. MINIMIZATION AND MITIGATION FOR OTHER FEDERALLY LISTED SPECIES IN ALL PLANNING UNITS

47 Oregon Silverspot Butterfly

48 Aleutian Canada Goose

48 Bald Eagle

48 Peregrine Falcon

49 Gray Wolf

51 Grizzly Bear

52 Columbian White-tailed Deer

C. Minimization and Mitigation for Other Federally Listed Species in All Planning Units

In addition to the northern spotted owl and marbled murrelet, seven species listed by the federal government as threatened or endangered occur, or may occur, on DNR-managed lands in the area covered by the HCP. The geographical ranges or habitats of five of these — the Oregon silverspot butterfly, Aleutian Canada goose, gray wolf, grizzly bear, and Columbian white-tailed deer — are peripheral to DNR-managed forest lands, and DNR management will have little effect on the viability of their populations in Washington. The other two federally listed species, the bald eagle and peregrine falcon, occur in or near DNR-managed forests, and adequate conservation of their habitats is expected to result from adhering to DNR policies, state regulations, and the conservation strategies of this HCP. Nevertheless, DNR seeks protection from prosecution for incidental take of these seven federally listed species throughout the entire area covered by the HCP.

Oregon Silverspot Butterfly

Conservation of Oregon silverspot butterflies and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas, wetlands, and upland wildlife habitat, and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policies Nos. 20, 21, 22, and 23 of the Forest Resource Plan, DNR 1992). DNR complies with state Forest Practices Rules, which currently require a SEPA environmental checklist for harvesting, road construction, aerial application of pesticides, or site preparation, within 0.25 mile of an occurrence of an individual Oregon silverspot that has been documented by the Washington Department of Fish and Wildlife (WAC 222-16-080). Under this HCP, all DNR forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources.

In addition, DNR will not harvest timber, construct roads, or apply pesticides within 0.25 mile of an individual occurrence of an Oregon silverspot butterfly, documented by the Washington Department of Fish and Wildlife. In places where DNR believes that effective conservation can be provided in a more efficient way, DNR may present to the the U.S. Fish and Wildlife Service a site-specific management plan that provides adequate protection for the species or habitat occurring at that site. If the the U.S. Fish and Wildlife Service does not approve of the plan, then a multi-agency science team will be convened. The team will evaluate the plan and determine if it is adequate, and if it is not, recommend additional measures that should be taken.

Although this species rarely occurs on DNR-managed lands, DNR seeks protection from prosecution for incidental take of Oregon silverspot butterflies. DNR expects that inadvertent incidental take will be minimal because distribution of the species and its potential habitat is peripheral to DNR-managed forest lands and current and proposed management of DNR-managed lands is generally neutral to beneficial to Oregon silverspot habitat.

Aleutian Canada Goose

The conservation of this species is peripheral to DNR's forest management, but some of the foraging and resting habitats that the Aleutian Canada goose uses during its migration will be protected through the HCP riparian conservation strategy which: (1) commits to no overall net loss of naturally occurring wetland acreage and function, and (2) protects lakes and ponds classified as Types 1, 2, or 3 waters.

Although the Aleutian Canada goose may rarely stop on or near DNR-managed lands, DNR seeks protection from prosecution for incidental take of this species. DNR expects that inadvertent incidental take of Aleutian Canada geese will be minimal.

Bald Eagle

Conservation of bald eagles and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas and upland wildlife habitat and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policy Nos. 20, 22, and 23 of the Forest Resource Plan, DNR 1992) and by compliance with state Forest Practice Rules (WAC 222-16-080) and state wildlife regulations (WAC 232-12-292) to protect nest and communal roost sites. Under this HCP, all DNR forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources. When developing a site-management plan for bald eagle habitat pursuant to WAC 232-12-292 DNR will, where appropriate, consider perch/pilot trees and foraging areas associated with nesting sites, winter roost trees, and winter feeding concentration areas, in addition to protection of nesting trees and the immediate vicinity.

In the west-side planning units, further conservation of bald eagles and their habitat is likely to result from the HCP riparian conservation strategy and the retention of very large old trees as described in the multispecies strategy on uncommon habitats. These measures should increase abundance and distribution of large trees in streamside areas for nesting and roosting and increase abundance and distribution of favorable salmonid habitat for foraging.

DNR expects that inadvertent incidental take of bald eagles will be minimal because DNR shall actively conserve known sites. Nevertheless, DNR seeks protection from prosecution for incidental take of bald eagles.

Peregrine Falcon

Conservation of peregrine falcons and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas and upland wildlife habitat and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policy Nos. 20, 22, and 23 of the Forest Resource Plan, DNR 1992). DNR complies with state Forest Practices Rules, which currently require a SEPA environmental checklist for harvesting, road construction, aerial application of pesticides, or site preparation within 0.5 mile of a known active nest site between March 1 and July 30 or within 0.25 mile of the nest at other times of the year (WAC 222-16-080). Known sites are based on documentation by the Washington Department of Fish and Wildlife. Under this HCP, all DNR

forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources.

In the five west-side planning units and the Olympic Experimental State Forest, additional conservation of peregrine falcons on DNR-managed lands will be provided by the generally improved wildlife habitat that will result from the HCP and Olympic Experimental State Forest riparian conservation strategies and from the site-specific conservation of cliff habitat as described in the multispecies strategy on uncommon habitats. In addition, in east- and west-side planning units and the Olympic Experimental State Forest, DNR shall where practicable:

- review and, where necessary, manage public access to DNR-managed lands within 0.5 mile of a known peregrine falcon aerie;
- conduct field review, by staff knowledgeable of peregrine biology and requirements, of all cliffs in excess of 150 feet, and conduct surveys for peregrine falcon aeries at cliffs judged to have likely potential for use;
- protect ledges on cliffs judged suitable for aeries;
- retain trees along the base and top of cliffs judged suitable for aeries, especially perch trees along the top of cliffs; and
- keep the location of peregrine falcon aeries on DNR-managed lands confidential to the extent permitted by law.

Although peregrine falcons rarely nest near DNR-managed lands, DNR seeks protection from prosecution for incidental take of this species. DNR expects that inadvertent incidental take of peregrine falcons will be minimal because most known peregrine sites and potential habitat are far from DNR-managed lands. Management of DNR-managed lands is generally neutral to peregrine falcon habitat, however, DNR shall actively conserve known sites.

Gray Wolf

The status of the gray wolf within the HCP area is unknown. However, it is likely that even if absent now, wolves will emigrate and reside in this area during the permit period. Biologically, the fate of the wolf is linked to that of its prey, which includes large herbivores such as elk and deer, and smaller mammals such as the snowshoe hare. No "recovery areas" have yet been designated for the gray wolf in the Washington Cascades. DNR will evaluate the amount of habitat for preferred wolf prey species and prioritize areas that have a higher likelihood of providing adequate habitat for the preferred prey species.

Conservation of gray wolves and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas and upland wildlife habitat and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policy Nos. 20, 22, and 23 of the Forest Resource Plan, DNR 1992). DNR complies with state Forest Practices Rules, which currently require a SEPA environmental checklist for harvesting, road construction, or site preparation within 1 mile of a known active den site between March 15 and July 30

or within 0.25 miles of the den at other times of the year (WAC 222-16-080). Known den sites are based on documentation by the Washington Department of Fish and Wildlife. Under this HCP, all DNR forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources.

DNR believes that the combination of riparian and marbled murrelet strategies in western Washington, and the spotted owl strategy and improved road management plan in both western Washington and the eastside planning units will provide support to gray wolves. Additionally, DNR will attempt to avoid or minimize potential impacts to gray wolves by maintaining habitat in a condition that allows wolves and their important prey species to meet their essential biological needs by providing:

- Den site and rendezvous site protection.

- Within 8 miles of a class 1 wolf observation, DNR shall establish a wolf habitat management area on DNR-managed lands. Class 1 observations are confirmed by a biologist and/or photograph, carcass, track, hair, or food cache (Almack et al. 1993).

- DNR, in cooperation with the U.S. Fish and Wildlife Service, shall develop and implement practicable site-specific plans to limit human disturbance within the wolf habitat management area. If the U.S. Fish and Wildlife Service does not approve of the plans, then a multi-agency science team will be convened. The team will evaluate the plans and determine if they are adequate, and if not, recommend additional measures that should be taken to make them adequate.

- Measures to limit disturbance shall remain in effect until five years after the last class 1 wolf observation in the wolf habitat management area.

- Provisions for Prey Habitat Conditions - Habitat management for wolves is primarily directed at habitat for its prey species (USFWS 1984). The most important prey species in the HCP area are deer and elk. The species use edges between cover (older forest) and forage habitats (stand initiation, shrub/sapling, and younger forest). The creation and maintenance of edge habitat through timber harvest activities will provide adequate habitat for wolf prey species.

- Road Management - DNR will attempt to provide more secure conditions for both prey species and wolves. Minimal contact with humans has been cited as the second most important biological necessity for wolf recovery (USFWS 1984). DNR has been involved in cooperative road closures with the Washington Department of Fish and Wildlife and the U.S. Forest Service to restrict vehicular activity to maintain or increase big game security and reduce hunting pressure. DNR will continue to participate in such cooperative activities. Ungulate fawning/calving and wintering areas are areas where wolves are most likely to occur. To the extent practicable, DNR will schedule forest management activities, including road construction and use, to occur at times of the year when wolves are least likely to be present.

The additional conservation measures described in this HCP should benefit the gray wolf because: the generally older forest cover in riparian ecosys-

tems resulting from the riparian conservation strategies will provide increased travel and hiding opportunities for wolves; the generally lower frequency of disturbance in the spotted owl nesting, roosting, and foraging areas, which are adjacent to gray wolf habitat on federal lands along the Cascade Range, will improve the potential of these areas as habitat; and the measures to reduce disturbance in areas of documented gray wolf use will improve the habitat values of these areas.

Although there have been only three observations of gray wolves on DNR-managed lands in the area covered by the HCP (WDFW PHS GIS Database 1989-93), DNR seeks protection from prosecution for incidental take of gray wolves. DNR expects that inadvertent incidental take of this species will be minimal because very few gray wolf occurrences have been recorded on DNR-managed lands in the area covered by the HCP. In addition, current and proposed management of DNR-managed lands is generally neutral to beneficial to gray wolf habitat, and DNR will actively implement conservation measures in areas where wolves occur.

Grizzly Bear

Conservation of grizzly bears and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas and upland wildlife habitat and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policy Nos. 20, 22, and 23 of the Forest Resource Plan, DNR 1992). DNR complies with state Forest Practices Rules, which currently require a SEPA environmental checklist for harvesting, road construction, aerial application of pesticides, or site preparation within 1 mile of a known active den site between October 1 and May 30 or within 0.25 mile of a den at other times of the year (WAC 222-16-080). Known sites are based on documentation by the Washington Department of Fish and Wildlife. Under this HCP, all DNR forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources.

The federal and state wildlife agencies believe that grizzly bears occur, at least occasionally, within the North Cascades Grizzly Bear Recovery Zone (hereafter referred to as the Recovery Zone). The Recovery Zone contains in excess of 6,000,000 acres including approximately 260,000 acres of DNR-managed forest lands. Less than 100,000 acres of the DNR-managed land, representing less than 2 percent of the Recovery Zone, is included within the area covered by the HCP.

The DNR-managed lands covered by the HCP and within the Recovery Zone can be described as occurring in four locations: Skagit Valley, Spada Lake, the west side of the Methow Valley, and a group of separate sections between Wenatchee and Lake Chelan and are surrounded by U.S. Forest Service land. In each of these areas, the DNR-managed lands lie on the periphery of the Recovery Zone between federal ownership and areas of human occupancy and related activity. DNR believes the best use of the lands it manages is to serve as a buffer between the federal ownership, where active recovery efforts are most likely to occur, and the areas of increased public use. DNR believes that this role will be sufficiently supported by the combination of other strategies contained within the HCP.

DNR believes that the combination of riparian and marbled murrelet strategies in western Washington, and the spotted owl strategy and improved road management plan in both western Washington and the east-side planning units will provide support to grizzly bears. In addition, DNR proposes to provide the following site-specific measures:

- Within 10 miles of a class 1 grizzly bear observation, DNR shall establish a grizzly bear habitat management area on DNR-managed lands within the North Cascades Grizzly Bear Recovery Area. Class 1 observations are confirmed by a biologist and/or photograph, carcass, track, hair, dig, or food cache (Almack et al. 1993).

- DNR, in cooperation with the U.S. Fish and Wildlife Service, shall develop and implement practicable site-specific plans to limit human disturbance in the grizzly bear habitat management area.

- Measures to limit disturbance shall remain in effect until five years after the last class 1 grizzly bear observation in the grizzly bear habitat management area.

The additional conservation measures described in this HCP should benefit grizzly bears because: the improved function of riparian ecosystems resulting from the riparian conservation strategies will provide increased foraging, travel, and hiding opportunities for bears; the generally lower frequency of disturbance in the spotted owl nesting, roosting, and foraging areas, which are adjacent to grizzly bear habitat on federal lands along the Cascade Range, will improve the potential of these areas as habitat; and the measures to reduce disturbance in areas of documented grizzly bear use will improve the habitat values of these areas.

Although there has been only one observation of a grizzly bear on DNR-managed lands in the area covered by the HCP (WDFW PHS GIS Database 1990-93), DNR seeks protection from prosecution for incidental take of grizzly bears. DNR expects that inadvertent incidental take of this species will be minimal because only one grizzly bear occurrence has been recorded on DNR-managed lands in the area covered by the HCP. In addition, current and proposed management of DNR-managed lands is generally neutral to beneficial to grizzly bear habitat, and DNR will actively implement conservation measures in areas where grizzlies occur.

Columbian White-tailed Deer

Conservation of Columbian white-tailed deer and their habitat is currently achieved by DNR policies that mandate general protection for riparian areas, wetlands, and upland wildlife habitat and specific commitments to respect state and federal requirements for protection of threatened and endangered species (Policies Nos. 20, 21, 22, and 23 of the Forest Resource Plan, DNR 1992). Although the current range of the Columbian white-tailed deer is peripheral to DNR-managed forest lands, DNR seeks protection from prosecution for incidental take of this species. Under this HCP, all DNR forest management activities in the area covered by the HCP shall comply with state Forest Practices Rules and state wildlife regulations and shall be consistent with the policies set forth by the Board of Natural Resources.

Additional conservation of Columbian white-tailed deer and their habitat on DNR-managed lands will result from the HCP riparian conservation strategy that describes management beneficial for the riparian and tidal forests that are potential habitat for these deer.

DNR expects that inadvertent incidental take of Columbian white-tailed deer will be minimal because:

(a) Columbian white-tailed deer are not currently known to inhabit DNR-managed forest lands.

(b) Current and proposed management of DNR-managed forest lands is generally neutral to beneficial to Columbian white-tailed deer habitat.

(c) DNR-managed forest lands near the range of the Columbian white-tailed deer are currently occupied by black-tailed deer, which are displacing the white-tailed deer through competition in upland sites like those managed by DNR (WDW 1991).

55 D. RIPARIAN CONSERVATION STRATEGY FOR THE FIVE WEST-SIDE PLANNING UNITS

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D. Riparian Conservation Strategy for the Five West-side Planning Units

Under this HCP, riparian conservation strategies shall be implemented in the five west-side planning units and the Olympic Experimental State Forest. The riparian conservation strategy for the Olympic Experimental State Forest is different than that to be implemented in the five west-side planning units because:

(1) in the Olympic Experimental State Forest, the emphasis on research and the systematic application of knowledge gained will likely lead to refinements and revisions in the riparian conservation strategy over time, and

(2) the climatic, geological, and physiographic characteristics of the western Olympic Peninsula present special problems for forest management around riparian areas.

See Section E of this chapter for a description of the Olympic Experimental State Forest riparian conservation strategy.

Neither riparian conservation strategy will be applied in the east-side planning units. But riparian management there will continue to follow state Forest Practices regulations and policies of the Board of Natural Resources.

DNR will continue to participate in watershed analysis according to state Forest Practices Rules (WFPB 1994). If watershed analysis indicates that public resources require a greater level of protection than that specified by the HCP, the prescriptions developed through watershed analysis to provide this additional protection shall be implemented. As of the writing of this HCP watershed analysis does not address wildlife, and one of the objectives of the riparian conservation strategy, as discussed below, is the conservation of riparian obligate wildlife. In order to continue to meet this conservation objective, all components of the strategy shall still apply to DNR-managed lands in Watershed Administrative Units for which watershed analysis has been conducted, unless stated otherwise elsewhere in this HCP.

The U.S. Fish and Wildlife Service and National Marine Fisheries Service are prioritizing watersheds for the conservation of salmon. DNR will consider the results of this prioritization when planning its participation in Watershed Analysis.

This section of Chapter IV will discuss the conservation objectives of the riparian conservation strategy for the five west-side planning units, the conservation components of the strategy, the rationale for the conservation components, and the effects of the strategy on salmonids.

Conservation Objectives

DNR identified two conservation objectives for the riparian conservation strategy for the five-west-side planning units:

(1) to maintain or restore salmonid freshwater habitat on DNR-managed lands, and

(2) to contribute to the conservation of other aquatic and riparian obligate species.

As described in Section D of Chapter III titled Salmonids and the Riparian Ecosystem, salmonid habitat includes the entire riparian ecosystem, and therefore, conservation objective (1) requires maintaining or restoring the riparian ecosystem processes that determine salmonid habitat quality. Also, as described in Section D of Chapter III, hydrological and geomorphological processes originating in upland areas may also affect salmonid habitat. Thus, conservation objective (1) further requires that the adverse effects of upland management activities be minimized. Contributions to the conservation of other aquatic and riparian obligate species, conservation objective (2), will occur indirectly through forest management that maintains or restores salmonid freshwater habitat.

Conservation Components

The riparian conservation strategy for the five west-side planning units defines the riparian management zone and describes future forest management with respect to unstable hillslopes, the road network, hydrologic maturity within the rain-on-snow zone, and wetlands.

RIPARIAN MANAGEMENT ZONE

The riparian management zone consists of an inner riparian buffer and an outer wind buffer where needed. (See Figure IV.7.) The principal function of the riparian buffer is protection of salmonid habitat; the principal function of the wind buffer is protection of the riparian buffer. Harvesting can occur within the buffers as long as management activities support these principal functions and are consistent with the conservation objectives.

Riparian Buffers

A riparian buffer shall be applied to both sides of Types 1, 2, and 3 waters (water types are defined in WAC 222-16-030). The width of the riparian buffer shall be approximately equal to the site potential height of trees in a mature conifer stand or 100 feet, whichever is greater. For the purposes of this HCP, the height shall be derived from standard site index tables (King 1966), using 100 years as the age at breast height of a mature conifer stand. When determining the width of the buffer, the site productivity used in the derivation will be that occurring in upland portions of the riparian ecosystem for that particular site. The site index table used will be that corresponding to the dominant conifer species occurring in the upland portion of riparian ecosystem. As discussed below, this prescription should result in average riparian buffer widths between 150 and 160 feet.

A riparian buffer 100 feet wide shall be applied to both sides of Type 4 waters. Type 4 waters classified after January 1, 1992, are assumed to be correctly classified. Type 4 waters classified prior to January 1, 1992, must either have their classification verified in the field or be assumed to be Type 3 waters. In general, it is currently standard practice for DNR staff to physically examine the classification of streams within a management unit when preparing the unit for a timber sale. If an area has already been classified post 1992 and prior to the effective date of this HCP, it is likely in a management activity area that is probably sold and/or harvested. Therefore, for all practical purposes, stream typing will be examined or verified in the field whether they were typed before or after 1992.

In the field, the width of the riparian buffer shall be measured as the horizontal distance from, and perpendicular to, the outer margin of the 100-year floodplain.

Figure IV.7: The relationship between the riparian ecosystem and DNR's riparian management zone

Thin lines denote the natural zonation of a forest landscape, i.e., the extent of the riparian ecosystem and the zones within the ecosystem. Thick lines denote areas of special forest management, i.e., the riparian management zone and the buffers within it. At most sites, the wind buffer is applied only as needed to the windward side of a stream. (Modified from Sedell et al. 1989)

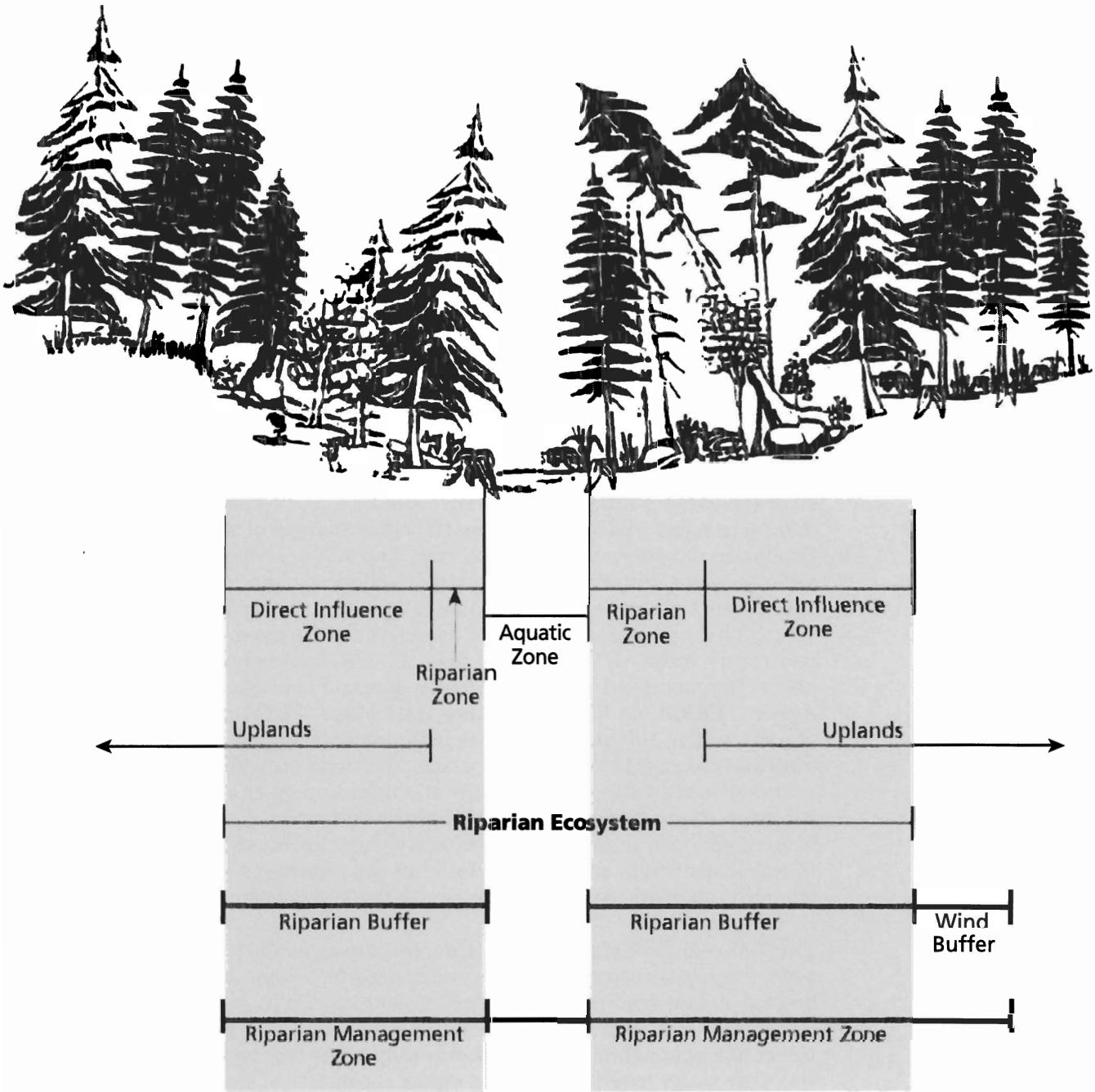


Table IV.5: Expected average widths of interior-core riparian buffers in the Olympic Experimental State Forest

Buffer widths will be determined on a site-specific basis using the proposed 12-step watershed assessment procedure (see text) and might vary locally with landform characteristics. Average widths are not expected to vary significantly, however, because these values are derived from a statistical analysis of buffer protection previously applied to about 55 percent of DNR-managed lands in the OESF. (See text for discussion.) Widths are expressed for each stream type as average horizontal distances measured outward from the 100-year flood-plain on either side of the stream.

Stream type	Width of riparian interior-core buffer (horizontal distances, rounded to the nearest 10 feet)
1	150
2	150
3	100
4	100
5	width necessary to protect identifiable channels and unstable ground (see text)

Average buffer widths are given in Table IV.5 as average horizontal distances measured outward from the outer margin of the 100-year floodplain on either side of the stream. The 100-year floodplain is the valley-bottom area adjoining the stream channel that is constructed by the stream under the present climatic regime and overflowed at times of very high discharge (i.e., flooding associated with storms of a 100-year recurrence interval, (Dunne and Leopold 1987)). One-hundred-year floodplains commonly are delineated by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRM) for each county of a state. The 100-year floodplain includes meandering, braided (i.e., multiple channel braids), and avulsion channels, as well as side channels that transport water from one part of a mainstream channel to another. Avulsion channels are portions of mainstream and side channels that have been abandoned temporarily by lateral displacement of the channel network elsewhere on the floodplain but are expected to be reoccupied when the network migrates back across the valley bottom.

The 100-year floodplain, which often encompasses the channel-migration zone, frequently occupies a several-hundred-foot wide section of the valley bottom on low-gradient, alluvial river systems. On higher-gradient streams in moderate to steep terrain, the 100-year floodplain typically coincides with the active channel margin or extends only a few feet beyond the active (e.g., the high-water mark). The active channel consists of the wetted area and bed or bank surfaces exposed during low flows, as well as portions of the valley bottom nearest the channel that are inundated during typical flood events (i.e. comparable to the two-year recurring flood). Active channel margins commonly are identified in the field by piles of accumulated flood debris, overbank sediment deposits, streamside vegetation altered or damaged by channel flows, bank scour, and the absence of aquatic biota (e.g., algae) normally found in slack-water channels. In the five west-side planning units and the OESF, DNR manages only a few hundred acres on 100-year floodplains of the major river systems. Most floodplain acreage is privately owned or federally managed. FEMA maps indicate that most

100-year floodplains are associated with Type 1 and 2 waters. Collectively, Type 1 and 2 waters represent less than 5 percent of the stream miles on DNR-managed lands. Hence, the impact to DNR management associated with using the 100-year floodplain as the inner margin of riparian management zones is relatively negligible. A method for determining the location of the active channel margin will be described in agency procedures to be developed for this HCP.

If Type 4 and 5 waters without fish become fishbearing upon removal of obstructions, they will be reviewed for proper typing. Type 4 or 5 waters documented to contain fish that are proposed or candidates for federal listing or federal species of concern will be treated as Type 3 waters, if appropriate.

All Type 5 waters that flow through an area with a high risk of mass wasting shall be protected as described in the subsection below titled Unstabled Hillslopes and Mass Wasting. During the first 10 years of this HCP, all other Type 5 waters shall be protected according to Policy No. 20 of the Forest Resource Plan (DNR 1992 p. 35). Under this policy, Type 5 waters are protected "when necessary for water quality, fisheries habitat, stream banks, wildlife, and other important elements of the aquatic system." In addition, during this interim 10-year period, a research program shall be initiated to study the effects of forest management along Type 5 waters located on stable slopes. At the end of the 10 year period, a long-term conservation strategy for forest management along Type 5 waters shall be developed and incorporated into this HCP as part of the adaptive management component.

Type 5 waters classified after January 1, 1992 are assumed to be correctly classified. Type 5 waters classified prior to January 1, 1992, will either have their classification verified in the field or be assumed to be Type 3 waters.

Wind Buffers

An outer wind buffer shall be applied on Types 1, 2, and 3 waters in areas that are prone to windthrow. Physical evidence of windthrow, windthrow models, and the potential for windthrow will guide the placement of wind buffers along riparian buffers. For Types 1 and 2 waters, where there is at least a moderate potential for windthrow, a 100-foot wind buffer shall be placed along the windward side(s). For Type 3 waters wider than 5 feet, where there is at least a moderate potential for windthrow, a 50-foot wind buffer shall be placed along the windward side(s). Where forest stands are subject to strong winds from multiple directions, it may be necessary to put wind buffers along the riparian buffers on both sides of the stream. If no evidence of windthrow exists or models predict a low risk of windthrow, then wind buffers will not be applied. The width and positioning of wind buffers may change as research concerning windthrow in managed forests, especially that conducted in the Olympic Experimental State Forest, finds solutions to the problem of minimizing windthrow. A method for determining on a site-specific basis the placement of the wind buffer will be described in agency procedures to be developed for this HCP.

ACTIVITIES IN THE RIPARIAN MANAGEMENT ZONE

Forest management activities that maintain or restore the quality of salmonid habitat shall be allowed within the riparian management zone. To ensure that this occurs, site-specific forest management activities along all Types 1, 2, 3, and 4 waters shall conform to the following:

(1) No timber harvest shall occur within the first 25 feet (horizontal distance) from the outer margin of the 100-year floodplain. Maintenance of stream bank integrity is the primary function of the

no-harvest area, and therefore, a wider no-harvest area will be established where necessary. DNR anticipates that only ecosystem restoration will occure in this area.

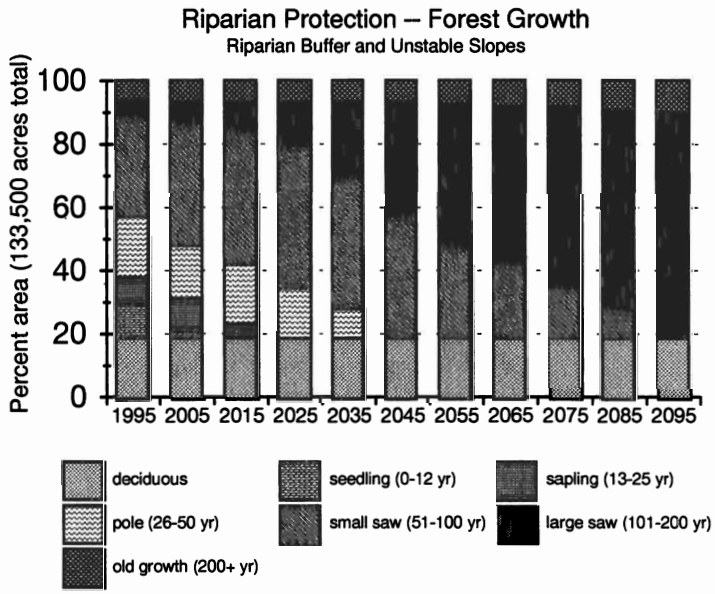
(2) The next 75 feet of the riparian buffer shall be a minimal-harvest area. Activities occurring between 25 and 100 feet (horizontal distance) from the 100-year floodplain must not appreciably reduce stream shading, the ability of the buffer to intercept sediment, or the capacity of the buffer to contribute detrital nutrients and large woody debris. Maintaining natural levels of stream temperature, sediment load, detrital nutrient load, and instream large woody debris is the primary function of the minimal-harvest area, and therefore, a wider minimal-harvest area will be established where necessary. DNR an-ticipates that only two types of silvicultural activities will occur in this area: ecosystem restoration and the selective removal of single trees.

(3) The remaining portion of the riparian buffer (more than 100 feet from the active channel margin) shall be a low-harvest area. DNR anticipates that selective removal of single trees, selective removal of groups of trees, thinning operations, and salvage operations will occur in this area. (See the discussion of salvage operations in the subsection titled Other Management Considerations, in Section A of this chapter on spotted owl mitigation.)

All forest management within riparian management zones will be site-specific, i.e., tailored to the physical and biological conditions at a particular site. All forest management in the riparian buffer shall maintain or restore the quality of salmonid habitat, but because of variation in site conditions, it is anticipated that the intensity of management will vary and that the forest stands which result from management will vary in both composition and structure.

To accommodate the greater flexibility afforded by managing riparian areas on a site-specific basis and the uncertainties surrounding the results of these activities conducted over time, an adaptive-management process will be used to specify management activities within riparian-management areas. Mechanisms used to achieve conservation objectives will vary as new information becomes available.

DNR believes that this strategy will lead, over time, to an age-class distribution within the riparian zones as depicted by the following graph:



Methods for making site-specific, forest-management decisions in the riparian mangement zones and wind buffers will be described in DNR's implementation procedures. These procedures will be developed by DNR and provided to the U.S. Fish and Wildlife Service and National Marine Fisheries Service for their review prior to being implemented. These procedures will, at a minimum:

(a) Describe in detail the conservation objectives.
These objectives will include desired outcomes for such items as maintaining bank stability, water temperature, shade, and natural sedimentation rates; retaining large trees and snags necessary to support viable populations of riparian wildlife and recruit future snags, coarse woody debris (downed logs on land), and large woody debris (in-stream logs); and maintaining the natural capacity of these areas to provide diversity including overstory composition, understory composition, detritus input, and natural pool frequencies.

(b) Define terminology, activities, and prescriptions.
For example, single-tree removal may be defined in terms of distance between removed trees and years between entries and may vary by site. It is expected that additional considerations such as lean of the tree, distance from stream bank, size, soundness, and abundance of other mature conifer would be factors considered during a site-specific analysis. The implementation procedures will provide guidance on how to incorporate those types of considerations. Similarly, the implementation procedures may describe how considerations of the rooting zone may extend the 25-foot no-harvest area on a site-specific basis using canopy diameters or other such indicators. Terms such as restoration, single-tree removal, minimal harvest, low harvest, etc. would be defined for each component of riparian management zones and wind buffers. Prescriptions for placement of yarding corridors and other such activities would also be included.

(c) Detail the monitoring methods to be used in the feedback process for adaptive management designed to ensure riparian-management zones and wind buffers are adequately providing the desired characteristics (e.g., large woody debris, stream stability, water temperature, snag densities, etc.); and

(d) Describe the training to be provided to agency staff.

These procedures will be developed by DNR and presented to the U.S. Fish and Wildlife Service and National Marine Fisheries Service within 12 months of signing the HCP documents. If the U.S. Fish and Wildlife Service and National Marine Fisheries Service do not agree with the procedures developed by DNR, a multi-agency science team will be convened to review the sufficiency of the procedures. Timber harvesting conducted within the riparian management zones and wind buffers prior to agreement on the proposed agency procedures will be subject to the following limitations:

- Within the 25-foot no-harvest area, only commonly accepted restoration activities may occur.

- Within the minimal-harvest area, low-harvest area, and wind buffer, partial harvests may occur that remove no more than 10 percent of the conifer volume and/or 20 percent of the hardwood volume per rotation.

However, if three months have passed since the U.S. Fish and Wildlife Service and National Marine Fisheries Service have received procedures developed by DNR and all three agencies have been unable to reach agreement on their sufficiency, DNR may increase timber harvest within the riparian management zones and wind buffers with the following limits:

(a) Within the 25-foot no-harvest area, only commonly accepted restoration activities may occur.

(b) Within the minimal-harvest area, single-tree or partial harvests may occur that remove up to 10 percent of the volume.

(c) Within the low-harvest area, partial harvests may occur that remove up to 25 percent of the volume.

(d) Within the wind buffer, partial harvests may occur that remove up to 50 percent of the volume.

UNSTABLE HILLSLOPES AND MASS WASTING

Unstable hillslopes will be identified through field reconnaissance or identified with slope geomorphology models (e.g., Shaw and Johnson 1995) and verified through field reconnaissance with qualified staff. If, in the future, timber harvest and related activities can be accomplished without increasing the frequency or severity of slope failure and without severely altering the natural input of large woody debris, sediment, and nutrients to the stream network, then such activity shall be allowed. A method for delineating on a site-specific basis the portions of hillslopes with a high risk of mass wasting will bedescribed in agency procedures to be developed for this HCP. Where slope stability models are less accurate (i.e., Southwest Washington), DNR will also rely on additional information, such as soil type databases.

Harvest operations will at times require that roads pass through areas with a high risk of mass wasting. Roads will be allowed to pass through such areas, but they must be engineered to minimize, to the fullest extent feasible, the risk of mass wasting and be routed through the use of a comprehensive landscape-based road network management process (below).

Road Network Management

On a Watershed Administrative Unit basis, DNR shall minimize adverse impacts to salmonid habitat caused by the road network. With this conservation objective in mind, a comprehensive landscaped-based road network management process shall be developed and instituted. Major components of this process shall include:

- the minimization of active road density;
- a site-specific assessment of alternatives to new road construction (e.g., yarding systems) and the use of such alternatives where practicable and consistent with conservation objectives;
- a base-line inventory of all roads and stream crossings;
- prioritization of roads for decommissioning, upgrading, and maintenance; and
- identification of fish blockages caused by stream crossings and a prioritization of their retrofitting or removal.

Prior to the completion of the landscaped-based road network management process, forest management activities will continue, provided they are consistent with conservation objectives.

BACKGROUND

Impacts from roads have been indicated to be important potential influences on many species of wildlife and fish and their habitats. For example, elk use closed roads as travel corridors (Ward 1976). Also, both elk and deer use of habitat increases with increasing distance from open roads (Lyon and Jensen 1980; Lyon 1979; Perry and Overly 1977).

Grizzly bears generally avoid roads and associated human disturbance, and the Grizzly Bear Recovery Plan recognizes road management as the single most important tool to manage and maintain suitable grizzly habitat (USDI 1993).

Wolf dens and rendezvous sites are often characterized by distance from human activity, and the Rocky Mountain Wolf Recovery Plan states, "Habitat for wolves is an adequate supply of vulnerable prey (ideally in an area with minimal opportunity for exploitation of wolves by humans)" (USDI 1987).

The Washington Department of Fish and Wildlife Draft Bull Trout/Dolly Varden Management and Recovery Plan (WDWF 1992) recommends closing roads permitting public access to spawning areas or access that facilitates poaching. Additional riparian impacts include increased sedimentation from road runoff and increased rates of slope failure caused by improperly constructed or poorly maintained roads (Murphy 1995).

The effects that roads have on the environment are influenced by what happens during the six distinct phases of road development: planning, design, construction, use, maintenance, and abandonment.

The planning phase determines road location across a landscape and has the single most significant impact on road density and road net configuration. In general, road spacing is determined by an economic balance between environmentally sound road transportation costs and environmentally sound yarding costs. At the site level, road spacing is controlled by topography that controls landing locations which are ultimately connected by a road network. Unstable slopes, wetlands, sensitive habitat, and other environmental issues are best addressed at this early stage as the location of a road will likely change very little once the control points are established.

The design phase ensures that a road will be built from one control point to another with sufficient width, usable grades, proper alignment, use of non-erosive surfacing material, adequate water drainage features, and stable cut-and-fill slopes.

Compliance with construction standards ensures that the road is built to the design specifications <u>and</u> ensures that the construction techniques minimize the amount of sediment moving from the road prism. If not carefully controlled, the construction phase can represent a significant percentage of the life cycle contribution of road sediment.

Forest roads are designed to handle traffic at some level of normal operations (road use). Roads are not typically designed to handle excessive loads or high volume traffic during very wet weather or during the thawing cycle associated with cold weather. Uncontrolled traffic can generate the largest percentage of the life cycle contribution of road sediment.

Maintenance operations attempt to keep the road at the designed level of performance. Maintenance primarily deals with keeping drainage structures functional and keeping the running surface usable. Maintenance cannot solve problems associated with a bad location, improper design, poor construction, or misuse.

Abandonment is an alternative to maintenance when the cost of maintaining a road segment is greater than the benefits of keeping the road open and environmentally sound.

DNR'S CURRENT ROAD MANAGEMENT STRATEGY

Current direction for DNR's road construction and maintenance program comes from Forest Practices regulations (WAC-222-24) and the 1992 Forest Resource Plan.

The objectives of DNR's current road management program are to:

(1) minimize further road related degradation of riparian, aquatic, and identified species habitat;

(2) plan, design, construct, use, and maintain a road system that serves DNR's management needs; and

(3) remove unnecessary road segments from the road net.

PLANNING

In general, DNR plans for high lead (800-foot optimum average yarding distance) yarding systems on land with slopes above 40 percent, and ground based systems (1000-foot average yarding distance) below 40 percent. This, together with topography, results in typical road densities between 0.5 to 6.0 miles per square mile.

DESIGN

DNR's design specifications meet or exceed Forest Practices regulations and hydraulic code requirements. Current road design standards call for 100-year flood design levels for water crossing structures, abutments of bridges to be outside the ordinary high water mark of streams, 18-inch minimum cross drain culverts, 12-foot running surfaces with 12-percent adverse and 18-percent favorable grades, and 60-foot minimum curve radius. Backslopes are designed according to soil type and meet or exceed the recommended angles required by Forest Practices regulations. Most Regions require that all roads on land with slopes greater than 40 percent be full bench construction with endhaul of excavated material when slopes exceed 55 percent or when within 100 feet of Type 1, 2 or 3 waters and wetlands. DNR also has minimum requirements for rock hardness and soluble degradation to reduce the amount of surface erosion generated from traffic.

CONSTRUCTION

DNR's road construction specifications meet or exceed the Forest Practices minimums. DNR requires compaction of fills in 2-foot layers, prohibits any woody debris from being incorporated into the fills, and often requires that the subgrade surface be compacted and graded prior to surface application. DNR prohibits construction during inclement weather and generally restricts construction to the dryer summer months.

ROAD USE

DNR currently allows all-season use of roads except for log truck traffic which may be restricted during periods of freeze-thaw cycles. DNR occasionally closes roads in agreement with the Washington Department of Fish and Wildlife for the purpose of game management. DNR also has occasional road closures related to fire control.

MAINTENANCE

DNR road maintenance specifications meet or exceed the Forest Practices minimums. Road maintenance activities focus on four main activities: timber sales, forest management, fire control access, and recreation. All roads are maintained to meet Forest Practices environmental and forest road safety standards. Each type of road has a different driveability standard that is linked to the type of vehicle used for each activity.

ABANDONMENT

When a road segment is determined to be too expensive to maintain, or is no longer needed, it is stabilized and abandoned. DNR is currently building more road per year than it is abandoning. While the number of miles of road per section is getting lower, the need to keep roads open longer coupled with the need to access additional acreage means the road network keeps growing. The need to keep roads open longer is driven by new environmentally sensitive approaches to harvesting, such as partial cutting and staggered settings. These silvicultural techniques dictate the need for multiple entries into a stand over the long term.

DNR'S HCP ROAD MANAGEMENT STRATEGY

In 1994, an analysis of the transportation information contained in the DNR GIS system showed that the average density of roads in the nine HCP planning units ranged from 1.69 to 3.29 miles per square mile although road density varies greatly within each planning unit.

The options available to DNR to reduce the mass wasting and surface erosion impacts to streams primarily focus on the amount and location of problem roads that are currently unnecessary and on how well necessary roads are managed. Road management can best be addressed with improved design, construction compliance, control of use, and maintenance management. Potential problems can best be addressed during a landscape-level planning phase.

DNR will initially focus on improvements in the more sensitive areas of a landscape with priority given to locations on steep slopes with unstable soil and high precipitation, and locations within 100 feet of Type 1, 2, and 3 waters and wetlands.

PLANNING

DNR will ensure that planning processes specifically include the consideration of longer yarding capacity systems whenever faced with placing roads in unstable areas. The alternatives generated during the planning process will be reviewed by an interdisciplinary team of foresters, scientists, and engineers who will evaluate the environmental, silvicultural, public use, and economic benefits and costs of these alternatives, and recommend harvest strategies for these sensitive areas. Alternate locations for new roads will be considered in more sensitive areas where other slope-parallel roads exist. The selection process will emphasize the overall goals of the HCP.

In considering road densities, it is assumed that the current emphasis on small staggered settings with greenup requirements, and partial-cut silvicultural systems designed to achieve environmental objectives will continue. These systems will, by their nature, result in more extensive road systems which will be active for longer periods of time. While expansion is inevitable as new areas are accessed, DNR's goal will be to reduce the additional amount of new roads needed through careful planning and control the overall size of the network by effective abandonment.

DESIGN

(1) In unstable areas, DNR will consider options such as:

(a) road designs by professional engineers;

(b) narrower running surfaces;

(c) less steep cut and fill slopes;

(d) more comprehensive slope revegetation/stabilization systems;

(e) designed slope retaining structures;

(f) larger and more frequent cross drains;

(g) full bench on all roads located on 40 percent or greater side slopes;

(h) endhaul of waste on all sideslopes greater than 55 percent;

(i) subgrade and surfacing matrix enhancers (fabric, lime, concrete);

(j) outsloping where appropriate;

(k) permeable fills to stabilize sub-grades; and

(l) other techniques for road-benching, including sliver-fills, back casting, and multi-benching.

(2) When within 100 feet of Type 1, 2, or 3 waters or wetlands, DNR will consider options such as:

(a) requiring higher quality rock surfacing specifications or the use of surfacing binders such as asphalt or lining sulfonate;

(b) using more comprehensive cut and fill slope revegetation/ stabilization systems;

(c) designing culverts and bridges for debris capacity as well as 100-year flood hydraulic criteria; and

(d) placing sediment traps to avoid delivery of surface erosion into stream crossings, particularly at sites of through-cuts.

CONSTRUCTION

(1) In unstable areas, DNR will consider options such as:

(a) slope stake design and compliance for road construction on 55 percent sideslopes;

(b) performing a thorough compaction of subgrade;

(c) prohibiting woody debris in all fills;

(d) using compact fills on slopes between 40 percent and 55 percent in 6-inch lifts with compacting machines designed for that purpose;

(e) controlling road construction shutdowns using moisture content indicators;

(f) employing controlled blasting, (e.g., pre-splitting) in order to avoid triggering landslides, especially during wet conditions; and

(g) using a backhoe rather than dozer to reduce ground disturbance.

(2) When within 100 feet of Type 1, 2, or 3 waters or wetlands, DNR will consider options such as:

(a) performing a thorough compaction of subgrade;

(b) using filter barriers downslope of construction;

(c) fully diverting flowing waters during culvert installation;

(d) installing silt filter devices at outlets of cross drains;

(e) delaying construction during inclement weather; and

(f) limiting the extent of exposed soils adjacent to a watercourse.

(3) Reconstructing necessary roads on unstable soils will be given high priority.

ROAD USE

(1) In unstable areas, DNR will consider options such as closing roads to log truck traffic during high rainfalls.

(2) When within 100 feet of Type 1, 2, or 3 waters or wetlands, DNR will consider options such as:

(a) closing roads to log truck traffic during high rainfalls;

(b) placing limits on volume hauled per day on marginal road segments;

(c) restricting hauling on some road systems to low pressure tire hauling vehicles (Central Tire Inflation);

(d) closing temporarily inactive road segments with gates; and

(e) installing silt filter devices at outlets of cross drains.

MAINTENANCE

(1) In unstable areas, DNR will consider options such as:

(a) employing road stabilization techniques that reduce the size of the road prism;

(b) stabilizing and armoring cut and fill slopes; and

(c) performing more frequent ditch and drainage structure maintenance.

(2) When within 100 feet of Type 1, 2, or 3 waters or wetlands, DNR will consider options such as:

(a) paving or lignin sulfonate surfacing stabilizers;

(b) performing more frequent ditch and surface maintenance; and

(c) resurfacing projects.

ABANDONMENT

DNR will become more aggressive in abandoning unneeded unstable roads and will increase the level of integrating abandonment of short use spurs in conjunction with timber sale activities.

HYDROLOGIC MATURITY IN THE RAIN-ON-SNOW ZONE

DNR shall minimize the adverse impacts to salmonid habitat caused by rain-on-snow floods. Two-thirds of the DNR-managed forest lands in drainage basins in the significant rain-on-snow zone shall be maintained in forest that is hydrologically mature with respect to rain-on-snow events. This prescription shall be applied to drainage basins that are approximately 1,000 acres or larger in size. A method for delineating the boundaries of drainage basins will be described in agency procedures to be developed for this HCP.

In some 1,000-acre or larger drainage basins there will be little risk of material damage to salmonid habitat during rain-on-snow floods, and in others, because of ownership patterns, DNR's management will not significantly decrease the risk of material damage. Therefore, DNR-managed forest lands need not conform to the basin hydrologic maturity prescription when:

- the basin has less than one-third of its area in the significant rain-on-snow zone; or
- the basin has at least two-thirds of its area in the significant rain-on-snow zone covered by hydrologically mature forests, and there is a reasonable assuraxnce that it will remain in that condition (e.g., forests in National Parks or National Forest Late successional Reserves); or
- the basin has less than one-half of its area in the significant rain-on-snow zone under DNR management, and there is no reasonable assurance that other landowners will contribute hydrologically mature forests (e.g., because land is in mines, farms, or housing developments). In such situations, an interdisciplinary team of scientists will be convened to develop a prescription for DNR-managed land within the drainage basin. Economic considerations will be included in the deliberations.

On the west side of the Cascades, conifer forests reach hydrologic maturity with respect to rain-on-snow events at approximately age 25. For the purposes of this HCP, hydrologically mature is defined as a well-stocked conifer stand at age 25 or older. DNR's geographical information system, which contains information on forest stand ages and tree species composition,

will be used to determine the proportion of DNR-managed forest land in the significant rain-on-snow zone that is hydrologically mature.

The basin hydrologic maturity prescription is intended to be a straight forward way to provide a standard level of protection. In some basins, this will not be the most efficient means available to provide effective protection to salmonid habitat. Therefore, in places where DNR believes that effective protection can be provided in a more efficient way, DNR may use the Hydrologic Change Module of Watershed Analysis to develop drainage basin prescriptions. Once the analysis is complete and any necessary prescriptions are developed, the hydrologic maturity prescription specified in this HCP shall be waived.

In the future, DNR may conduct research to determine the relationship between soils within a drainage basin and adverse impacts to salmonid habitat during rain-on-snow floods. If it can be demonstrated, in a scientifically credible manner, that drainage basins consisting of certain soil types or soil parent materials have a low likelihood of adverse impacts to salmonid habitat during rain-on-snow floods, then such basins will not be required to conform to the basin hydrologic maturity prescription.

WETLANDS PROTECTION

Management activities in and around wetlands shall be consistent with the Forest Resource Plan Policy No. 21 (DNR 1992 p. 36), which states that DNR "will allow no overall net loss of naturally occurring wetland acreage and function." The primary conservation objective of the wetlands protection strategy is to maintain hydrologic function. This will be achieved through:

(1) continuously maintaining a plant canopy that provides a sufficient transpiration surface and established rooting;

(2) maintaining natural water flow (e.g., no channelization of surface or subsurface water flow); and

(3) ensuring stand regeneration.

The primary wetland functions that will be protected are the augmentation of stream flow during low-flow seasons and the attenuation of storm peak flows.

Wetlands to receive protection are those that fit the definition used by the state Forest Practices Rules (WAC 222-16-010). All wetlands 0.25 acre or larger shall be protected by a buffer. The minimum size of wetland to be protected was based on operational feasibility because wetlands smaller than this are difficult to locate. Wetlands that are larger than 1 acre shall have a buffer width approximately equal to the site potential height of trees in a mature conifer stand or 100 feet, whichever is greater. For the purposes of this HCP, the height shall be derived from standard site index tables (King 1966), using 100 years as the age at breast height of a mature conifer stand. Wetlands from 0.25 acre to 1 acre shall have a 100-foot-wide buffer. In the field, the width of the wetlands buffer shall be measured as the horizontal distance from, and perpendicular to, the edge of the wetland. Seeps and wetlands smaller than 0.25 acre will be afforded the same protection as Type 5 waters. That is, such features will be protected where part of an unstable hillslope. Research to study the effects on aquatic resources of forest management in and around seeps and small wetlands will be included in research programs for Type 5 waters.

Timber harvest within the forested portions of forested wetlands and wetland buffer areas shall be designed to maintain and perpetuate a stand that:

(1) is as wind-firm as possible;

(2) has large root systems to maintain the uptake and transpiration of ground water; and

(3) has a minimum basal area of 120 square feet per acre.

No road building shall occur in wetlands or wetland buffers without mitigation. Roads constructed within wetlands or wetland buffers shall require on-site and in-kind equal acreage mitigation in accordance with DNR's wetland policy. The effects of roads on natural surface and subsurface drainage shall be minimized.

Forestry operations in wetlands and wetland buffers shall be in accordance with DNR's policy of no overall net loss of wetland function. Forest management in forested wetlands and in buffers of nonforested wetlands will minimize entries into these areas and utilize practices that minimize disturbance, such as directional felling of timber away from wetlands and using equipment that cause minimal soil disturbance (e.g., tractors with low pressure tires). If ground disturbance caused by forest management activities alters the natural surface or subsurface drainage of a wetland, then restoration of the natural drainage shall be required. Soil compaction and rutting usually preclude the use of ground-based equipment in wetland areas. Salvage operations will be allowed within wetland buffers in areas that are not periodically flooded. (For discussion of salvage operations, see subsection titled Other Management Considerations, in Section A of this chapter on spotted owl mitigation.)

Rationale for the Conservation Components

RIPARIAN MANAGEMENT ZONE

The purpose of the riparian management zone is to maintain or restore the ecological functions in riparian and upland areas that directly influence salmonid freshwater habitat. Riparian management zones consist of a riparian buffer and, where appropriate, a wind buffer. Harvesting can occur, as long as management activities are consistent with the conservation objectives.

Riparian Buffers

The width of the riparian buffer is designed to maintain the functions of riparian ecosystem processes that influence the quality of salmonid freshwater habitat. Water temperature, stream bank integrity, sediment load, detrital nutrient load, and the delivery of large woody debris were the principal considerations used for designing the riparian buffer widths.

Large woody debris was considered especially important in the design of buffer widths because of the fundamental role it plays in aquatic ecosystems. Therefore, the primary design criterion of the riparian management zone was to provide the quantity and quality of instream large woody debris that approximates the quantity and quality provided by unmanaged riparian ecosystems. In a managed forest, the amount of large woody debris delivered to a stream from the direct influence zone is principally a function of buffer width and tree heights within the buffer

(Van Sickle and Gregory 1990; McDade et al. 1990). Therefore, in order to satisfy the primary design criterion, the width of the riparian buffer is based on tree height.

In western Washington, the direct influence zone of unmanaged riparian ecosystems typically consists of old-growth conifer forest. These old-growth conifer forests supply strong, large-diameter, long-lasting large woody debris to aquatic ecosystems. Simple geometry shows that instream large woody debris can originate from sites that are up to one tree height from the stream bank (Van Sickle and Gregory 1990). In fact, tree height is one of the main variables used to describe the spatial extent of the direct influence zone. On sites with moderate productivity (site productivity class III), Douglas fir often attain heights exceeding 200 feet. Thus, in a "typical" unmanaged riparian ecosystem, the direct influence zone may extend beyond 200 feet from the stream, and trees within this zone have a potential to become instream large woody debris.

However, the likelihood of falling into the stream is different for every tree and is related to the tree's distance from the stream — the closer a tree is to a stream, the greater the likelihood that it will end up as a log in that stream. The relationship between distance from stream and a tree's likelihood of becoming instream large woody debris is nonlinear. McDade et al. (1990) showed that in old-growth conifer forests, approximately 80 percent of instream large woody debris originates from distances within half an average tree height. The remaining 20 percent of instream large woody debris originates from distances beyond half an average tree height. In the "typical" unmanaged riparian ecosystem, that portion of the direct influence zone within 100 feet of the stream (approximately half an average tree) is critically important for supplying instream large woody debris. Beyond 100 feet, as the distance from the stream increases, the importance of the direct influence zone for contributing large woody debris decreases.

The primary design criterion of the riparian management zone is to provide the quantity and quality of instream large woody debris that approximates that provided by unmanaged riparian ecosystems. Managing the riparian management zone for a natural mix of hardwood and very large diameter conifer trees should provide the same quality of large woody debris as that found in unmanaged ecosystems. In a managed forest, the quantity of instream large woody is determined by the width of the riparian management zone and the amount of timber removed from the riparian management zone.

The width of an unmanaged riparian ecosystem is approximately equal to the site potential height of trees in an old-growth conifer stand. The width of the riparian buffer along Types 1, 2, and 3 waters is based on the site potential height of trees in a mature conifer stand. A mature forest stand is one in which the annual net rate of growth has peaked (Thomas et al. 1993). In general, conifer stands in the Pacific Northwest reach maturity between ages 80 and 100 years (FEMAT 1993; Spies and Franklin 1991). Conifer stands reach the old-growth stage at about 200 years (Spies and Franklin 1988, 1991). The site potential height of trees in a mature forest stand was selected as the basis for the riparian buffer width because Douglas fir and western hemlock, the principal conifer species in DNR-managed forests, obtain 70 to 80 percent of their old-growth height in the first 100 years of growth. Field measurements (McDade et al. 1990) indicate that buffer widths equal to approximately 60 percent of the average tree height will provide 90 percent of the natural level of instream large woody debris. Extrapolating from these results, a buffer width based on the 100-year site potential tree height, which is more than 60 percent of

the height of old-growth trees, should provide more than 90 percent of the natural level of instream large woody debris.

Because most DNR-managed forests in riparian ecosystems are currently 60 years old or younger, the definition of tree height must take into account future growth. Site index curves are a practical means to predict future growth. Site index curves are nonlinear regressions of tree height versus breast height age for different site productivities (King 1966; Wiley 1978). The average 50-year site index calculated from DNR's geographic information system database is 106 for the five west-side planning units. Site index curves for Douglas fir (King 1966) and western hemlock predict that a site index of 106 yields a potential height of approximately 150 feet at age 100 years for both species. Based on DNR field data from 1991, the average 50-year site index of DNR-managed forests is 113 for the five west-side planning units. Site index curves for Douglas fir (King 1966) and western hemlock predict that a site index of 113 will yield potential heights of approximately 160 feet at age 100 years for both species.

On the least productive sites, i.e., site productivity class V, the potential heights at age 100 years for Douglas fir and western hemlock are predicted to be 86 feet and 102 feet, respectively. On the most productive sites, i.e., site productivity class I, Douglas fir is predicted to reach a total height at age 100 years of 215 feet, and western hemlock is predicted to reach 205 feet. Because the riparian conservation strategy calls for riparian buffer widths equal to the site potential height of conifers at age 100 or 100 feet, whichever is greater, the implementation of this strategy will result in buffer widths ranging from 100 feet to 215 feet, with an average width of approximately 150 feet to 160 feet.

In the five west-side planning units, Types 4 and 5 waters make up approximately 90 percent (by length) of the stream network on DNR-managed forest lands. Low-order streams (i.e., Types 4 and 5 waters) are the major link between hillslopes and higher order fish-bearing streams (FEMAT 1993; MacDonald and Ritland 1989). Low-order streams provide water, sediment, nutrients, and wood to downstream fish habitat (Swanston 1991; Potts and Anderson 1990; Richardson 1992; Conners and Naiman 1984; Bilby and Bisson 1992). Riparian management zones along all Type 4 and some Type 5 waters are intended to maintain the physical and biological processes that form this linkage.

Type 4 waters range from 2 to 10 feet in width, may not contain significant populations of salmonids, and may be perennial or intermittent (WAC 222-16-010). These small streams are significant because of their influence on downstream water quality (WAC 222-16-010). For the maintenance and restoration of salmonid habitat, current thinking is that Type 4 waters warrant less protection than Types 1, 2, and 3 waters. Under this HCP, a 100-foot-wide riparian buffer is applied to both sides of Type 4 waters. Buffer widths of 100 feet are thought to be effective in maintaining water temperature (Beschta et al. 1987), intercepting sediments (Lynch et al. 1985; Moring 1982), and providing detritus (Erman et al. 1977 as discussed in FEMAT 1993). One hundred feet is approximately 50 percent of the site potential height of old-growth (200-year-old) Douglas fir on a site with the average site productivity of DNR-managed forests. As discussed earlier, according to the results of McDade et al. (1990), the source of 80 percent of instream large woody debris lies within a distance equal to 50 percent of average tree height.

Wind Buffers

The stability and longevity of riparian buffers has been an issue of concern (Steinblums et al. 1984; FEMAT 1993). Windthrow may compromise the intended function of the riparian management zone. A single wind storm could raze entire sections of the riparian buffer, or successive high wind events may, over longer periods, slowly degrade the integrity of the riparian ecosystem. Windthrow is vital to riparian ecosystems — a significant proportion of all instream large woody debris (Murphy and Koski 1989, McDade et al. 1990) is blowdown — but the aerodynamics of the abrupt forest edges which commonly occur between riparian buffers and clearcuts cause more frequent catastrophic windthrow events or accelerated rates of blowdown. Gratowski (1956) measured windthrow along the edges of clearcuts in western Oregon. He reported that most windthrow occurred within 200 feet of the edge between forest and clearcut and was concentrated in first 50 feet. Excluding one extreme case of windthrow beyond 200 feet, Gratowski (1956) found that 77 percent of the blowdown occurred within 100 feet of the edge. Also, Gratowski (1956) observed that the amount of blowdown diminished by one-half for each successive 50 feet from the edge. Gratowski's studies took place only two years post-harvest, and therefore, he could not report on the continuing loss of standing live trees over longer periods of time.

The purpose of the wind buffer is to increase the stability and longevity of the riparian buffer, i.e., to maintain its ecological integrity. There are very few publications on the subject of stable wind buffer design (e.g., Steinblums et al. 1984). While the body of scientific knowledge regarding buffer wind stability is growing (Mobbs and Jones 1995; Sherwood 1993; Rot 1993; Harris 1989), it is currently inadequate for designing a long-term conservation strategy. Thomas et al. (1993) proposed a 100-foot-wide buffer to protect riparian buffers along fishbearing streams from wind and fire, and they did not explicitly propose a buffer to protect riparian buffers along non-fishbearing streams. Their proposal was intended to provide protection until a watershed analysis could be completed that would modify these interim buffer widths according to the characteristics of a given site.

The wind buffer specifications of this HCP should be considered interim. The width of the wind buffer may change as research concerning windthrow in managed forests, especially that conducted in the Olympic Experimental Forest State, finds means of minimizing windthrow. Monitoring the success of wind buffers in maintaining the ecological integrity of the riparian buffer will be an important element of this HCP.

ACTIVITIES IN THE RIPARIAN MANAGEMENT ZONE

In the riparian management zone, forest management activites will be site-specific, i.e., tailored to the physical and biological conditions at a particular site. As previously explained, the width of the riparian buffer is based on site-potential tree height, but because of variations in site-specific conditions, the intensity of forest management in the riparian buffer may vary. It is generally recognized that as the distance between management activities and the active channel margin decreases, the potential for adverse impacts to salmonid habitat increases. With this in mind, the no-harvest, minimal-harvest, and low-harvest areas of the riparian buffer were developed to guide management activities.

The no-harvest area is intended to maintain stream bank integrity by (1) eliminating disturbances to fragile stream banks and (2) protecting the vital contribution of tree roots to stream bank integrity. Root strength of conifers is thought to decline greatly at distances greater than a tree crown

radius (FEMAT 1993). Crown radii are mainly a function of stand density and vary widely. Using a simple stand model that assumes maximum stand density, one can show that crown radii of Douglas fir rarely exceed 25 feet. Therefore, within 25 feet of the stream bank, all trees should be retained to achieve the maximum level of soil stabilization provide by root systems.

Buffer widths of 100 feet are thought to be effective in maintaining water temperature (Beschta et al. 1987), intercepting sediment (Lynch et al. 1985; Moring 1982), and providing detritus (Erman et al. 1977 as discussed in FEMAT 1993). The specifications for the minimal-harvest area, which extends to 100 feet from the active channel margin, were based on these research results and recommendations and are intended to maintain natural instream levels of these three key elements of salmonid habitat. The same results and recommendations are the basis for the 100-foot minimum width of the riparian buffer along Type 4 waters.

One hundred feet is approximately 50 percent of the site potential height of old-growth (200-year-old) Douglas fir on a site with the average site productivity of DNR-managed forests. According to the results of McDade et al. (1990), the source of approximately 80 percent of instream large woody debris lies within a distance equal to 50 percent of average tree height. Based on these research results, forest management in the minimal-harvest area should retain most, and at some sites all, of the standing trees (dead or live) to serve as a source of large woody debris.

DNR anticipates that only two types of activities will occur in the minimal-harvest area: ecosystem restoration and selective removal of single trees. The principal conservation objectives of riparian ecosystem restoration will be to achieve a more natural mix of hardwood and conifer species and to enhance the development of old conifer forests. One means of addressing this objective may be to accelerate forest succession through the selective removal of hardwoods (e.g., red alder) and the replanting of conifer species. Another means may be to accelerate tree growth through precommercial or commercial thinning.

The low-harvest area of the riparian buffer (i.e., beyond 100 feet from the active channel margin) is important for contributing large woody debris, intercepting sediment on steep slopes (Broderson 1973), and in some places, maintaining natural levels of stream shading (Steinblums et al. 1984). A process will be developed for assessing site-specific conditions and determining the silvicultural activities that may occur that meet the conservation objective "to maintain or restore the quality of salmonid habitat." For the leeward side of streams where there is no wind buffer, the low-harvest area must serve the additional function of maintaining forest health. Clearcuts change the microclimate of adjacent forest stands (Chen et al. 1995). These changes may exert a physiological stress on trees that may result in their increased susceptibility to pests and diseases. To maintain the ecological integrity of the riparian ecosystem, the low-harvest area will be managed to mitigate microclimatic changes in the minimal- and no-harvest areas.

Yarding through the riparian management zone creates a break in the vegetation and disturbs stream banks. This could lead to short-term increases in water temperature and sediment. However, road construction results in long-term increases in water temperature, sediment, and alteration of basin hydrology. Therefore, in general, yarding logs through riparian areas is less damaging to aquatic resources than new road construction.

UNSTABLE HILLSLOPES AND ROADS

A clearcut on an unstable slope increases the likelihood of landslides (Swanson and Dyrness 1975; Swanson et al. 1987). Landslides resulting from timber harvest are considered a significant source of sediment input into streams (Wu and Swanston 1980; Chesney 1982; Everest et al. 1987; Sidle 1985). In the Pacific Northwest, roads appear to cause more landslides than does clearcutting; however, this pattern varies substantially among areas (Sidle et al. 1985) and seems to be highly dependent on watershed characteristics (Duncan and Ward 1985).

Typically, landsliding occurs where soil pore water pressure increases to a degree that the friction between soil particles is inadequate to bind them together and the soil consequently slides downslope under the force of gravity. Timber harvest affects the local soil pore water pressure in at least two ways until the new trees reach hydrologic maturity. First, transpiration decreases following tree removal. Decreased transpiration increases soil moisture, thus increasing the risk of slope failure. Second, because the forest canopy intercepts precipitation, the amount of precipitation reaching the forest floor per unit time increases after harvest, and this too causes an increase in soil moisture. Also, tree harvest ultimately results in the decay of tree roots. Living tree roots add strength to the soil, but as roots of harvested trees decay, this strength is lost, and the likelihood of landsliding increases until new root systems are established.

Roads in upland areas have significant detrimental impacts on salmonid habitat. Only rarely can roads be built that have no negative effects on streams (Furniss et al. 1991). Roads are a major source of management-related sedimentation in streams (Cederholm and Reid 1987). The contribution of sediment per unit area from roads is often greater than that from all land management activities combined (Furniss et al. 1991). In northern coastal California, haul roads and tractor skids were found to alter the drainage network and sediment yield of water basins (Swanson et al. 1987). Cederholm et al. (1981) reported a significant positive correlation between fine sediment in spawning gravels and the percentage of basin area with roads. Forest roads can increase the incidence of mass soil movements (i.e., landslides) by 30 to 300 times as compared to undisturbed forests (Furniss et al. 1991).

HYDROLOGIC MATURITY IN THE RAIN-ON-SNOW ZONE

The strategy for managing the amount of hydrologically mature forest is intended to prevent damage to salmonid habitat during peak flows associated with rain-on-snow events. (See Section C of Chapter III titled Salmonids and the Riparian Ecosystem.) The strategy follows the principles used to develop the 1991 emergency state Forest Practices rule on rain on snow.

A subbasin in western Washington that is completely within the significant rain-on-snow zone is estimated to yield an additional inch of water during a 10-year 24-hour rain-on-snow event if one-third of the subbasin is in a hydrologically immature condition. The implicit assumption used to develop WAC 222-16-046 is that peak flows caused by the addition of more than 1 inch of water to the amount accumulated in a 10-year 24-hour storm, i.e., a storm of moderate intensity, present an unacceptable level of risk to public resources.

The appropriate size of the drainage basin for the hydrologically mature forest prescription was based on guidelines in the hydrology module of watershed analysis (WFPB 1994) and their current application by hydrologic analysts. In watershed analysis, increases of peak flow greater than

10 percent may adversely affects public resources. Also, it is generally recognized that the precision of flow measurements is on the order of 10 cubic feet per second. Therefore, 100 cubic feet per second (a 10 percent change of 100 cubic feet per second equals 10 cubic feet per second) seems to be a reasonable level of peak flow from which to derive the appropriate drainage basin size. Bankfull discharge is a geomorphologically effective discharge that causes long-term channel erosion and sediment transport (especially bedload movement). A regression equation relating bankfull discharge to drainage basin area for the Puget Lowland and western Cascades (Frederick and Pitlick 1975, and Parson 1976 as discussed in Dunne and Leopold 1978 p. 616-617) shows that approximately 100 cubic feet per second of bankfull flow can be generated by a drainage basin having an area of approximately 1,220 acres.

In addition, a poll of watershed analysis reports shows that most hydrologic analysis units (defined through the watershed analysis process to calculate peak flows) are greater than 900 acres. In a few instances, the hydrologic analysis units are as small as 350 acres, but these are fragment areas between basins of significant creeks. Most hydrologic analysts involved in watershed analysis delineate hydrologic analysis units that are 1,000 acres or more.

In some 1,000-acre or larger drainage basins there will be little risk of material damage to salmonid habitat during rain-on-snow floods. For example, as discussed previously, in basins with less than one-third of the area in the significant rain-on-snow zone, the estimated additional yield caused by rain-on-snow during a 10-year 24-hour storm is less than 1 inch. For similar reasons, in basins with at least two-thirds of the area in the significant rain-on-snow zone covered by hydrologically mature forests that are reasonably assured of remaining in that condition (e.g., forests in National Parks or National Forest Late successional Reserves), there is little risk of material damage to salmonid habitat. In some basins, because of ownership patterns, DNR's management will not significantly decrease the risk of material damage. Consider a basin with exactly half of its area in the significant rain-on-snow zone under DNR management. If other landowners did not manage for hydrologically mature forest and DNR maintained two-thirds of its forest lands in a hydrologically mature condition, then only one-third of the area in the significant rain-on-snow zone would be hydrologically mature forest. During a 10-year 24-hour rain-on-snow event, the estimated additional yield of water due to the hydrologically immature area would be 2 inches. DNR management in this case would not significantly decrease the risk of material damage because a 2 inch additional yield would likely cause material damage to salmonid habitat.

WETLANDS PROTECTION

In many watersheds, wetlands have a profound influence on hydrology and water quality. The conservation strategy for wetlands is intended to maintain the wetland functions of moderating stream flows and enhancing water quality.

Through the process of evapotranspiration, plants move water from the ground to the atmosphere. Evapotranspiration affects water table and soil moisture levels, and consequently timber harvest in and around a wetland can affect the hydrologic regime of the wetland. The principal organs of evapotranspiration are leaves, and a minimum leaf area per acre is necessary to maintain the hydrologic regime of a forested wetland. Leaf area is measured by leaf area index, and a leaf area index of 30 should maintain at

least 95 percent of the potential evapotranspiration in a forest stand (U.S. Environmental Protection Agency 1980). Through an allometric relationship, stand basal area may be used as a surrogate for leaf area index (USEPA 1980). A basal area of 120 square feet per acre corresponds to a leaf area index of 30 (USEPA 1980).

Because of the wet soils and shallow tree rooting typical of forested wetlands, trees in such areas are more susceptible to windthrow. The harvest of trees from areas in and around wetlands often results in even wetter soils and a consequent increase in the potential for windthrow. Furthermore, after harvest, the lower stem density of the residual stand provides less shelter from strong winds. The cumulative effects of harvest on the hydrologic regime of the wetland continue through time as trees are lost through windthrow. Therefore, it is important that trees left after harvest be among the most wind-firm in the forest stand.

Effects of the Riparian Conservation Strategy on Salmonid Habitat

Many factors, both human-caused (fisheries management, hydropower dams, agriculture, and municipal development) and natural (El Niño), affect salmonid populations, and these are beyond the control of DNR. The role that DNR, or any forest manager, has in the fate of a particular salmonid population is difficult to gauge, but the effects that a forest manager has on the quality of salmonid freshwater habitat can be shown. Therefore, salmonid freshwater habitat will be used as a proxy to evaluate the effects of the riparian conservation strategy on salmonids.

The forest management described in the riparian conservation strategy will result in improved salmonid habitat on DNR-managed lands. The improvement will occur as:

(1) deciduous and young conifer forests within riparian ecosystems develop into older conifer forests;

(2) young forests on unstable hillslopes develop greater root strength and reach full hydrologic maturity; and

(3) the adverse impacts of roads are reduced through comprehensive landscape-based road network management.

Prescriptions for the significant rain-on-snow zone and wetlands should minimize the potential adverse impacts of forest management on winter peak-flows and summer low-flows.

At present, 49 percent of forests in riparian buffers of the riparian management zone are even-aged conifer forest younger than 60 years old, 25 percent are deciduous forest, and 26 percent are conifer forest older than 60 years. Much of the riparian deciduous forest on DNR-managed lands developed naturally following timber harvesting. Therefore, as a result of forest management, more than half of the riparian ecosystems on DNR-managed lands do not contain the large conifer trees essential for providing instream large woody debris, which is one of the most important elements of salmonid habitat. Also, in some harvest units, the current riparian management zones along Types 3 and 4 waters may not be adequate to maintain stream bank integrity and natural levels of stream shading, sediment load, and detrital nutrient load.

Under this HCP, the riparian buffer will be managed to maintain or restore salmonid habitat. Given this conservation objective, the no-harvest and minimal-harvest areas of the buffer are anticipated to develop into forest with old-growth characteristics, i.e., large old trees, multilayered canopy, and numerous snags and logs. The low-harvest area will be managed according to the same conservation objective, but its distance from water may permit more harvest, and therefore it is anticipated that in most instances the low-harvest area will eventually have a range of uneven-aged mature forest characteristics. The low-harvest area is intended to provide some large woody debris to the aquatic and riparian zones, and therefore, large trees will be retained for this purpose. The width of the riparian buffer and the management within it should be adequate to maintain stream bank integrity and natural levels of stream shading, sediment load, and detrital nutrient load.

At present, DNR has no standard practices for the protection of riparian management zones from windthrow. Under the HCP, the ecological integrity of the riparian buffer, and the salmonid habitat contained therein, will be protected by wind buffers. Management within the wind buffers will be largely experimental, and therefore, the forest conditions within the wind buffer cannot be accurately predicted.

Unstable hillslopes are estimated to occupy an additional 5 to 10 percent of DNR-managed lands outside the riparian management zone. At present, 30 percent of these areas are in even-aged conifer forests younger than 40 years old, 13 percent are in deciduous forest, and 47 percent are in older conifer forest. Under this HCP, harvest in these areas and other areas identified as having a high risk of mass wasting will be deferred until it can be demonstrated that such activity can be accomplished without increasing the frequency or severity of slope failure. As the forests in these areas develop, the frequency of mass-wasting events on DNR-managed lands should decrease.

Roads have been proven to cause significant adverse impacts to salmonid habitat. Under this HCP, the road network will improve, but improvements are anticipated to occur gradually because of the tremendous costs. DNR has already begun a shift toward more ecologically sensitive road management, and the incorporation of road network management into the riparian conservation strategy demonstrates DNR's commitment to a continual improvement of the road network.

Road network management will be at a landscape level. Road inventories, routing, cumulative effects analysis, and the prioritization of construction, maintenance, and decommissioning will consider an entire landscape. Road network management will consider multiple-use objectives and constraints, identify road uses and users, establish a long-term planning horizon, and maintain a timeline for each road, from construction to periodic maintenance and eventual decommissioning.

The riparian conservation strategy should result in high quality salmonid habitat in the fishbearing waters on DNR-managed lands. Nevertheless, during the term of this HCP, adverse impacts to salmonid habitat will continue to occur because past forest practices have left a legacy of degraded riparian ecosystems, deforested unstable hillslopes, and a poorly planned and maintained road network. The frequency and severity of these adverse impacts will decrease as forests develop and the road network improves. The riparian conservation strategy, which includes active restoration of some riparian ecosystems and improvements to the road network, will serve to minimize and mitigate the adverse impacts of past management.

Forest management entails a myriad of activities, and many of these can have an adverse impact on salmonid habitat. Timber harvesting, road building, road use, site preparation, herbicide application, mineral extraction, power line rights-of-way, fire control, and other lawful forest management activities will continue to occur and may have an adverse impact on salmonid habitat. In addition, during the first 10 years of this HCP, Type 5 waters not associated with unstable slopes will be protected only "when necessary for water quality, fisheries habitat, stream banks, wildlife, and other important elements of the aquatic system" (DNR 1992 p. 35). However, the riparian management zone along Types 1, 2, 3, and 4 waters will minimize the adverse impacts of timber harvesting, site preparation, and herbicide application on salmonid habitat. Logs may still be yarded across streams and roads built over streams, but the impacts from these activities will be infrequent and localized. Changes in drainage basin forest cover will continue to affect the water available for runoff and water yields, but the components of the riparian strategy addressing management in the significant rain-on-snow zone and wetlands should minimize and mitigate these adverse impacts.

Some components of the riparian conservation strategy require on-site management decisions, and adverse impacts to salmonid habitat may occur inadvertently. For example, timber harvesting in the riparian buffer must "maintain or restore salmonid habitat", but, at present, the amount of timber harvesting in riparian ecosystems compatible with high quality salmonid habitat is unknown. In the early stages of this HCP, the amount of timber harvested from the riparian buffer or the methods used for its extraction may harm salmonid habitat. The same can be said for the management of the wind buffer or harvest on unstable slopes. Through research, monitoring, and systematic application of the knowledge gained, adverse impacts should decrease in frequency and severity.

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E. Olympic Experimental State Forest Planning Unit

Integrated Approach to Production and Conservation

UNZONED FOREST

As discussed in the section in Chapter I titled Why the Olympic Experimental State Forest [the OESF or the Experimental Forest] is Unique, the goal of the OESF is to learn how to integrate production and conservation across the landscape. To achieve this goal, the northern spotted owl conservation strategy in the Experimental Forest is based on an "unzoned forest" concept, i.e., a forest in which no special zones are set aside exclusively for either species conservation or commodity production. The intent is to have a forest that includes a full range of forest conditions in order to ensure that trust revenues are produced, quality timber is available for harvest, and native species have sufficient habitat. In this approach, harvestable timber and habitat for northern spotted owl, marbled murrelet, and salmon become outputs of a well-managed, unzoned forest.

The goal of maintaining an unzoned forest will guide management activities and research. In the context of long-term forest management, the unzoned approach will define desired outcomes of activities conducted on the landscape. One desired outcome, for example, is the eventual development of older stands that are well distributed throughout the OESF as part of the forest mix. The unzoned forest is an experimental approach, which is why research, monitoring, and systematic application of the knowledge gained will be so important.

However, the distinction between zoned and unzoned is not absolute, because there is a physical and biological zonation in forest landscapes that must be respected and that links directly to the processes and functions the OESF seeks to understand. The riparian areas, which provide the foundation for the conservation strategies, will be treated almost like "zones", because they are linked to relatively fixed physical features on the landscape. However, these riparian management areas will be tailored to the unique characteristics of each stream in the landscape, and research and experimentation will help managers determine what type and degree of resource use can be allowed within these areas. Thus over time, the riparian management zones may begin to blend more with adjacent areas, although this will not be expected to occur until well into the future.

Within this general approach, several conservation objectives can be identified for the Experimental Forest conservation strategies:

(1) To protect, maintain, and aid natural restoration of riparian systems on DNR-managed lands in the OESF, while promoting a long-term integration of resource use and conservation.

(2) To rely on the riparian strategy to provide the physical and biological foundation around which management activities and upland conservation strategies are constructed, recognizing the vital role of watersheds in supporting the web of life.

(3) To look to natural disturbance regimes for the keys to understanding how to achieve restoration and maintenance of natural systems.

(4) To learn to integrate older forest ecosystem values and their functions with commercial forest activities assuming, as a working hypothesis, that landscapes managed for a fairly even apportionment of forest cover among stands in all stages of development, from stand initiation to old growth (Oliver and Larson 1990) will support desirable levels of both commodities and ecosystem functions.

(5) To consider the spatial arrangement of habitat and other conservation values being provided on federal lands when developing habitat within the Experimental Forest.

(6) To fill critical information gaps related to aquatic, riparian, and upland ecosystems and the links between these and forest management activities in order to enhance DNR's decisions and check assumptions behind management strategies and techniques.

MANAGEMENT PROCESSES

The unzoned forest approach complements the OESF management objectives, which include integrating production and conservation. For effective implementation of this integration and of the experimental approach to conservation, six processes are recommended as part of the Experimental Forest management approach:

(1) research and monitoring,

(2) planning from a landscape perspective,

(3) silvicultural techniques that integrate production and conservation,

(4) systematic application of knowledge gained,

(5) efficient information management, and

(6) effective communication.

Research and Monitoring

For an experiment on the scale being attempted in the OESF, carefully planned, focused information-gathering activities and information-management infrastructure are essential. A broad range of formal research, case studies, and monitoring of operations and conditions are included under the heading of research and monitoring. Information-gathering activities carried out in the Experimental Forest, including activities traditionally described as "management experiments", "operational trials", "field evaluations", "case studies", and "demonstrations", will be part of the research and monitoring activities. (See the sections titled Monitoring and Research in Chapter V.)

The following five objectives underlie the research and monitoring component of the OESF:

(1) Acquire new information that will allow DNR managers to (a) meet trust obligations through timber production, (b) conserve and protect public resources (e.g., wildlife, fish, water), and (c) ensure the long-term health and productivity of the forest ecosystem.

(2) Monitor implementation of the HCP and evaluate the effectiveness of activities in meeting the Experimental Forest objectives.

(3) Ensure that information-gathering activities are carried out in a scientifically credible manner, allowing confident use of results in management decisions.

(4) Ensure that information-gathering activities are well coordinated and that the results of different investigations are integrated to achieve OESF objectives.

(5) Ensure that new information is rapidly incorporated into management of the Experimental Forest and, as appropriate, other DNR-managed lands.

Two categories of research and monitoring will occur within the OESF:

(1) research and monitoring required for HCP compliance with the Endangered Species Act; and

(2) information gathering and analysis required to investigate hypotheses and acquire new knowledge needed to accomplish the mission of the Experimental Forest. To the greatest extent possible, research and monitoring conducted in the first category will contribute directly to the information needs in the second category. It is the second category that directly supports the needs of the OESF and provides the scientific foundation for systematically applying new knowledge to managing the forest. (See also the sections in Chapter V titled Monitoring and Research.)

Landscape-level Planning

Planning from a landscape perspective will be the initial basis for integrating production and conservation in the Experimental Forest, moving from current landscape-level patterns to different patterns at specific points in the future. This is consistent with the emphasis on cumulative effects that landscape planning allows. Activities and the resulting landscape-level conditions can be projected and evaluated across space and time to ensure the forest condition is moving in the desired direction through a dynamic process.

DNR's Olympic Region has set preliminary boundaries related to watersheds for landscape planning throughout the region. Eleven of these landscapes lie within the OESF. (See Map IV.9.) Most of the landscapes range in size from 10,000 to 30,000 acres; the largest is 56,000 acres (Upper Clearwater). Boundaries may be adjusted over time during implementation of this plan. It will take time and funding to conduct landscape planning in these landscapes.

Silviculture as an Integration Tool

One of the underlying hypotheses of integrating production and conservation in the Experimental Forest is that it is possible to produce quality commercial timber and provide and protect ecological values in a managed forest by maintaining an arrangement of forest structure and stand diversity. Through silviculture, a forester works in harmony with natural forest growth to achieve desired structural outcomes, whether for habitat, production, or some other objective.

Forest stands have an arrangement or structure that is three dimensional. On the horizontal plane, various configurations and sizes of open and closed spaces, trees, and other species are all part of structure. Vertically, the

quantity of vegetation layers from ground to the upper forest stand canopy is also a part of the stand structure. Configurations of structure are a result of disturbance, either natural or human-caused action. But forests are also dynamic and changing as individual trees grow, die, and are replaced and are commonly described as having four basic stages or structures:

(1) stand initiation, an open condition with new regeneration (also called "open");

(2) stem-exclusion, with tree competition and mortality (also called "closed");

(3) understory reinitiation, with undergrowth development and some tree regeneration (also called "understory"); and

(4) old growth.

A transitional structure (sometimes called "layered") is also sometimes recognized when second growth is being manipulated to create old-growth features and there is greater structural diversity than understory and somewhat less than classic old growth. Silviculture in the OESF is a means to manipulate and produce a variety of possible stand structures based on specific objectives.

Silvicultural techniques are applied at the stand level. However, the results are expressed at both stand and landscape levels. Because of this, silviculture is linked closely with the landscape planning process and is one of the tools essential for integrating production and conservation. A landscape, in an ecological sense, is a large area that is composed of various interacting patterns of stand structure and function going through alterations over time. Natural events, such as the 1921 windstorm on the Olympic Peninsula, can have tremendous effects through the years, altering large areas. Pattern size, patch isolation or connectivity, and edge contrast have profound effects on wildlife and implications for forest utilization planning (Diaz and Apostol 1992). Within this variability however, influencing patterns across the landscape can be planned. Activities that emphasize both commodity production and ecological function can be designed at the stand level with attention to what is retained as well as what is removed and at the landscape level with attention to the arrangements of structures to be developed in and across multiple stands to meet desired patterns. Simulated outcomes of these silvicultural operations across landscapes based on today's ecological conditions can provide glimpses of the future forest. This will provide direction for stand-level prescriptions to meet the desired long-term landscape condition. (See also Section H of this chapter titled Forest Land Management Activities.)

Systematic Application of Knowledge Gained

Integration of new knowledge is to be a scientific, information-based process in the Experimental Forest. In a generic sense, a prudent manager monitors the results of management activities and then adapts future actions based on what has been learned from those results. However, systematic application of knowledge gained has a more focused approach. The basic task is to define a program of experiments that can, over the course of the planning horizon, identify or verify potential avenues for successfully meeting targets for commodity production and ecosystem conservation within the unzoned forest context. The assumptions and hypotheses will be tested through implementation, intentional testing and learning, and making adjustments as activities are conducted and feedback loops provide new information. Such intentional learning should increase the potential benefits of an experimental approach and allow managers to make decisions with greater confidence. The scientif-

ically credible basis for decisions and actions should reduce the risk to the trusts of taking an experimental approach to managing the forest.

Information Management

Information management is used in its broadest sense to include the full scope of computerized and non-computerized information flow. It is in this realm that the research and monitoring activities link directly with the communication and education activities and with operations and decision-making.

Communication Outreach

While research and monitoring focus on acquiring and applying new information, communication and education focus on sharing this new information with trust-land managers and others in a variety of ways, with an emphasis on two-way discussion and learning. Communication can be grouped into five categories: (1) public information, (2) research communications support, (3) technical information exchange, (4) public involvement, and (5) education. A basic premise of the OESF is that by sharing, brainstorming, and working creatively with emerging information, new possibilities and techniques can be discovered for achieving production and conservation goals and can contribute to resolving forest management issues for the trusts and the state.

Experimental Forest communication should be more than a casual sharing of information. The expectations are to identify needs or common goals and work toward them. The communication and education effort envisioned for the OESF will be put into place over time as funding allows. The vision for these efforts can be described as follows:

> Dynamic exchange of ideas internal and external to DNR will contribute to effective problem solving and creative management of the OESF, helping achieve the purpose behind creating the Experimental Forest: to benefit the trusts by integrating production and conservation across the landscape.
>
> Internal mechanisms for effective management response and adaptation to new knowledge will be highly visible and functional, serving the interests of the trusts and providing a well-respected and internationally recognized model for businesses and other government agencies for applying new learning to management.
>
> The Experimental Forest will become a world-renowned site for ecological, forest management, and harvest technology research in a commercially viable forest and for adult and youth education programs built around this emerging knowledge.
>
> Researchers, tourists, recreating visitors, and college and K-12 students will come from throughout the country and around the world to participate in these programs. Laboratories, convention and classroom facilities, trail systems, and field sites will support a broad range of study and research activities. Recreational and tourist activities will link closely with the research and education programs through a joint partnership with peninsula communities and travel organizations.
>
> Modern communication technology will link the activity centers with computer databases and satellite telecommunication networks and provide interactive education experiences.

Partnerships with research and educational organizations throughout the state, nation, and world will help support these programs. Partnerships, participant fees, and external grants will strengthen the core financial base provided by DNR's management account and the state general fund.

SUMMARY

The Experimental Forest conservation strategies are based on current knowledge and are expressed as hypotheses to be tested experimentally. However, DNR recognizes that current knowledge can not answer all the questions about how to achieve integration of conservation and production effectively and economically. Research and monitoring will focus on answering these questions in the OESF. As new information and understanding emerge, feedback loops will allow DNR to apply this knowledge, adjusting management activities and techniques and revising assumptions and hypotheses. This process of intentional learning and systematic application to management should be supported through focused communications and education activities, which can help facilitate discussion, evaluation, problem solving, and decision making that are important parts of the internal and external feedback loops.

Because the Experimental Forest has a special mission of learning how to integrate timber production and habitat conservation across the landscape, the spotted owl, riparian, and multispecies conservation strategies for the OESF Planning Unit are unique, with more emphasis than in the other planning units on experimentation, research, monitoring, and systematic application of new knowledge. The interim conservation strategy for the marbled murrelet is the same as for the five west-side planning units. (See Section B of this chapter.) The conservation strategy for other listed species is the same as for all planning units. (See Section C of this chapter.)

Conservation Strategy for the Northern Spotted Owl in the Olympic Experimental State Forest

INTRODUCTION

The strategy proposed for conservation of the northern spotted owl on DNR-managed lands in the Olympic Experimental State Forest is unique because of the physical and biological conditions and land ownership of the area and because of the experimental approach to integrated management for forest commodity and ecosystem values that is the mission of the OESF. This strategy proposes objectives for restoring a level of habitat capable of supporting spotted owls on DNR-managed lands in the Experimental Forest rather than prescribing forest management activities for those lands. Management to achieve these objectives will be adaptive — that is, it will develop and test a variety of methods to integrate spotted owl habitat and commercial forest management and will apply those methods that are most effective and efficient.

CONSERVATION OBJECTIVES

The objectives for spotted owl conservation on DNR-managed lands in the OESF reflect both the requirements of the Endangered Species Act for approvable habitat conservation plans and the mission of the Experimental Forest. Those conservation objectives are to:

(1) Develop and implement land-management plans that do not appreciably reduce the chances for the survival and recovery of the northern spotted owl sub-population on the Olympic Peninsula.

(2) Develop, implement, test, and refine management techniques for forest stands that integrate older forest ecosystem values — including the stands' functioning as dispersal, foraging, roosting, and nesting habitat for spotted owls — with commercial objectives for those stands.

(3) Develop, implement, test, and refine landscape-level forest management techniques that support a wide range of forest ecosystem values in commercial forests, including their occupancy by successfully reproducing spotted owls that are a functional segment of the Olympic Peninsula sub-population.

The latter two of these conservation objectives may also be thought of as expressions of the primary working hypothesis of the OESF: that DNR can discover and implement forest management practices at the stand and landscape levels that allow for greater integration of natural resource commodity production and ecosystem support than is provided by current practices.

CONSERVATION STRATEGY

The conservation strategy proposes to achieve the objectives listed above, proposes to learn how to achieve these objectives in the most effective and efficient manner, and seeks to avoid explicit, long-term prescriptions for forest management. This is consistent with the OESF management process of systematically applying knowledge gained from research. However, it is necessary, both for evaluation of the strategy and application of new knowledge, to propose managing toward some explicitly stated conditions. These should be considered expressions of hypotheses based on current knowledge and conditions relevant to spotted owl conservation in the Experimental Forest, and they should be expected to change with further knowledge or changing conditions.

The strategy of conserving spotted owls by restoring habitat capability is proposed as a working hypothesis regarding the necessary quality, quantity, and distribution of potential habitat, accompanied by an approach for managing toward those conditions. The strategy is to be implemented in two phases, one of habitat restoration followed by one of maintaining and enhancing a mosaic of habitat that shifts over time as guided by analyses and plans for individual landscape planning units.

Integrating Forest Management and Spotted Owl Conservation: A Working Hypothesis

Management for desired owl habitat conditions will be planned and implemented at the scale of landscape planning units. As discussed earlier in the subsection titled Integrated Approach to Production and Conservation, landscape planning units are watershed-based and contain between 10,000 and 56,000 acres of DNR-managed lands. The objectives of landscape-level management are directed at developing landscapes that produce a mix of commercial products and ecosystem outputs across the entire OESF. Spotted owl conservation will primarily be derived from the integrated, ecosystem-oriented management, rather than direct the management.

A principal working hypothesis of the OESF is that landscapes managed for a fairly even apportionment of forest cover among stands in all stages of development, from stand initiation to old growth (Oliver and Larson 1990), will support desirable outputs of both commodities and ecosystem functions. Mid-aged and older forest stands in the stem-exclusion to old-growth stages support a broad range of commodity and ecosystem functions, including that of spotted owl habitat.

On the basis of current understanding of the responses of spotted owls to forest stands and landscapes (Horton in press), an approach to the integrated management of the Experimental Forest for timber production and spotted owl habitat is proposed. This approach can be stated and implemented as a working hypothesis for evaluation and systematic application and refinement: DNR can meet its objectives for commodity production and spotted owl conservation in the OESF by managing each landscape planning unit to maintain or restore threshold proportions of potential habitat. Those proportions are:

(1) at least 20 percent of DNR-managed lands in the landscape planning unit in the understory-reinitiation to old-growth stages that are potential old-forest habitat (after Hanson et al. 1993); and

(2) at least 40 percent of DNR-managed lands in the landscape planning unit in the stem-exclusion to old-growth stages that are potential old-forest, sub-mature, or young- forest marginal spotted owl habitat types (Hanson et al. 1993), including any old-forest habitat described in (1) above.

The threshold levels for habitat quality and proportion were selected because:

(1) There is substantial concurrence that 30-50 percent habitat at spatial scales from spotted owl ranges to landscapes can support reproductive owl pairs (e.g., Forsman and Meslow 1985; Bart and Forsman 1992; Carey et al. 1992; Lehmkuhl and Raphael 1993; Holthausen et al. 1994; Bart 1995).

(2) A conservation objective of the OESF is to support old-forest ecosystem functions, including that of spotted owl habitat, partly through providing a shifting mosaic of stands that are managed to retain or develop structural complexity. Some of the spotted owl habitat in the Experimental Forest is expected to be provided by these managed stands. There is considerable support among ecologists and silviculturalists that such techniques can be effective (e.g., USDI 1992, Appendix F; Franklin 1992).

(3) There is some uncertainty as to the ability of landscapes devoid of older forests to support successfully reproducing spotted owls. The hypothesized threshold amount of old-forest habitat is based on observations of significantly greater occupancy and productivity by owls in areas with greater than 20 percent cover of older forest than in those with less (Bart and Forsman 1992).

(4) A primary, overall goal of the OESF is integrated management for forest commodities and ecosystem functions. The proposed threshold proportions of spotted owl habitat are at the low end of the range of observed values in order to allow managers and researchers the greatest flexibility in arriving at effective and efficient solutions, but they are consistent with the recommendations of the U.S. Fish and Wildlife Service and Bart's (1995) conclusions as to the proportion of suitable habitat necessary to maintain site or population stability.

The currently proposed threshold proportions of potential spotted owl habitat are not intended to be targets for management; rather, they are minimum standards that reflect the current understanding of forest-ecosystem processes. The quantity and quality of potential spotted owl habitat will

ultimately vary among landscape planning units with their physical and biological conditions and other management objectives for commodities and experimentation.

Current Conditions in the OESF

Forest cover on 58 percent of DNR-managed lands in the Experimental Forest is dominated by young stands that have regenerated following timber harvesting during the past 30 years. Structure and composition, not age, best predict the capability of forest stands as spotted owl habitat. However, stand age is correlated with structure and composition and provides a simple estimate of the area of the OESF currently in stands that are potential owl habitat. DNR's inventory (DNR GIS April 1995) shows that 19 percent of the Experimental Forest is in stands over 100 years old; most of these fit the Hanson et al. (1993) description of old-forest habitat. An additional 11 percent of the OESF is covered by stands 51-100 years old (including stands originating from a major 1921 windstorm); many of these stands fit the Hanson et al. (1993) description of young-forest marginal or sub-mature habitat.

An estimate of forest structure and composition (WDFW 1994) using satellite imagery obtained in 1991 generally concurs with the DNR inventory-based estimates for old-forest habitat (18 percent cover of old-growth and large sawtimber) and for sub-mature and young-forest marginal habitat (14 percent cover of small sawtimber). The Washington Department of Fish and Wildlife (1994) estimate of 32 percent total potential spotted owl habitat exceeds the DNR GIS (April 1995) estimate of 30 percent probably for two reasons: some harvesting of potential habitat has occurred in the four years since the satellite images were acquired; and the Washington Department of Fish and Wildlife (1994) estimates based on structure and composition appear to assign some stands to more highly structured categories at ages younger than those used to subdivide the DNR inventory, e.g., some 60-year-old stands were classified as large sawtimber, some 35-year-old stands as small sawtimber.

Both the age-based (DNR GIS April 1995) and structure-based (WDFW 1994) estimates of habitat probably overestimate the amount of younger forest habitat types. Field assessments by Washington Department of Fish and Wildlife and DNR biologists frequently categorize younger, simply structured stands of small sawtimber as not potential spotted owl habitat. By any measure, current amounts and distribution of potential spotted owl habitat across the OESF are decidedly sub-threshold.

Amounts of potential owl habitat vary widely among the 11 landscape planning units (Map IV.9). DNR's inventory estimates from 3 to 30 percent cover of stands more than 100 years old (potential old-forest habitat), 7 to 35 percent cover of stands more than 70 years old (potential old-forest and sub-mature habitat), and 12 to 57 percent cover of stands more than 50 years old (potential old-forest, sub-mature, and young-forest marginal habitat). See Table IV.6. These estimates of the abundance of potential habitat based on stand age are not perfect. For example, some stands not much older than 100 years would be classified as sub-mature habitat based on their structure and composition, just as some 75-year-old stands with a substantial component of older trees would be classified as old-forest habitat. But it is likely that estimates of the abundance of old-forest habitat are relatively unbiased, that is, some stands estimated to be old-forest habitat are really sub-mature and some stands estimated to be sub-mature are really old-forest. Similarly, estimates of the abundance of sub-mature habitat are likely to be relatively unbiased. However, the abundance of young-forest marginal habitat is likely overestimated based on the abundance of stands currently over 50 years old. The structure and composition of some of these

Table IV.6: Two estimates of the current abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest

Landscape planning unit[1]	Acres		Estimated stand condition on DNR-managed land[2] (percent)			
	All ownerships	DNR-managed	Old forest[3] Inv./TM	Sub-mature[4,6] Inv./TM	Y-f marg[5,6] Inv./TM	Non-hab[7] Inv./TM
Sekiu	109,260	10,620	3/9	4/15	5/15	88/76
Clallam	79,470	18,374	3/14	32/21	16/21	51/65
Dickodochtedor	111,442	27,842	14/14	16/12	1/12	69/72
Sol Duc	84,035	18,465	5/23	18/22	33/22	45/45
Reade Hill	15,809	8,898	27/27	11/19	0/19	64/54
Goodman	66,251	24,639	21/18	6/11	0/11	75/71
Willy/Huel	51,965	38,963	22/23	3/14	2/14	73/63
Kalaloch	54,420	18,492	18/13	3/12	1/12	81/75
Clearwater	58,329	57,073	30/25	0/11	0/11	73/64
Coppermine	44,244	19,904	16/16	3/13	0/13	83/71
Queets	34,329	22,295	23/16	5/12	2/12	72/72

[1]See Map IV. 9 for location of landscape planning units.

[2]The percentage of DNR-managed land estimated to meet definitions of spotted owl habitat (Hanson et al. 1993) in each landscape planning unit. Two methods of estimation were used: DNR's stand inventory (DNR GIS 1995), column sub-heading "Inv."; and supervised classification of Landsat Thematic Mapper scenes taken July 1991 (WDFW 1994), column sub-heading "TM".

[3]Old forest = stands with origin dates estimated or measured as 1894 or older (Inv.), or old-growth and large-saw cover as estimated by supervised classification of Landsat Thematic Mapper (TM).

[4]Sub-mature= stands with origin dates estimated or measured as 1895-1924 (Inv.), or small-saw cover as estimated by supervised classification of Landsat Thematic Mapper scenes (TM).

[5]Y-f. marg = young-forest marginal habitat. Stands with origin dates estimated or measured as 1925-1945 (Inv.), or small-saw cover as estimated by supervised classification of Landsat Thematic Mapper scenes (TM).

[6]The same TM estimate of small saw is shown in both sub-mature and young-forest marginal columns because TM estimates of small sawtimber probably encompass both sub-mature and young-forest marginal habitat types. This estimate should be counted only once when totaling amounts of habitat by landscape planning unit.

[7]Non-hab = not suitable for habitat. Stands with origin dates estimated or measured as 1946-1995 (Inv.), or pole, sapling, and open-cover classes as estimated by supervised classification of Landsat Thematic Mapper scenes (TM).

stands are such that they would offer too few opportunities for foraging and roosting to be classified as young-forest marginal habitat. It is likely that the current abundance of young-forest marginal habitat is some proportion of the abundance of forest stands between 51 and 70 years of age and that proportion varies among landscape planning units with stand-level and landscape-level features that are unique within landscapes. Currently, potential spotted owl habitat[1] probably does not constitute much more than 40 percent of any landscape planning unit, although old-forest habitat appears to be at or above the 20 percent threshold in several landscape planning units (Table IV.6).

Management During the Restoration Phase

Spatially explicit forest growth models predict that all landscape planning units within the Experimental Forest will meet or exceed the 40 percent threshold for total old- and young-forest spotted owl habitat types in 40 to 60 years. These models demonstrate that time until restoration depends on natural and silviculturally aided successional processes in the abundant young stands and is independent of the level of retention of existing habitat (Table IV.7). This 40- to 60-year period during which existing young stands are developing the characteristics of young-forest marginal and sub-mature habitat is defined as the restoration phase of the proposed conservation strategy for the OESF. The longer period following the restoration phase that is required for threshold amounts of old-forest habitat to develop in all landscape planning units is defined as part of the maintenance and enhancement phase. Management during this phase will be discussed in the next subsection.

Management of the Experimental Forest will be planned and implemented at the level of individual activities within the framework of specific plans for each landscape planning unit. These landscape plans will focus and direct the integration of ecosystem, commodity, and information goals. Several elements of landscape plans will indirectly support the maintenance or restoration of spotted owl habitat. A primary objective for the conservation strategies of the OESF is to maintain and aid the natural restoration of the composition, structure, and function of aquatic and riparian ecosystems. This will likely result in the maintenance or restoration of older forests in streamside areas and on unstable hillslopes. (See the subsection titled the Riparian Conservation Strategy for the Olympic Experimental State Forest.) These streamside forests are of great value to spotted owls and many of their potential prey (Carey et al. 1992; Carey and Johnson 1995), as well as to the function of the aquatic and riparian ecosystems.

Commitments to the conservation of marbled murrelets will be also incorporated into landscape plans. The long-term conservation strategy for murrelets has not yet been developed, but the interim strategy is to defer the harvest of most potential murrelet habitat until after the development of the long-term strategy. (See Minimization and Mitigation for the Marbled Murrelet, in Section B of this chapter.) There is likely to be a high degree of overlap among potential murrelet and spotted owl habitats, thus the probable result of the interim murrelet strategy will be to defer harvest of much potential spotted owl habitat.

Landscape plans will help integrate diverse goals, in part by mapping and scheduling timber harvests and other silvicultural activities so that their influence on ecosystem processes can be assessed in advance. Harvests of currently suitable, potential spotted owl habitat will be planned, scheduled,

[1]In discussions regarding northern spotted owls and the OESF, the term "potential spotted owl habitat is used to generally characterize forest stands that, because of their structure and composition, are similar to those described as young- or old-growth forest spotted owl habitat by Hanson et al. (1993). The adjective "potential" is used to acknowledge that not all such stands will actually be used (become habitat) by owls, for a variety of reasons including that they occur in landscapes dominated by clearcuts and young plantations and are thus incapable of supporting owls.

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1]

Decade	Percent of landscape in cover type				Total habitat[6]
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	
Sekiu Landscape Planning Unit					
0	88	5	4	3	12
1	75	18	4	3	25
2	69	21	6	4	31
3	54	34	7	5	46
4	33	51	11	5	67
5	23	42	29	6	77
6	33	18	36	12	67
7	37	10	39	15	63
8	34	16	27	22	66
9	31	17	19	33	69
10	28	20	15	37	72
Clallam Landscape Planning Unit					
0	49	16	32	3	51
1	46	9	42	3	54
2	55	14	28	3	45
3	50	32	6	12	50
4	50	28	6	15	50
5	48	18	18	17	52
6	45	20	18	17	55
7	30	24	25	21	70
8	17	31	21	31	83

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				Total habitat[6]
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	
Clallam Landscape Planning Unit *(continued)*					
9	17	19	28	35	83
10	29	12	21	37	71
Dickodochtedor Landscape Planning Unit					
0	70	1	15	14	30
1	64	6	14	16	36
2	68	13	3	16	32
3	57	23	1	18	43
4	40	40	3	17	60
5	25	40	18	17	75
6	35	19	30	16	65
7	36	13	35	16	64
8	38	17	25	20	62
9	40	15	19	26	60
10	42	11	15	32	58
Sol Duc Landscape Planning Unit					
0	44	34	18	5	56
1	24	42	28	6	76
2	31	26	35	7	69
3	67	9	14	9	33
4	67	9	13	11	33

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	Total habitat[6]
Sol Duc Landscape Planning Unit *(continued)*					
5	58	18	10	15	42
6	55	16	9	20	45
7	47	16	17	21	53
8	13	48	16	23	87
9	10	39	23	28	90
10	15	8	42	35	85
Reade Hill Landscape Planning Unit					
0	62	0	11	27	38
1	67	2	11	20	33
2	49	29	3	19	51
3	37	40	1	22	63
4	42	26	10	22	58
5	34	24	20	22	66
6	29	19	29	23	71
7	26	16	24	34	74
8	27	10	23	40	73
9	19	17	20	45	81
10	23	19	10	49	77
Goodman Landscape Planning Unit					
0	73	0	6	21	27
1	75	0	6	19	25

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				Total habitat[6]
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	
Goodman Landscape Planning Unit *(continued)*					
2	73	7	2	19	27
3	53	26	1	20	47
4	29	50	2	19	71
5	17	48	16	19	83
6	25	20	37	19	75
7	30	7	44	19	70
8	41	6	28	24	59
9	44	8	16	32	56
10	42	14	7	37	58
Willy-Huel Landscape Planning Unit					
0	73	2	3	22	27
1	74	3	3	20	26
2	67	10	3	19	33
3	48	31	1	20	52
4	27	48	6	19	73
5	18	41	21	20	82
6	23	18	38	20	77
7	30	6	40	24	70
8	35	5	28	33	65
9	35	9	14	42	65
10	35	12	6	48	65

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				Total habitat[6]
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	
Kalaloch Landscape Planning Unit					
0	78	1	3	18	22
1	77	1	3	19	23
2	72	8	2	19	28
3	50	30	1	19	50
4	25	54	3	18	75
5	24	46	17	13	76
6	31	18	39	13	69
7	40	5	40	15	60
8	44	6	28	22	56
9	47	10	10	32	53
10	35	22	6	37	65
Clearwater Landscape Planning Unit					
0	70	0	0	30	30
1	74	0	0	26	26
2	71	3	0	26	29
3	54	20	0	26	46
4	24	49	1	26	76
5	12	49	13	26	88
6	13	22	38	26	87
7	20	6	47	27	80
8	28	2	36	33	72

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	Total habitat[6]
Clearwater Landscape Planning Unit *(continued)*					
9	33	4	15	47	67
10	34	9	3	54	66
Coppermine Landscape Planning Unit					
0	81	1	3	16	19
1	81	1	3	16	19
2	77	6	1	16	23
3	52	31	1	17	48
4	28	53	2	17	72
5	16	47	20	17	84
6	22	22	39	17	78
7	25	7	50	19	75
8	35	6	34	25	65
9	40	7	16	37	60
10	34	14	7	45	66
Queets Landscape Planning Unit					
0	71	2	5	23	29
1	74	2	5	19	26
2	67	12	2	19	33
3	53	27	0	20	47
4	39	41	2	19	61
5	22	41	18	19	78

Table IV.7: An estimate of the future abundance of potential spotted owl habitat in proposed landscape planning units of the Olympic Experimental State Forest and the forest at large based on one set of harvest regimes[1] *(continued)*

Decade	Percent of landscape in cover type				Total habitat[6]
	Non-habitat[2]	Young-forest marginal[3]	Sub-mature[4]	Old forest[5]	
Queets Landscape Planning Unit *(continued)*					
6	29	23	29	19	71
7	40	10	31	20	60
8	47	7	27	20	53
9	42	14	21	23	58
10	47	12	7	34	53

[1]Estimates are based on harvest assessments for the OESF unzoned alternative presented to the Board of Natural Resources on June 6, 1995, and represent one possible set of regimes for illustrative purposes only. Actual harvest levels will be determined through the landscape planning process. Old-forest habitat will not be reduced in amount if it comprises 20 percent or less of a landscape planning unit. See Map IV.9 for location of proposed landscape planning units.

[2]Non-habitat is assumed to be either a) untreated stands 50 years old or younger, or b) stands that were 71 years old or older when they were partially-harvested within the past 10 years.

[3]Young-forest marginal habitat is estimated to be either a) untreated stands 51-70 years old, or b) stands that were 71 years old or older when they were partially-harvested within the past 11-30 years.

[4]Sub-mature habitat is estimated to be either a) untreated stands 71-100 years old, or b) stands that were 71 years old or older when they were partially-harvested within the past 31-50 years.

[5]Old-forest habitat is estimated to be either a) untreated stands 101 years old or older, or b) stands that were 71 years old or older when they were partially-harvested over 51 years ago.

[6]Total habitat is the sum of young-forest marginal, sub-mature, and old-forest habitat.

and implemented using the following guidelines as a filter to determine what is allowable:

(1) Harvests of young- or old-forest habitat will support riparian ecosystem and marbled murrelet conservation as set forth in other sections of this HCP.

(2) Harvest activities will maintain the proportion of old-forest habitat at or above 20 percent of each landscape planning unit and will not further reduce sub-threshold proportions. In this phase, harvest activities in young-forest habitat may occur independent of the 40 percent threshold if consistent with other elements of the HCP.

(3) Plans for harvest of young- or old-forest habitat will recognize the importance of interior old-forest conditions to overall ecosystem function and will maintain or develop these conditions in accordance with landscape plans.

(4) Harvests of available young- and old-forest habitat will be evenly distributed over the duration of the restoration phase. Available habitat will be calculated for each landscape planning unit, and harvests of that habitat will be scheduled and conducted so that they are evenly distributed by decade over the duration of the restoration phase of the HCP.

(5) Harvests of available young- and old-forest habitat will be scheduled in consideration of the value of individual owl sites to conservation, research, and validation monitoring in the Experimental Forest. DNR will consider the recommendations of the U.S. Fish and Wildlife Service when scheduling these harvests during the first decade of the HCP.

(6) Harvests of available young- or old-forest habitat will take advantage of opportunities to learn new silvicultural techniques for retaining old-forest ecosystem functions, including those providing spotted owl habitat. This is an important conservation goal of the Experimental Forest, although not all harvests will necessarily be for research in silvicultural options.

Habitat restoration will also proceed under landscape plans. Harvesting, silvicultural activities, and other activities (e.g., road building, maintenance, etc.) in areas that are not currently suitable habitat will be planned, scheduled, and implemented using the following guidelines as a filter to determine what is allowable:

(1) All activities will support riparian ecosystem and marbled murrelet conservation as set forth in other sections of this HCP.

(2) Activities will restore at least 20 percent cover of old-forest habitat to each landscape planning unit, including the development of some interior old-forest conditions.

(3) Harvests and other silvicultural activities in young (0- to 30-year-old) stands will promote development of young- or old-forest spotted owl habitat so that the restoration phase is expedited.

(4) Harvests and other silvicultural activities in young (0- to 30-year-old) stands will be take advantage of opportunities to learn new silvicultural techniques for accelerating the development of old-

forest ecosystem functions, including those providing spotted owl habitat. This is an important conservation goal of the OESF, although not all such activities will necessarily be for research in silvicultural options.

Activities that precede thorough landscape analyses and plans will be conducted in accord with the above guidance and will proceed cautiously to avoid foreclosing options for commodity production, ecosystem support, and research.

Management During the Maintenance and Enhancement Phase

The maintenance and enhancement phase of the HCP for the Experimental Forest covers the remainder of the permit period and follows the restoration of threshold amounts of total spotted owl habitat in each landscape planning unit. During this phase, some stands will continue developing the characteristics of old-forest habitat to meet conservation needs for riparian ecosystems, as well as possibly for marbled murrelets and spotted owls and for other ecosystem functions. Other stands will receive a variety of silvicultural treatments including clearcut harvests where appropriate, but total spotted owl habitat will make up at least 40 percent of each landscape planning unit. Current estimates are that those landscape planning units that contain less than the threshold amounts of old-forest habitat will attain the threshold level over the next 20 to 80 years. Thus, restoration of the entire OESF to conditions that are currently hypothesized to support desired outputs of commodity and ecosystem products is predicted to take as long as 80 years. This restoration depends on natural and silviculturally aided successional processes, in both young-forest habitat types and the abundant young stands. Conditions and knowledge will likely change substantially over this time, altering strategies and tactics; however, some discussion of the current proposal for management follows.

Activities will likely continue to be planned and implemented at a scale larger than forest stands, but the base units for planning may differ from the current landscape planning units. It is also likely that these plans will continue to integrate diverse goals, in part by mapping and scheduling timber harvests and other silvicultural activities so that their influence on ecosystem processes can be predicted. Activities for this phase should be planned, scheduled, and implemented using the following guidelines as a filter to determine what is allowable:

(1) Activities will support necessary riparian ecosystem or marbled murrelet conservation.

(2) Activities will maintain or enhance at least 20 percent cover of old-forest habitat in each landscape planning unit, including the maintenance or development of interior old-forest conditions in each unit.

(3) Harvest activities will maintain the proportion of young- and old-forest habitat at or above 40 percent of each landscape planning unit.

(4) New research goals will evolve to ensure the success of this phase.

RATIONALE FOR THE SPOTTED OWL CONSERVATION STRATEGY

The non-specific nature of the conservation objectives acknowledges the incomplete understanding of spotted owl population dynamics within the context of the overall mission of the Experimental Forest. Not enough information is available about the numbers, distribution, and demographic

performance necessary to maintain the current chances for survival and recovery of the sub-population of spotted owls on DNR-managed lands in the OESF. Nor is it known what management regimes best support that goal. It may be possible to maintain the chances for survival and recovery with very small contributions to spotted owl habitat from the Experimental Forest. However, an important part of the OESF mission is to learn how to manage commercial forests for integrated outputs of commodity and ecosystem products, including those ecosystem products that derive from the workings of older forests. Spotted owls are a visible, measurable output of older forest ecosystems. Management of the Experimental Forest that restores and supports a reproducing segment of the spotted owl population would be an important conservation goal of the OESF whether spotted owls were listed as threatened or not.

The conservation strategy was developed in light of current physical and biological conditions and the land-ownership and land-management context in the northwestern portion of the range of the northern spotted owl. Seven key items were considered:

(1) the physical geography and land-cover patterns of the region;

(2) the size and trends of the spotted owl sub-population on the Olympic Peninsula (see Section A of Chapter III for a discussion of biological data for spotted owls on the Olympic Peninsula);

(3) the current distribution of spotted owls and their habitat on the Olympic Peninsula (see Section A of Chapter III);

(4) patterns of land ownership and current objectives of forest managers (see the section in Chapter I titled Land Covered by the HCP);

(5) recent trends in occupancy by spotted owls on DNR-managed lands in the Experimental Forest and current habitat conditions there;

(6) current knowledge and hypotheses regarding spotted owls and managed forests; and

(7) the mission of the OESF to discover effective approaches for integrated management of commercial forests.

Consideration of these key items led to several conclusions that guided the development of the conservation strategy. Geography and land-use patterns have isolated spotted owls on the Olympic Peninsula from other significant sub-populations in western Washington and Oregon. Recent studies suggest that the sub-population is substantially larger than was formerly believed, is interconnected, and is either stable or declining slowly (Holthausen et al. 1994; Burnham et al. 1994). Currently, the vast majority of spotted owls and potential habitat are found on federal lands in the Olympic National Forest and Olympic National Park. These federal lands border a substantial portion of DNR-managed lands in the Experimental Forest. Management objectives for the federal lands include supporting the recovery of a viable, well-distributed population of spotted owls (USDA and USDI 1994b). Thus, while the conservation of spotted owls on the Olympic Peninsula is of particular concern, the population size, distribution, and status, as well as the substantial commitment to habitat protection and recovery by the Olympic National Forest and Olympic National Park, appear to provide a population and habitat base that allows considerable flexibility in developing a conservation strategy for DNR-managed lands.

The amount and distribution of potential spotted owl habitat on DNR-managed lands in the OESF is currently sufficient to support only a few spotted owl pairs. Recent observations on those lands have found a substantial proportion of sites formerly occupied by spotted owl pairs to be either intermittently occupied by unpaired spotted owls or vacant. Apparently, significant demographic support to the spotted owls on the western Olympic Peninsula from the Experimental Forest must await the development of habitat conditions in the abundant young stands on these lands.

The current understanding is that both the structure and composition of forest stands and the composition and pattern of forested landscapes determine their capability as spotted owl habitat (Horton in press). Some management techniques currently exist to maintain or restore spotted owl habitat capability; many others are hypothesized (e.g., USDI 1992, Appendix F). DNR intends to implement, evaluate, and refine techniques such as these in the OESF. Thus, there is reason to believe that meaningful contributions to spotted owl conservation can result from management of the Experimental Forest.

The conservation strategy is based primarily on the restoration of habitat capability for spotted owls and assumes a level of risk because it allows some reduction in the amount of potential spotted owl habitat in the near term. The level of risk may be acceptable because:

(1) current habitat conditions allow so few spotted owl pairs to occupy these lands successfully that only marginal losses to the Olympic Peninsula sub-population are likely;

(2) the levels of near-term habitat removal are fairly low; and

(3) the overall status of the Olympic Peninsula spotted owl sub-population and habitat appears to be reasonably secure within the context of management plans for federal lands (Holthausen et al. 1994; see the section in Chapter II on the Reanalysis Report for the Spotted Owl on the Olympic Peninsula and Section A of Chapter III on biological data for the spotted owl on the Olympic Peninsula for a brief discussion of Holthausen et al. 1994).

POTENTIAL BENEFITS AND IMPACTS TO SPOTTED OWLS

DNR proposes to manage the OESF as a commercial forest, and simultaneously, to restore a greater level of habitat capability for spotted owls than currently exists there. DNR anticipates that during the life of the HCP, some spotted owls may be displaced and forest management activities may degrade habitat conditions for some individual spotted owls or owl pairs to the point where the habitat is temporarily incapable of supporting them. These activities may constitute incidental take of spotted owls as defined by the Endangered Species Act. The HCP was designed to minimize and to mitigate for this take within the context of its objectives. In fact, it is intended that management of the Experimental Forest will result in spotted owl habitat that is more abundant and widely distributed than it is at present.

Benefits

The HCP for the OESF will potentially benefit spotted owls in several ways:

(1) by deferring older stands (potential old-forest habitat) from harvest to meet (a) riparian or marbled murrelet conservation strategies,

(b) the 20 percent per landscape planning unit threshold for old-forest spotted owl habitat, or (c) harvest scheduling objectives;

(2) by deferring mid-aged forest stands (potential young-forest marginal, sub-mature, or occasionally, old-forest habitat) from harvest to meet (a) conservation strategies for riparian ecosystems or marbled murrelets, (b) harvest scheduling objectives, or (c) the 40 percent per landscape planning unit threshold for young-forest marginal, sub-mature, or old-forest spotted owl habitat; and

(3) by developing spotted owl habitat in young stands. A description of how these three measures will benefit the spotted owl during the restoration phase of the HCP for the Experimental Forest follows.

Preliminary analyses suggest that about 30 percent of the older forests are near stream channels or on unstable hillslopes and an additional 10 percent are in potentially wind-prone areas near streams. Because these older forests will be managed to meet the objectives of the OESF riparian conservation strategy (see the next subsection), DNR expects to maintain the potential of these stands as old-forest habitat for spotted owls. The long-term conservation strategy for murrelets has not yet been developed, but the interim strategy is to defer harvest of most potential murrelet habitat at least until the development of the long-term strategy. (See Section B of this chapter on the marbled murrelet strategy.) Preliminary examination of raw data from a two-year study of upland habitat relationships of murrelets in the OESF suggests that there will be a high degree of overlap among potential murrelet habitat and potential old-forest habitat for spotted owls. Thus, the likely result of the interim murrelet strategy will be to defer harvest of much potential old-forest habitat.

In order to support the 20 percent old-forest habitat threshold for each landscape planning unit, harvest is proposed to be deferred in those forests for 50-80 years in six landscape planning units in which amounts of that cover type are hypothesized to be insufficient. These deferrals will benefit the spotted owl. In the five landscape planning units in which old-forest cover is estimated to be greater than 20 percent, about 8,000 acres are in excess of the threshold amount. The retention of at least 20 percent old-forest cover in these landscapes will benefit the spotted owl. To the extent that harvest of supra-threshold old-forest habitat in these areas does not conflict with conservation strategies for riparian ecosystems or marbled murrelets, DNR proposes harvest be evenly distributed over the duration of the restoration phase of the HCP. Gradual harvest of about 12 percent of the existing old-forest habitat over 40 or more years (while some mid-aged stands are becoming old-forest habitat) will also benefit the spotted owl.

Preliminary analyses suggest that about 20 percent of mid-aged forests are near stream channels or on unstable hillslopes and an additional 10 percent are in potentially wind-prone areas near streams. Because these forests will be managed to meet the objectives of the riparian ecosystem conservation strategy (see the next subsection), DNR expects to maintain or enhance the potential of these stands as habitat for spotted owls. The long-term conservation strategy for murrelets has not yet been developed, but the interim strategy is to defer harvest of most potential murrelet habitat at least until the development of the long-term strategy. (See the earlier section in this chapter on the marbled murrelet strategy.) Preliminary examination of raw data from a two-year study of upland habitat relationships of murrelets in the Experimental Forest suggests that there will be some overlap among potential murrelet habitat and potential sub-mature habitat for spotted

owls. Thus, the likely result of the interim murrelet strategy will be to defer harvest of some potential sub-mature habitat. DNR proposes that harvest of other mid-aged forests be evenly distributed over the duration of the restoration phase of the HCP. This gradual harvest of perhaps as much as 20,000 acres of young-forest marginal and sub-mature habitat over 40 or more years while over 100,000 acres of younger forests are becoming young-forest marginal and sub-mature habitat will also benefit the spotted owl.

Preliminary analyses suggest that approximately 130,000 acres of forest stands in the OESF are between 11 and 50 years old (DNR GIS 1995). Currently, these stands provide little if any young-forest marginal habitat for spotted owls. However, during the 40- to 60-year restoration phase of the HCP, most of these stands will, through natural or silviculturally-aided processes, develop into young-forest marginal, sub-mature, and old-forest habitat. (See Table IV.7.) Most of the habitat that will develop during this phase will be of the young-forest marginal and sub-mature types, with more and higher quality habitat developing in the latter half of the restoration phase. The development of young-forest marginal and sub-mature owl habitat while existing, similar habitat is harvested will serve to benefit the spotted owl.

The mission of the Experimental Forest is to learn how to conduct integrated forest management for commodity and ecosystem outputs. One facet of this mission is to learn how to manage commercial forest landscapes such that they support successfully reproducing spotted owls that are a functional segment of the Olympic Peninsula sub-population. DNR expects this to result from several outcomes of proposed management of the OESF:

(1) providing owl habitat during a significant proportion of the management cycle in some forest stands;

(2) providing owl habitat fairly continuously in some forest stands;

(3) supporting older forest ecosystem processes, including spotted owl survival and reproduction, through management of forest landscapes;

(4) learning effective and efficient techniques for supporting spotted owls in commercial forests and conveying this information to forest scientists and managers so that it can potentially be employed elsewhere. A description of how these four measures will benefit the spotted owl during the life of the HCP for the Experimental Forest follows.

Forest stand management in the OESF will increasingly focus on retention of elements of existing stands to promote diversity within each stand and the development of owl habitat at earlier ages than might be achieved without such retention. (See Section H in this chapter titled Forest Land Management Activities.) For example, a regime that harvested 90-year-old stands, retaining one-third of their volume, and conducted intermediate harvests that maintained or enhanced structural diversity may be hypothesized to provide at least young-forest marginal and sub-mature habitat between 50 and 90 years post-harvest (44 percent of the management cycle for the stand). This regime has been used to represent a median silvicultural regime for the Experimental Forest and was the basis for the harvest assessment presented at the Board of Natural Resources Workshop on October 3, 1995. Other silvicultural regimes will develop stands with multiple age classes and large structural elements from previous stands. (See Section H of this chapter titled Forest Land Management

Activities.) Such stands may be hypothesized to provide both younger forest and possibly even old-forest habitat types during portions of the management cycle. An estimate of the rate of development of potential owl habitat in landscape planning units of the OESF is presented in Table IV.7, which shows that substantially more potential habitat that is more widely distributed potential habitat will be developed during the life of the HCP than currently exists. Silvicultural practices that provide owl habitat in commercial forest stands during significant portions of the management cycle and result in substantially more habitat than currently exists result in significant benefits to spotted owls.

Some forest stands will be managed such that they provide owl habitat fairly continuously. Many of these stands will be in or near riparian areas or on unstable areas in the uplands. Silvicultural practices in these areas are currently hypothesized to include: minimal or no harvest; thinnings and light partial harvests designed to enhance structural diversity and thus wind-firmness; and conversion of some streamside areas, which were invaded by deciduous trees or shrubs following timber harvest, to conifer stands in order to better support riparian ecosystem functions. (See the OESF riparian strategy and Section H of this chapter titled Forest Land Management Activities.) It is predicted more than 20 percent of the Experimental Forest will be managed by such methods, and it is predicted that most of these areas will either remain or become potential old-forest habitat for spotted owls. An estimate of the rate of development of potential old-forest habitat in landscape planning units of the OESF is presented in Table IV.7, which shows that substantially more, and more widely distributed, potential old-forest habitat will be developed toward the end of the HCP period than currently exists. Management practices that increase the amount and broaden the distribution of old-forest habitat relative to what currently exists result in significant benefits to spotted owls.

Reproducing spotted owl pairs need substantial areas of potential habitat. The proposed management of forest landscapes to achieve at least threshold qualities and quantities of potential habitat is intended to provide these substantial areas of habitat. An estimate of the rate of development of potential young-forest marginal, sub-mature, and old-forest habitat in landscape planning units of the OESF is presented in Table IV.7. Note that preliminary landscape management regimes used in developing the harvest assessment from which the table was derived result in all landscape planning units surpassing hypothesized threshold qualities and quantities of owl habitat. Management practices that increase the amount and broaden the distribution of young-forest marginal, sub-mature, and old-forest habitat such that the capabilities of forest landscapes to support spotted owls are greater than their current capabilities constitute significant benefits to spotted owls.

Learning how to manage commercial forests effectively and efficiently for ecosystem and commodity values requires a significant commitment to research, monitoring, and information exchange. (See the earlier subsection in this chapter titled Integrated Approach to Conservation and Production as well as the sections in Chapter V titled Monitoring and Research.) It is difficult to predict how much of what is learned in the Experimental Forest will be used to manage other commercial forests so that they provide a greater level of support to the regional population of northern spotted owls. But, given the commitment to such learning, then to the extent that information derived is applied by other forest scientists and managers and produces positive results, those results also constitute benefits to spotted owls.

Impacts

It may be argued that the degradation of spotted owl habitat which occurs during the earlier restoration phase of the HCP is possibly more significant than that which occurs during the later maintenance and enhancement phase because, during that later phase, the harvest and development of potential spotted owl habitat will be more or less at equilibrium and, hypothetically, landscapes will have more or less stable occupancy by owls. This suggests that measures to minimize habitat degradation during the restoration phase are of potentially greater importance than they might be during the maintenance and enhancement phase and that measures to mitigate for take are likely of roughly equal importance during both phases because mitigation during the restoration phase is predicted to enable the equilibrium among harvest and development of habitat that is intended during the maintenance and enhancement phase.

Riparian Conservation Strategy for the Olympic Experimental State Forest

INTRODUCTION

The riparian conservation strategy proposed for the Olympic Experimental State Forest is distinct from that for other HCP planning units because of the unique physical and ecological features of the western Olympic Peninsula. The need for special protective measures stems from a high potential throughout the Experimental Forest for:

(1) mass wasting (i.e., landslides, debris torrents, channel-bank collapse), due to highly erosive, weathered bedrock and overlying glacial deposits, heavy annual precipitation, and steep terrain, and

(2) tree blowdown, due to alignment of major river valleys with the prevailing wind directions, fully saturated soils during the winter months, and edge effects associated with clearcutting adjacent to mature timber stands.

Of the many factors affecting habitat for salmonids and riparian-dependent species, mass wasting and windthrow exert the greatest short- and long-term influences. Hence, this conservation strategy explicitly addresses these two driving factors by creating riparian buffers designed to minimize mass wasting and windthrow. A principal working hypothesis of this approach is that buffers designed to minimize mass wasting and blowdown will be sufficient to protect other key physical and biological functions of riparian systems.

This riparian strategy is unique because it incorporates experimentation as a means of developing and evaluating new methods of integrating forest-commodity production with protection of riparian-ecosystem health. This emphasis reflects the primary mission of the OESF. In addition, the riparian conservation strategy cannot be separated from other conservation and forest management measures for the OESF. All conservation, research, and management strategies were designed in concert to achieve an integrated management approach. Conservation measures for upland species, hence, rely in part on the riparian conservation strategy to meet their short- and long-term objectives. For example, proposed buffers on streams and streamside habitat account for more than 50 percent of habitat projected for the northern spotted owl on DNR-managed lands within the Experimental Forest.

As in the conservation proposal for the northern spotted owl in the OESF, the riparian strategy sets objectives for protecting and restoring functional species habitat, rather than prescriptions for forest practices within proposed riparian-buffer areas. Currently, scientific understanding is incomplete with regard to riparian processes, the complex interactions between physical and biological parameters within riparian ecosystems, and the long-term impacts of forest management activities on these processes. Riparian buffers, therefore, are proposed as the present best means for protecting a number of important habitat features, such as stream bank stability and coarse woody debris inputs, in lieu of a scientifically proven method for protecting all aspects of riparian ecosystems. A central mission of the OESF is to explore these relationships through research and monitoring, in order to acquire a better understanding of riparian ecosystems in managed landscapes. The type and intensity of management activities within proposed riparian buffers will depend on their ability to achieve riparian objectives in the short and long term. Management approaches will be adaptive, to incorporate new insights obtained from experiments and other sources into effective management strategies.

Conservation Objectives

DNR-managed lands within the OESF shall be managed to:

(1) maintain and aid restoration of the composition, structure, and function of aquatic, riparian, and associated wetland systems which support aquatic species, populations, and communities;

(2) maintain and aid restoration of the physical integrity of stream channels and floodplains;

(3) maintain and aid restoration of water to the quantity, quality, and timing with which these stream systems evolved (i.e., the natural disturbance regime of these systems);

(4) maintain and aid restoration of the sediment regime in which these systems evolved, and

(5) develop, use, and distribute information about aquatic, riparian, and associated wetland-ecosystem processes and on their maintenance and restoration in commercial forests.

These objectives reflect the requirements for maintaining habitat that is capable of supporting viable populations of salmonid species, as well as for other non-listed and candidate species dependent on in-stream and riparian environments. The riparian conservation objectives also incorporate the OESF mission. Objective 5, in particular, seeks the implementation of a structured and credible program of research, experimentation, and monitoring to aid forest management and the scientific understanding of riparian systems in managed landscapes.

The principal underlying theme of these objectives is the need to conserve habitat complexity afforded by natural disturbance regimes on the western Olympic Peninsula. Habitat complexity includes (e.g., see Bisson et al. 1992):

(1) variations in stream-flow velocity and stream depth created by structural obstructions to channel flow;

(2) physical and biological interactions between a channel and its floodplain;

(3) aquatic and riparian structures that provide cover from predators;

(4) a variety of stream substrates that includes gravel for fish spawning and macro-invertebrate habitat;

(5) sufficient storage area within channels and floodplains for sediment and organic matter; and

(6) diversity of riparian vegetation that provides adequate sources of woody debris and nutrients to channels and that moderates water and air temperatures within the riparian corridor.

Habitat complexity is maintained by natural events such as landslides, debris flows, peak stream-flows (floods), fires, forest-disease outbreaks, and vegetation changes associated with forest competition, all of which periodically deliver sediment, wood, nutrients, and water to riparian areas from upslope and floodplain sources (Pringle et al. 1988; Benda et al. 1992; Naiman et al. 1992).

Riparian Ecosystem Defined

For the purposes of this riparian conservation strategy, riparian areas are defined as three-dimensional zones of direct interaction between terrestrial and aquatic environments. They encompass the forest canopies, floodplains, wetlands, open bodies of water (e.g., ponds, lakes, estuaries, and nearshore marine environments), channel banks and beds, surface waters, and ground water zones that connect channels with adjacent hillslopes and floodplains (Swanson et al. 1982; FEMAT 1993).

Aquatic systems are considered part of the riparian ecosystem for the purposes of the OESF. Aquatic systems directly influence, and are influenced by, riparian zones and upland areas that contribute water, organic matter, sediment, detrital nutrients, prey (e.g., macro-invertebrates), heat, and energy to a stream channel (Figure IV.8).

The aquatic system of the northwestern Olympic Penisula encompasses estuarine and near-shore marine environments that are occupied during a life stage of anadromous organisms and that influence the nutrient and mineral exchange, water quality, and morphology and dynamics of Olympic coastal channels. DNR recognizes the importance of minimizing impacts to estuarine and near-shore environments associated with forest practices on DNR-managed lands, although the cumulative effects of such impacts are derived as well from management activities on lands not managed by DNR. The OESF riparian conservation strategy, therefore, contains no explicit measures for protecting estuarine and near-shore environments, other than to minimize sedimentation and declines in water quality related to forest practices on DNR-managed lands.

CONSERVATION STRATEGY

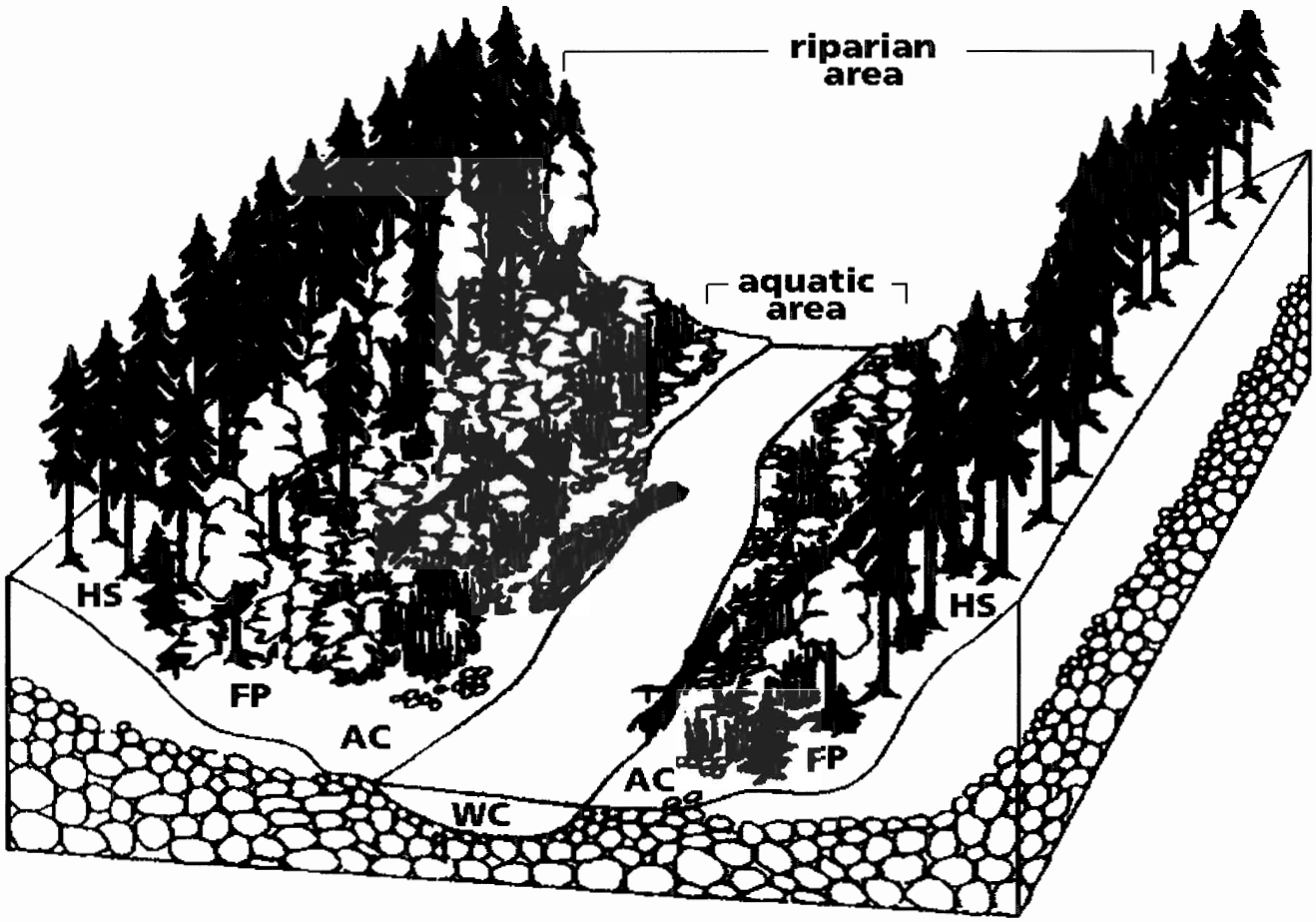
The riparian conservation strategy for the OESF seeks to meet the stated objectives by establishing:

(1) interior-core buffers on all stream types (although not on all streams — see discussion titled Interior-core Buffers regarding buffers for Type 5 streams),

(2) exterior wind buffers on all stream types (although not on all streams — see discussion titled Exterior Buffers regarding use of wind buffers),

Figure IV.8: Geomorphic features associated with riparian areas

The active channel (AC) includes the wetted channel (WC) and active channel surface exposed during low flow. Floodplains (FP) are located between the active channel and hillslope (HS); they support mosaics of herbs, shrubs, and deciduous trees. Conifers dominate riparian forests on lower hillslopes. (Modified from Gregory et al. 1991)



(3) comprehensive road-maintenance plans,

(4) protection of forested wetlands, and

(5) a research and monitoring program integrated with on-the-ground riparian protection.

These five components are described below.

Interior-core Buffers

Interior-core riparian buffers are intended to minimize disturbance of unstable channel banks and adjacent hillslopes (i.e., potential areas of mass wasting) in order to protect and aid natural restoration of riparian processes and functions. Harvesting in interior-core buffers can occur, provided that management activities are consistent with the conservation objectives. The ability of management, conservation, and restoration activities to meet the conservation objectives will be evaluated through landscape-level assessments of the physical and biological conditions of

riparian forests (discussed later in the subsection titled Implementing the Riparian Conservation Strategy).

DNR's working hypothesis, based on current knowledge, is that riparian conservation objectives are best met by establishing buffers on streams and riparian forests in order to effectively maintain key physical and biological functions until streams recover sufficiently from past disturbances to allow greater integration of commodity production and conservation. The width of riparian buffers will be determined on a site-specific basis, according to the assessment procedure described later in this section. Although buffers will be established based on landscape-level field evaluations, DNR expects that buffer widths will be, on average, comparable to those in Table IV.5. (See Chapter IV, Section D, pg. IV.58.) The buffer widths for each stream type, as shown in Table IV.5, have been calculated based on average buffer dimensions that were used by DNR's Olympic Region from 1990 through 1994 to protect unstable ground in the Experimental Forest. Buffer widths established once the Experimental Forest is under way, therefore, are not expected to vary substantially from those in Table IV.5 because they reflect current practices for protecting unstable ground.

Average buffer widths are given in Table IV.5 as average horizontal distances measured outward from the outer margin of the 100-year floodplain on either side of the stream. The 100-year floodplain is the valley-bottom area adjoining the stream channel that is constructed by the stream under the present climatic regime and overflowed at times of very high discharge (i.e., flooding associated with storms of a 100-year recurrence interval (Dunne and Leopold 1987)). One-hundred-year floodplains commonly are delineated by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRM) for each county of a state. The 100-year floodplain includes meandering, braided (i.e., multiple channel braids), and avulsion channels, as well as side channels that transport water from one part of a mainstream channel to another. Avulsion channels are portions of mainstream and side channels that have been abandoned temporarily by lateral displacement of the channel network elsewhere on the floodplain but are expected to be reoccupied when the network migrates back across the valley bottom.

The 100-year floodplain, which often encompasses the channel-migration zone, frequently occupies a several-hundred-foot wide section of the valley bottom on low-gradient, alluvial river systems. On higher-gradient streams in moderate to steep terrain, the 100-year floodplain typically coincides with the active channel margin or extends only a few feet beyond the active (e.g., the high-water mark). The active channel consists of the wetted area and bed or bank surfaces exposed during low flows, as well as portions of the valley bottom nearest the channel that are inundated during typical flood events (i.e. comparable to the two-year recurring flood). Active channel margins commonly are identified in the field by piles of accumulated flood debris, overbank sediment deposits, streamside vegetation altered or damaged by channel flows, bank scour, and the absence of aquatic biota (e.g., algae) normally found in slack-water channels. In the five west-side planning units and the OESF, DNR manages only a few hundred acres on 100-year floodplains of the major river systems. Most floodplain acreage is privately owned or federally managed. FEMA maps indicate that most 100-year floodplains are associated with Type 1 and 2 waters. Collectively, Type 1 and 2 waters represent less than 5 percent of stream miles on DNR-managed lands. Hence, the impact to DNR management associated with using the 100-year floodplain as the inner margin of riparian management zones is relatively negligible.

Analysis of channel-floodplain geography in the Experimental Forest suggests that the combined interior-core and exterior buffers (to be described in the next subsection) are sufficient to protect the key physical and ecological functions of floodplains. (See Rationale for the Riparian Conservation Strategy later in this section). DNR manages only a few acres on the 50- to 100-year floodplains of the major river systems on the western Olympic Peninsula; most of this floodplain acreage is privately owned. Only 3 percent of the stream network on DNR-managed lands in the OESF is classified as Type 1 streams, and only 2 percent is Type 2 streams. (Stream types are defined in WAC 222-16-030.) On these streams, the 100-year floodplains typically are narrower than the proposed OESF riparian buffers, or the channels are incised deeply through glacial terraces, thereby limiting the stream's ability to migrate laterally or form extensive floodplains.

Widths of the interior-core buffer (Table IV.5) are given as average values because the lateral extent of riparian corridors varies locally with channel size, valley confinement, and landform characteristics. Furthermore, these widths should not be interpreted as maximum or minimum target values because site conditions might call for enlarging or reducing the buffer locally based on the extent of unstable ground. Each interior-core buffer will be designed to accommodate all channel, floodplain, and hillslope areas susceptible to mass wasting. Such protection would include channel-bed and floodplain surfaces that have the potential for trapping sediment and other materials carried downstream by debris flows and associated dam-burst floods. Riparian buffers that have been adjusted on the ground to accommodate site-specific physical conditions and conservation objectives, however, should be comparable in width to the recommended average buffers presented in this strategy. This follows from the fact that the recommended widths were derived statistically from actual riparian buffers that have been implemented to protect unstable ground in the OESF.

All Types 1 through 4 streams will be protected with interior-core buffers (Table IV.5). A separate protocol is warranted for Type 5 channels because of the abundance and variety of intermittent streams found on the western Olympic Peninsula. Management objectives in the Experimental Forest are to protect all Type 5 streams that cross unstable ground and occupy stable ground but have identifiable channels with evidence of water discharge or material transport. An identifiable channel is one in which the channel banks are well defined and measurable (Chorley et al. 1984). In the OESF, approximately 90 percent of Type 5 streams occupy unstable ground and directly contribute materials to the channel network. About 5 percent have identifiable channels on stable ground. The remaining 5 percent exert a negligible influence on aquatic or riparian habitat and, thus, require no special protection. Channels in this last group include those not connected to the watershed stream-network (e.g., sinks, seasonal wet areas excluding forested wetlands), slope depressions with no identifiable banks (e.g., swales with a continuous groundcover), and artificial channels that do not support aquatic habitat (e.g., ditches, yarding trails).

There are no available quantitative models or databases that specify which Type channels require buffer protection. Hence, determinations of location and size of riparian buffers on Type 5 streams will be made on a case-by-case basis in the field, using a 12-step watershed-assessment procedure described later in this chapter. The objectives-based nature of this riparian conservation strategy requires that assessments and proposals for manipulative research or management be reviewed by a qualified physical scientist. In addition, streams listed as Type 9 (unclassified) or streams not in DNR's

hydrology databases will be treated similarly. Type 4 or 5 streams documented to contain fish that are proposed or candidates for federal listing will be treated as Type 3 waters. Type 5 channels with a potential for delivering water, wood, sediment, nutrients, and energy to the channel network will be protected from the active channel margin outward tot he topographic break in slop on either side of the channel, as well as upstream to the channel initiation point and downstream to the channel confluence. (See Figure IV.9).

Figures IV.10, IV.11, and IV.12 demonstrate one of several potential scenarios for the adjustment of riparian-buffer widths to meet site conditions. These buffer configurations are based on mass-wasting inventories and field assessments of physical and ecological riparian conditions. Figure IV.10 shows the application of the expected average interior-core and exterior buffer widths to a segment of the Clallam River and its tributaries. Figure IV.11 compares the expected average riparian buffer widths for the same area and buffers designed solely on the basis of mass-wasting inventories. Figure IV.12 shows one potential example of a buffer configuration that would include mass-wasting sites and meet riparian conservation objectives for maintaining physical and ecological functions of the riparian system.

Exterior Buffers

Exterior riparian buffers are intended to protect the integrity of interior-core buffers from damaging winds. Exterior buffers will also help maintain channel-floodplain interactions, moderate riparian microclimate, shield the inner core from the physical and ecological disturbances of intensive management on upslope sites, and maintain diverse habitat for riparian-dependent and upland biota.

This riparian strategy treats the design and the layout of the exterior buffer in two ways:

(1) it intends light partial harvests, tailored to local landform and meteorological conditions, as an initial management approach (see discussion below);

(2) it relies on experiments, from which DNR can gain new knowledge to improve management techniques in riparian forests.

Although tree blowdown is recognized as a significant problem for timber management on the western Olympic Peninsula, the exact relation between timber harvest and tree blowdown is not well understood or documented. Hence, the purpose of the experiments in the exterior buffer will be to determine, for representative site conditions, the optimum buffer width and long-term management strategies for maintaining wind-firm streamside forests. Harvest and other management activities in the experimental exterior buffers, therefore, could follow any one of a series of experimental designs that will be replicated across the landscape to ensure statistical significance of experiment results.

Widths for the exterior buffers were estimated by qualitatively evaluating historical patterns of windthrow resulting from average winter storms in the OESF and by reviewing the limited information available from local wind-buffer trials. As a starting hypothesis, the average width of exterior buffers will be 150 feet for Type 1 through 3 streams and 50 feet for Type 4 and 5 streams (Table IV.8), measured in horizontal distances laterally from the outer edge of the interior-core buffer on either side of the stream. These

Figure IV.9: Example of management protection (riparian buffer) placed on Type 5 channel system

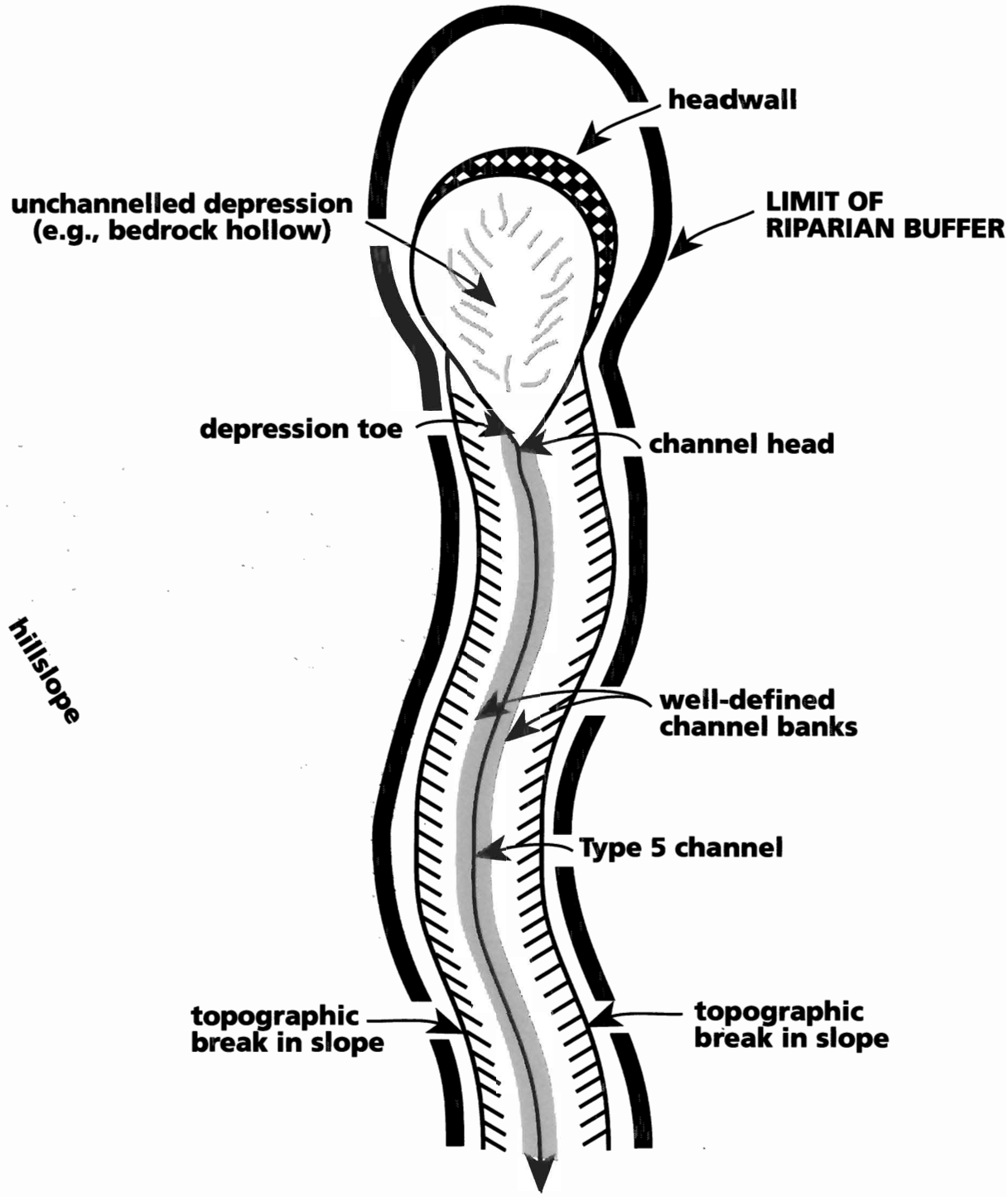
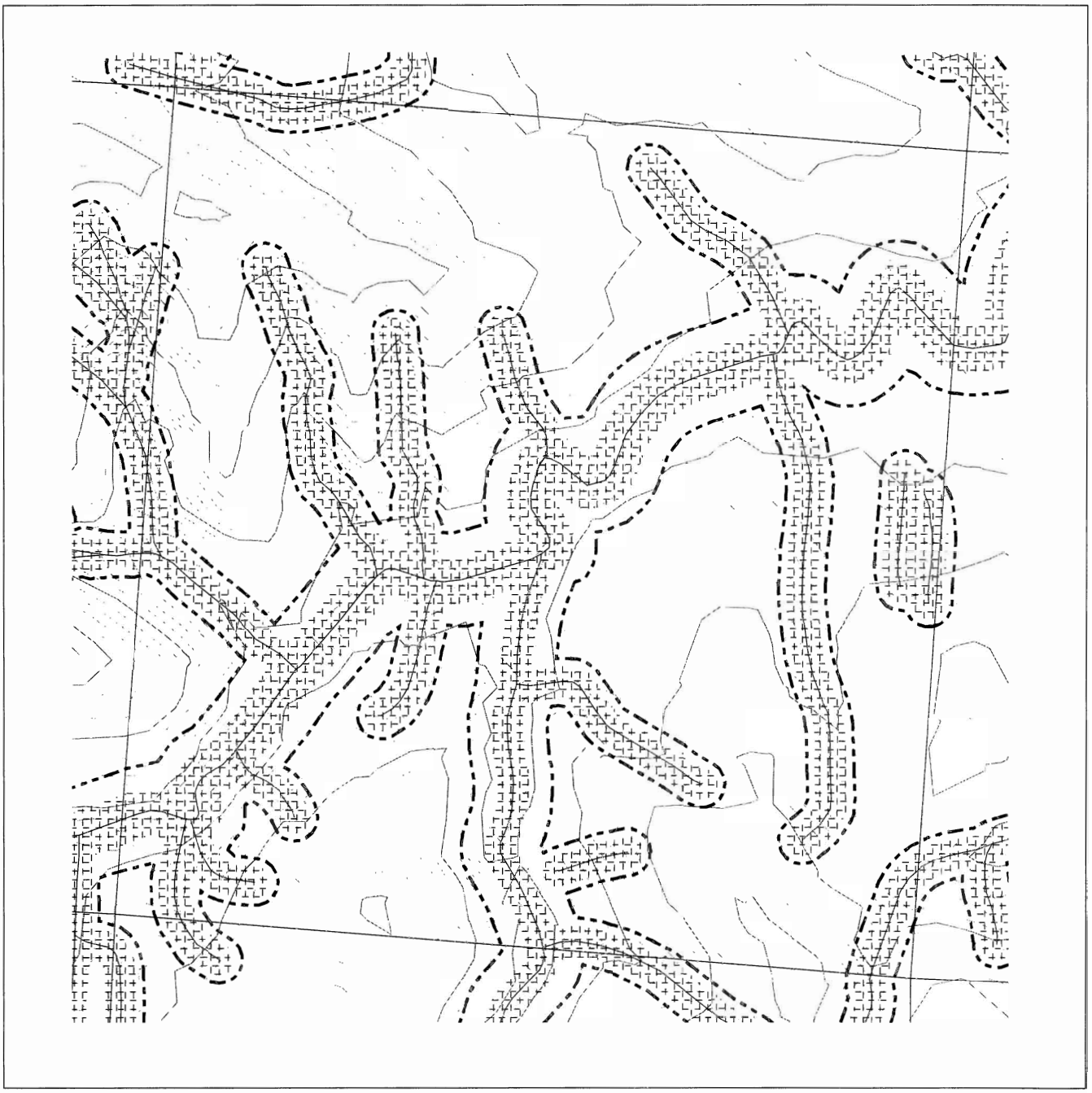


Figure IV.10: Application of expected average interior-core and exterior buffer widths to a segment of the Clallam River and its tributaries

These buffers have not been adjusted to meet site-specific requirements for unstable slopes. For purposes of simplicity, this figure assumes all Type 5 streams are buffered. However, that is not how the strategy will be implemented. See text.

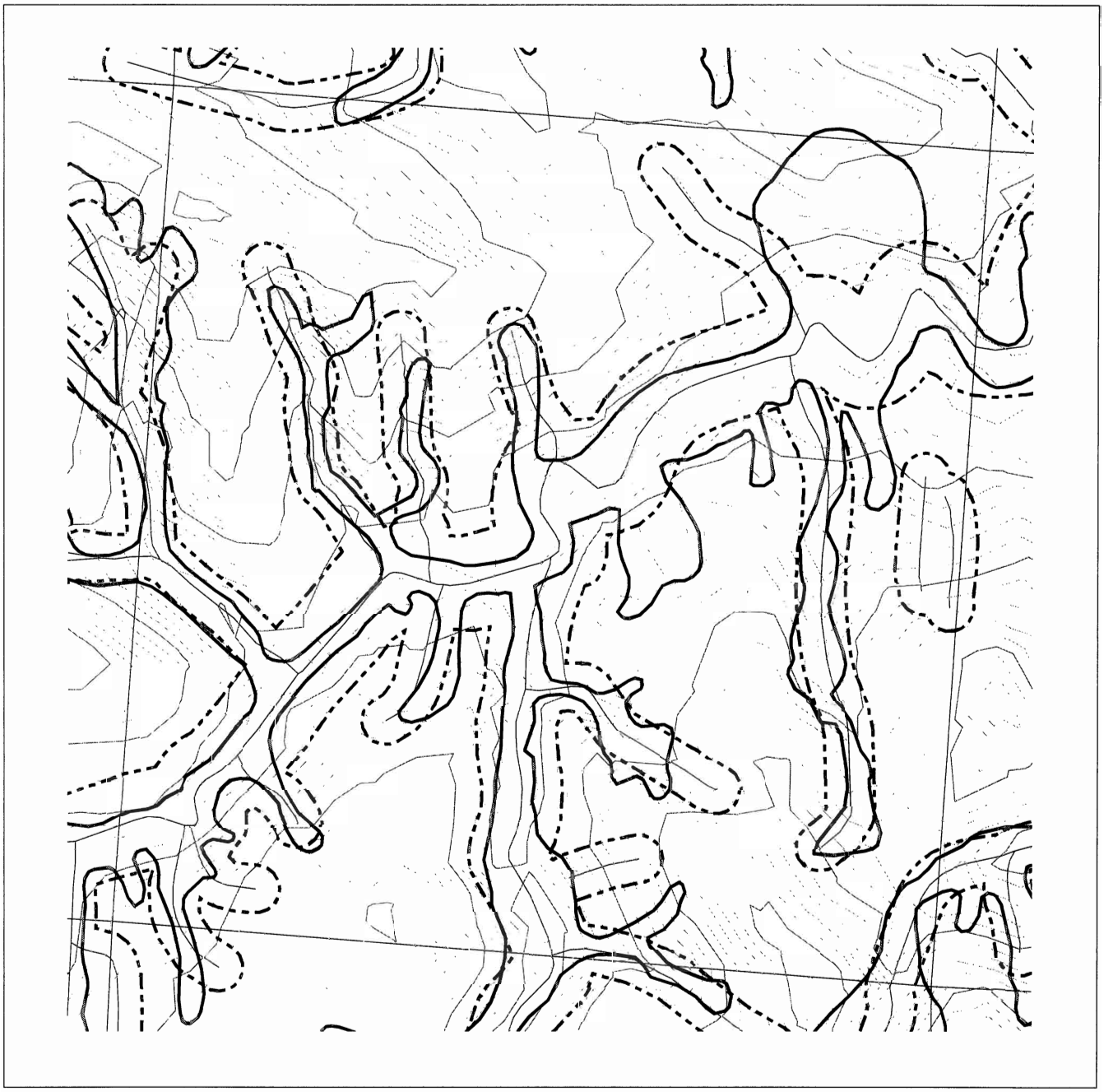


External riparian buffer

Interior-core riparian buffer

T31N R12W - Sec. 8
Scale 1:12,000
Contour Interval = 40 feet
September 18, 1995

Figure IV.11: Comparison of expected average riparian buffer widths and buffers applied to protect only mass-wasting sites for a segment of the Clallam River and its tributaries



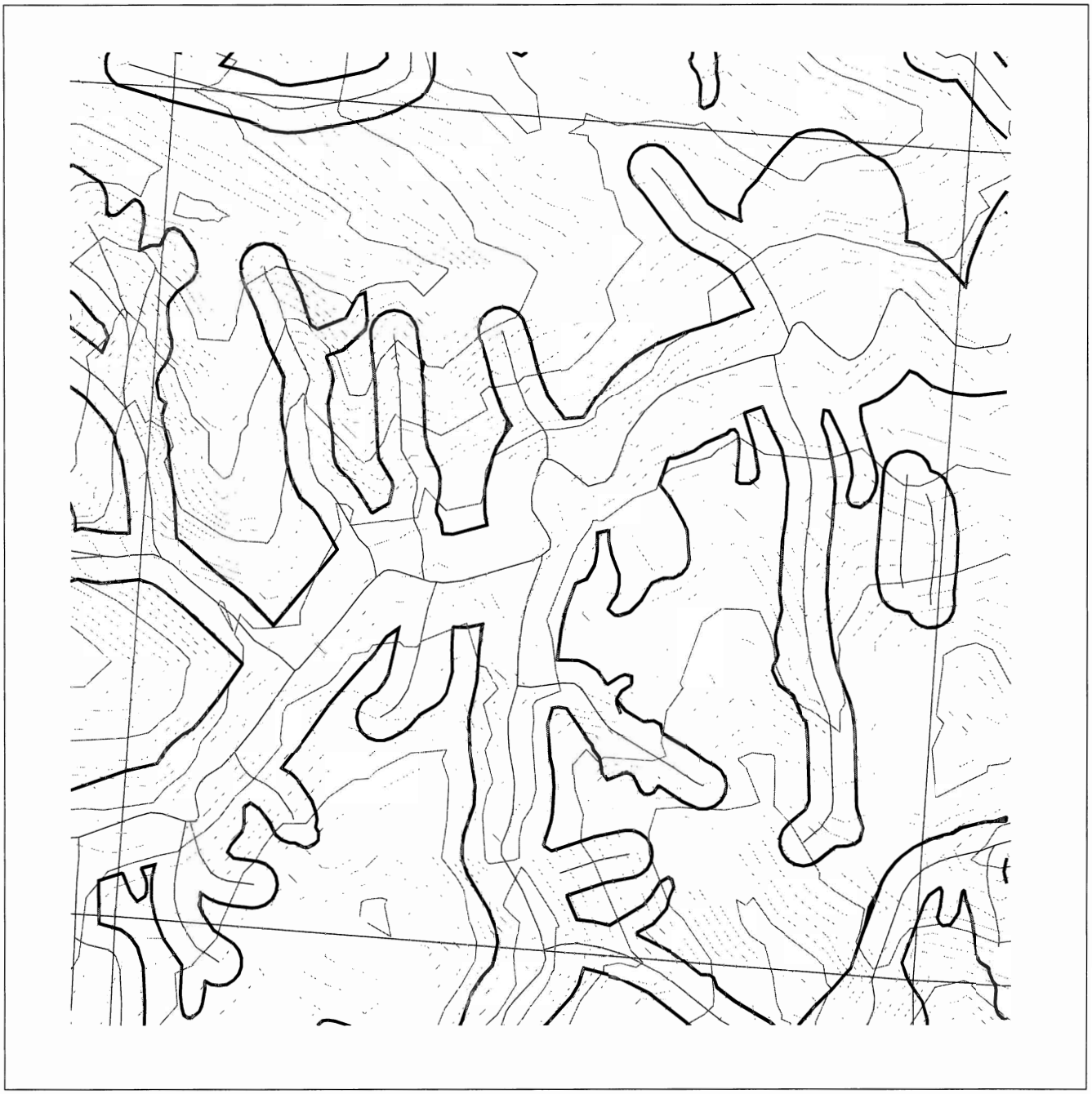
External riparian buffer

Mass-wasting buffer

T31N R12W - Sec. 8
Scale 1:12,000
Contour Interval = 40 feet
September 18, 1995

Figure IV.12: Application of expected average riparian buffer widths adjusted for mass-wasting sites for a segment of the Clallam River and its tributaries: one potential scenario

This buffer configuration meets riparian conservation objectives for maintaining physical and ecological functions of the riparian systems.



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Scale 1:12,000
Contour Interval = 40 feet
September 18, 1995

are average, rather than absolute, values because the size and configuration of wind buffers must vary locally to accommodate terrain and stand characteristics. Management to achieve wind-firm riparian stands will be adaptive, in order to test a variety of strategies and apply those strategies that are most effective in the long term.

Table IV.8: Proposed average widths of exterior riparian buffers in the Olympic Experimental State Forest

Widths are expressed as average horizontal distances measured outward from the interior-core buffer on either side of the stream. Widths are proposed as a working hypothesis and are based on local knowledge of windthrow behavior. Buffer widths and design will be evaluated through experiments in buffer design in the OESF. Buffers will be applied where necessary (see text).

Stream type	Width of riparian exterior buffer (horizontal distance, rounded to the nearest 10 feet)
1	150
2	150
3	150
4	50
5	50

Exterior buffer widths (Table IV.8) will be applied to interior-core buffers through a standard procedure or an experimental approach as follows:

(1) Standard procedure: To achieve the objective of wind-firm riparian forest, wind buffers will be placed on all riparian segments for which stand wind-firmness cannot be documented by historical information, windthrow modeling (e.g., Tang 1995), or other scientific means. Thirty-three percent or less, by volume, of the riparian trees in the designated exterior buffer may be removed for commercial purposes (i.e., excluding pre-commercial thinning and restoration activities) per rotation, until research is available supporting more frequent entry. This percentage corresponds to the lightest intensity partial harvest currently used in the Experimental Forest to produce forest stands that are robust and diverse, both structurally and compositionally. The spacing of tree removal will be determined in the field from an assessment of physical and biological conditions of each site (see Implementing the Riparian Conservation Strategy later in this section), windthrow potential, and the stated objectives of the riparian conservation strategy for the OESF. Exterior buffers within a landscape planning unit will not be harvested a second time until the conservation objectives of the riparian strategy are met in that landscape planning unit.

(2) Experimental approach: Foresters and managers will select from a number of experimental designs for the exterior buffer and apply the chosen design to the management area of interest. The designs for the outer buffer will be developed by DNR with input from others such as the Olympic Natural Resources Center and Timber-Fish-Wildlife Agreement cooperators and approved by DNR. The intent is to create a number of viable experimental designs for each of

several distinct riparian configurations in the Experimental Forest, identified on the basis of their landform, orographic, vegetational, and meteorological characteristics. The process will be documented and monitored closely to ensure that unsuccessful experimental designs are discarded, riparian disturbances are minimized, and adequate numbers of replicated experiments are performed to yield statistically meaningful results.

Not all riparian areas lend themselves to experiments because many forest stands have been fragmented by previous harvest activities. Fragmented forests in the OESF principally contain late successional stands, old-growth remnants, or trees that regenerated after the widespread windstorm in 1921 (referred to as "1921-blow" stands). Management activities in these forests should be consistent with the stated objectives of the riparian conservation strategy and with other conservation efforts that require stands in older age classes to achieve forest-wide biodiversity and suitable habitat (e.g., for species like the northern spotted owl).

DNR anticipates that the standard practice for implementing exterior buffers, as described above, will be applied on approximately 75 to 85 percent of the riparian areas in the OESF. In the remaining acreage, exterior buffers will be established via the experimental procedure. Experimental designs may range from no exterior buffer in wind-firm stands meeting the stated objectives of the riparian conservation strategy to buffers several hundred feet wider than those recommended (Table IV.8) in sites highly susceptible to windthrow. Experiments will be tracked through the OESF research and monitoring program. (See the sections titled Monitoring and Research in Chapter V.) Experiments will be conducted such that the protection and restoration objectives of this riparian strategy will not be knowingly compromised, recognizing that there is some risk of habitat alteration and incidental take associated with conducting experiments in riparian buffers.

Comprehensive Road-Maintenance Plans

The objectives of a comprehensive road-maintenance plan are to:

(1) ensure annual inventories of road conditions;

(2) maintain existing roads to minimize drainage problems and stream sedimentation;

(3) stabilize and close access to roads that no longer serve a management function or that cause intractable management or environmental problems;

(4) assure sound construction of any new roads;

(5) guarantee that additional new roads are built only where no other operationally or economically viable option exists for accessing management areas by existing roads or alternative harvest methods (e.g., full-suspension yarding);

(6) minimize active road density;

(7) prioritize roads for decommissioning, upgrading, and maintaining; and

(8) identify fish blockages caused by stream crossings and prioritize their retrofitting or removal.

No absolute threshold exists for acceptable road densities within drainage basins because the maximum carrying capacity for roads in a watershed depends on the topography, geology, climate, and competing ecological and land-use objectives, as well as road use, type, location, and construction method. Cederholm and Reid (1987) reported that 2.5 miles per square mile or less constitutes the optimum number of road miles for the Clearwater River basin. Roads on flatter ground than the Hoh-Clearwater terrain, however, are less likely to deliver sediment to streams; therefore, comparatively more roads might be possible without degrading water quality. Hence, optimum road densities must be determined on a watershed basis.

The riparian conservation strategy seeks to use landscape-planning tools to analyze the projected needs for roads over the long term (i.e., greater than 100 years) and use this information to minimize the total road density within each watershed. The Clallam River Landscape Plan (DNR Olympic Region 1995) represents one of several prototypes for how DNR envisions carrying out this objective in the 11 landscape planning units in the Experimental Forest. This method or other similar ones would be used to address road densities elsewhere in the Experimental Forest. The specific methods or models used, however, will vary as new technologies become available.

As an example, the Clallam River Landscape Plan covers approximately 16,000 acres in the northern portion of the Experimental Forest. The plan features conservation strategies similar to those proposed for the entire Experimental Forest and seeks to schedule management activities over multiple decades consistent with the dual objectives of sustaining long-term commodity production and ecological values. The present and future transportation network was evaluated through the use of a computer model (i.e., Scheduling and Network Analysis Program, Sessions and Sessions 1994) that analyzes proposed harvest units and road networks for a given landscape unit on the basis of constraints imposed by the conservation objectives and inventoried watershed conditions. The analysis was projected 100 years into the future so that the model would create all possible management units and road networks within the planning area. The resulting road network represented the maximum road density that hypothetically would be necessary at any time in the future. The analysts then systematically evaluated each road in the transportation layer to identify roads that could be eliminated because they duplicated access by other means or, in the case of existing roads, would not be used in the future. This analysis resulted in a comprehensive, long-term (i.e., 100-year) road plan for all essential new construction, abandonment, and relocation.

Protection of Forested Wetlands

The objective of forested-wetlands protection in the Experimental Forest is to maintain and aid natural restoration of wetland hydrologic processes and functions. The wetland strategy for the OESF seeks to achieve this objective by:

(1) retaining plant canopies and root systems that maintain adequate water transpiration and uptake processes;

(2) minimizing disturbance to natural surface and subsurface flow regimes;

(3) ensuring stand regeneration.

In addition, wetlands in areas susceptible to blowdown would be treated comparably to stream buffers, with maintenance of wind-firm stands as a primary conservation objective. Harvest-design experiments to achieve sturdy buffers should be considered in these instances.

Wetlands, as defined by the state Forest Practices Board Manual (WFPB 1993a), will be protected in the OESF. Forested wetlands larger than 0.25 acre and bogs larger than 0.1 acre will be protected with buffers and special management considerations. This is consistent with Policy No. 21 of DNR's Forest Resource Plan, which calls for "no net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36). Series of smaller wetlands will be protected if they function collectively as a larger wetland. In addition to meeting the requirements stated in WAC 222-30-020(7) (WFPB Manual 1993a), nonforested wetlands will receive buffer protection consistent with DNR's wetlands policy quoted above.

Table IV.9 describes the level of buffer protection proposed for forested and nonforested wetlands in the Experimental Forest. Average buffer widths are measured from the outer edge of the forested wetland, as defined by the U.S. Fish and Wildlife Service. (See Bigley and Hull 1993.) The recommended buffer width for wetlands greater than 5 acres is equal to the average site potential tree height for riparian forests in the OESF. For wetlands between 0.25 and 5 acres, the recommended buffer width averages two-thirds of the site potential tree height. Site-potential tree heights are determined from Wiley (1978) for dominant conifer species; see discussion related to coarse woody debris in Summary: Benefits of the Riparian Conservation Strategy later in this section.

Table IV.9: Proposed protection of forested and nonforested wetlands in the Olympic Experimental State Forest

Average buffer widths are measured from the outer edge of the forested wetland. Average buffer widths for forested wetlands: 150 feet for wetlands greater than 5 acres;100 feet for wetlands 0.25 to 5 acres.

Harvest within forested wetlands and their buffers	▮ Retain at least 120 square feet basal area ▮ Take appropriate steps to maintain wind-firm buffers, as per recommendations for exterior riparian buffers
Harvest within forested buffers of nonforested wetlands	▮ No harvest within 50 feet of wetland edge ▮ Harvest within buffers beyond 50 feet designed to maintain stand wind-firmness, as per recommendations for exterior riparian buffers ▮ Leave trees should be representative of the dominant and co-dominant species in the intact forest edge of the wetland

DNR estimated that retaining 120 square feet basal area in forested wetlands would maintain a minimum level of hydrologic function in wetland trees. This estimate is derived from models of leaf area recovery following harvest. Basal area is assumed to be an adequate surrogate for leaf area index in predicting the impacts of partial harvest on tree evapotranspiration and canopy interception. Predictions of leaf area index response (Kimmins 1993; McCarthy and Skaggs 1992) indicate that improvements in leaf area index with time should compensate for some modifications of wetland hydrology associated with tree removal. (See Section D of this chapter titled Riparian Strategy for the Five West-side Planning Units for additional discussion of the leaf area.)

Integration of Research and Monitoring

The riparian conservation strategy is integrated with the research and monitoring strategy for the OESF described in Chapter V. All experiments performed in riparian areas, particularly those to evaluate windthrow behavior in riparian forests, will be carried out according to research protocols established for the Experimental Forest. Watershed conditions will be monitored over time through:

(1) the monitoring method described in Standard Methodology for Conducting Watershed Analysis (WFPB 1995);

(2) the monitoring program established for the Hoh River, Kalaloch Creek, and Nolan Creek drainages (Hoh Tribe and DNR, Memorandum of Understanding, 1993); and

(3) the monitoring strategy for the Experimental Forest, implemented through the landscape planning program or the proposed 12-step watershed-assessment procedure. (See Implementing the Riparian Conservation Strategy later in this section.)

RATIONALE FOR THE RIPARIAN CONSERVATION STRATEGY

The effects of forest management activities on the physical and biological condition of riparian ecosystems, particularly with regard to the loss of habitat complexity, have been documented locally on the Olympic Peninsula (e.g., Cederholm and Lestelle 1974; Cederholm and Salo 1979; Schlichte et al. 1991; Benda 1993; Shaw 1993; Quinn and Peterson 1994; DNR and U.S. Forest Service 1994; DNR, Olympic Region 1995; McHenry et al. 1995; DNR and U.S. Forest Service, Sol Duc Watershed Analysis, in progress), as well as throughout the Pacific Northwest (e.g., Harr et al. 1975; Bisson and Sedell 1984; Grant 1986; Swanson et al. 1987; Bisson et al. 1992). Management-related modifications of riparian habitat occur, regardless of who owns or manages the land, as a consequence of the terrain characteristics, soil properties, rainfall regimes, and other natural phenomena that increase susceptibility to mass wasting and changes in channel morphology. The principal causes for loss of habitat complexity in the OESF are:

(1) channel erosion and sedimentation associated with landslides and related channel disturbances (e.g., debris flows and dam-burst floods);

(2) reduction in stream shade and delivery of organic debris to the channels due to alteration of the structure and composition of streamside forests; and

(3) channel-bank erosion and loss of long-term sources of coarse woody debris due to past management practices and extensive windthrow disturbances.

The dimensions of the interior-core buffers have been set on the basis of locally documented requirements for protecting channel margins and hillslopes susceptible to mass wasting. DNR chose this physical rationale because relatively more quantitative information exists regarding landforms and geomorphic processes than for ecological processes affecting riparian areas within the Experimental Forest. (See supporting evidence and discussion concerning current riparian practices in the Experimental Forest in the Draft EIS that accompanies this HCP.) Buffers wider than currently mandated by state-regulated Riparian Management Zones (WFPB 1993a) are frequently needed to incorporate unstable ground in the OESF. For example, most Types 4 and 5 streams in proposed harvest areas with slopes exceeding approximately 70 percent are protected by no-harvest buffers because of the recurrence and severity of landslides and debris flows that originate in the headwalls of these drainages (Benda 1993; Hoh Tribe and DNR 1993; O'Connor and Cundy 1993; Shaw 1993; DNR, Olympic Region, 1995; McHenry et al. 1995). Type 5 channels are a special concern in the Experimental Forest because they are the primary conduit for delivering material from upslope areas to fish-bearing stream reaches. Furthermore, current practices in DNR's Olympic Region commonly provide greater protection than state-regulated Riparian Management Zones in low-gradient alluvial stream systems (i.e., Types 1-3) because state-regulated Riparian Management Zones frequently do not adequately protect incised channel margins, unstable terrace and hillslope margins, and floodplain wetlands.

The dimensions of the exterior buffer represent DNR's best understanding of what might be required to protect the integrity of the interior-core buffers. A number of site factors promote susceptibility to windthrow on the western Olympic Peninsula, but there are no proven management techniques for successfully minimizing potential windthrow. The conservation strategy, which really is a working hypothesis, will lead toward better understanding of windthrow in managed forests through experimentation and systematic application and refinement of knowledge gained.

Although the riparian conservation buffers have been established on the basis of physical arguments, DNR expects that these buffers will contribute to the maintenance and recovery of ecological habitat complexity in aquatic and riparian systems. This hypothesis derives from the current understanding of the dynamics and processes of these systems. For that reason, research and monitoring can improve scientific knowledge and management practices in the Experimental Forest.

Table IV.10 compares the average buffer widths proposed for mass-wasting and windthrow protection in the OESF with those recommended in the literature for key physical and ecological parameters that are essential for creating and maintaining riparian and aquatic habitat in the OESF. This is not an exhaustive list of the ecological variables in riparian areas, but rather those key parameters about which enough is currently known to guide the development of best management practices in riparian areas. The importance of these parameters for salmonids is discussed generally in Section D of Chapter III titled Salmonids and the Riparian Ecosystem. The benefits of the riparian conservation strategy with regard to these parameters are summarized in the next paragraphs.

Table IV.10: Comparison of average riparian buffer widths expected as a result of applying the Olympic Experimental State Forest riparian conservation strategy and buffer widths proposed in the literature for several key watershed parameters

Buffer widths are given as average horizontal distances (or range of averages) outward from the active channel margin.

Key watershed parameter	Buffer width by stream type - proposed for the OESF				
	1	2	3	4	5
Mass wasting	150 ft all Type 1 streams will be protected	150 ft all Type 2 streams will be protected	100 ft all Type 3 streams will be protected	100 ft all Type 4 streams will be protected	0-500+ ft; depends on size of contribution area[1] and amount of unstable ground[2]
Mass wasting and windthrow combined	150 ft inner, 150 ft outer[3]	150 ft inner, 150 ft outer[3]	100 ft inner, 150 ft outer[3]	100 ft inner, 50 ft outer[3]	variable inner, 50 ft outer[3]

Key watershed parameter	Buffer width by stream type - proposed in the literature[4]				
	1	2	3	4	5
Coarse-woody-debris recruitment[5]	108-168 ft	108-168 ft	105-153 ft	105-153 ft	105-153 ft
Stream shade availability[5]	108-168 ft	108-168 ft	105-153 ft	105-153 ft	105-153 ft
Riparian forest microclimate[6]	300 ft	300 ft	250 ft for >5-ft-wide channels	125 ft	
Channel bank stability	Commensurate with mass-wasting buffer protection on stream channels.				
Lateral channel migration	Commensurate with combined mass-wasting and windthrow protection on stream channels.				
Water quality[5]	108-168 ft	108-168 ft	105-153 ft	105-153 ft	105-153 ft
Water quantity	Unknown. Objectives of proposed buffers are to help moderate peak-flow discharges related to removal of vegetation (e.g., harvest) by ensuring hydrologic maturity of forests, as per Washington Forest Practices Board (1994).				
Windthrow	Unknown. Objectives of proposed buffers are to enhance stand wind-firmness by decreasing tree height/diameter ratios, fetch distances in adjacent harvest units, and edge effect.				
Surface and road erosion	Variable, depending on site conditions. Objectives are to minimize erosion through implementation and comprehensive road-maintenance plans for each landscape unit (see text).				

[1]"Contribution area" refers to upslope channel heads, bedrock hollows, unchannelized valleys, and topographic depressions; see discussion of OESF Type 5 drainages in the Draft EIS associated with this HCP.

[2]Refer to discussion of Type 5 drainages in the Draft EIS associated with this HCP.

[3]Exterior (wind) buffer, where harvest and management activities are allowed. On Type 5 streams, exterior buffers will only be applied as necessary where there are interior-core buffers. See text.

[4]See discussion in this section of the text for citations of current literature.

[5]Buffer widths are based on available literature citing one site potential tree height for each stream type as the ecologically appropriate measure; see discussion in text.

[6]Buffers widths are recommended by FEMAT (1993) and Cederholm (1994).

Recruitment of Coarse Woody Debris

The probability that a tree will fall into a stream is greatest where the slope distance from the tree base to the active channel margin is less than one site potential tree height (i.e., as defined in Section D of this chapter titled Riparian Conservation Strategy for the Five West-side Planning Units; FEMAT 1993). The interior-core buffer widths for each stream type on the OESF are greater than or approximately equal to the site potential tree height for a 50-year growing cycle and 70 to 90 percent of the site potential tree height for a 120-year growing cycle. Representative site potential tree heights for each stream type were calculated by identifying streams of known type on soil survey maps registered by orthophotos, determining average site indices for growth potential from survey data for soils commonly found on stream banks and floodplains, and employing tree-height tables published in Wiley (1978). Estimated site potential tree heights for the Experimental Forest are: for Types 1 and 2 streams, 108 feet for a 50-year growing period, 155 feet for a 100-year period, and 168 feet for a 120-year period; and for Types 3 through 5 streams, 105 feet for a 50-year growing period, 153 feet for a 100-year period, and 165 feet for a 120-year period. Field measurements (McDade et al. 1990) indicate that buffer widths equal to approximately 60 percent of the average tree height will provide 90 percent of the natural level of instream large woody debris. Extrapolating from these results, a buffer width equal to approximately the 100-year site potential tree height, which is more than 60 percent of the 200-year site potential tree height (i.e., 60 percent of an old-growth tree height), should provide more than 90 percent of the natural level of instream large woody debris.

Stream Shade Availability

Shade regulates stream water temperatures throughout the year. Shade is supplied primarily by the forest canopy above and adjacent to the channel. Shade, however, varies with the type, height, and density of streamside vegetation, as well as local topography and diurnal changes in position of the sun relative to channel orientation (Naiman et al. 1992). The probability that a tree will provide shade is greatest where the slope distance from the tree base to the active channel margin is equal to or less than one site potential tree height. Limited studies in the western Pacific Northwest suggest that riparian buffers about 100 feet wide supply shade equivalent to undisturbed late successional or old-growth forests (Steinblums 1977; Beschta et al. 1987). Steinblums et al. (1984) reported that buffers between 75 feet and 125 feet wide maintain 60 to 80 percent of the undisturbed canopy density and, hence, the potential for stream shading. These widths are commensurate with, or less than, those recommended for recruitment of coarse woody debris. The proposed interior-core buffers, hence, are expected to be wide enough to provide 80 to 100 percent of stream shade, provided that streamside canopies are dominated by mature conifers. In the OESF, hardwood-dominated riparian forests offer insufficient shade following seasonal loss of foliage to moderate winter water temperatures (e.g., Hatten and Conrad 1995). Goals of the OESF riparian conservation strategy, therefore, are to maintain sufficient buffers in mature stands to moderate water temperatures year round and to manage for conifer succession in hardwood-dominated stands and young plantations. Because 70 percent of the riparian areas on DNR-managed lands in the OESF are hardwood-dominated or young stands, however, recovery of full stream-shade potential will take several decades.

Nutrient Input to Streams

Riparian vegetation regulates the food-energy base of aquatic ecosystems by supplying plant and animal detritus to the stream and forest floor. Dissolved nutrients and litter derived from flowers and fruits, leaves,

needles, wood, and insects provide essential food for aquatic invertebrates and fish (Gregory et al. 1991; Bilby and Bisson 1992). The Forest Ecosystem Management Assessment Team (1993) suggests that input of plant litter and other organic particulates from streamside forests decreases beyond a distance of about one-half tree height from the active channel margin. Other information relating probability of nutrient input to slope distance from the channel margin is scarce. Hence, the working hypothesis for the OESF is that sufficient forest-generated nutrients will be supplied from the area of interior-core buffers to maintain nutrient delivery to streams. The Experimental Forest will provide a forum for testing these hypotheses.

Alders, in particular, are important components of the aquatic and riparian ecosystem because they fix nitrogen and are significant sources of nitrogen as a dissolved nutrient. Although a goal of the Experimental Forest is to aid regeneration of conifers in hardwood-dominated stands, it is also the intent to maintain a conifer-hardwood mix characteristic of natural disturbance regimes, including alders as dominant and co-dominant species where ecologically appropriate within the riparian system.

Riparian Microclimate

Riparian forests moderate climatic conditions in the transitional areas between terrestrial and aquatic environments. Riparian ecosystems support more aquatic, terrestrial, and amphibious species than upland habitats, in part because streams and streamside forests create a more humid microclimate, have higher transpiration rates, are cooler in summer and warmer in winter, and maintain moister soils and greater air movement (Brown 1985). The ability of a riparian forest to ameliorate microclimate is diminished significantly where vegetation is removed from both sides of the stream. Few data are available from the western Olympic Peninsula or elsewhere in the Pacific Northwest pertaining to the effects of forest management on riparian microclimates. The primary working hypothesis of the OESF riparian conservation strategy, therefore, is that riparian microclimate will be improved by minimizing edge effects associated with proximity of harvest units to channels and their orientation with respect to prevailing wind directions. The exterior riparian buffer reduces wind disturbances of streamside forests and shields the riparian core from edge effects associated with intensive management on adjacent ground. Part of the experimental approach in establishing exterior buffers will be to situate adjacent harvest units and employ harvest designs (e.g., partial cuts, small clearcut units, uneven-aged stands) that reduce the potential for progressive loss of riparian-buffer function by edge-effect processes (e.g., blowdown).

Characteristic riparian microclimates may also be maintained by placing buffers on both sides of a stream that are sufficiently wide to insulate water and soils from direct radiation, reduce wind velocities in riparian forests and retain soil and air humidities.

Water Quality

The riparian conservation strategy seeks to maintain and aid natural restoration of water quality in order to meet state water-quality standards for all existing characteristic uses (e.g., aquatic habitat and domestic and municipal water supplies). The principal causes of declining water quality in the Experimental Forest are water temperatures that exceed state and federal standards and turbidity associated with stream sedimentation on commercial forest lands. According to current scientific understanding, the best method to deal with temperature and turbidity problems is to place buffers on streams that are wide enough to:

(1) maintain natural background sediment-delivery rates and minimize management-related input of sediments to streams;

(2) provide enough shade to regulate water temperatures; and

(3) assure long-term sources of coarse woody debris that will trap sediment and moderate flow.

The riparian conservation strategy seeks to reduce stream turbidity by:

(1) protecting all mass-wasting and surface-erosion sites that have a potential for delivering sediment to streams;

(2) maintaining roads and limiting road densities (i.e., potential new sources of surface erosion) through comprehensive road-maintenance plans; and

(3) restoring long-term sources of coarse woody debris. This strategy also provides for maintaining and restoring stream shade. (See previous discussion of stream shade availability in this section.)

Water Quantity

Increased surface runoff to streams can result from vegetation removal (Likens et al. 1970; Eschner and Larmoyeux 1963; Blackburn et al. 1982; WFPB 1994) and increased numbers of road drainages delivering water to streams. Precipitation conditions on the western Olympic Peninsula that lead to increases in the frequency and volume of peak flows are rain-on-snow events, rainfall of high intensity and long duration typical of winter months, and heavy rain on frozen ground, which can occur during January and February. The potential for these conditions to affect seasonal and annual water quantity is influenced by the type, age, and density of forest vegetation. Approximately 19 percent of DNR-managed lands in the OESF, mostly in the Hoh and Clearwater drainages, lie in the rain-on-snow zone as defined by state forest practices regulations (WFPB 1994). The state addresses the cumulative effects of rain-on-snow events by regulating the percent area in Type 3 basins with greater than 70 percent forest-crown closure and less than 75 percent hardwood or shrub canopies.

DNR recommends using the methods for analyzing rain-on-snow and peak-flow events given in the Standard Methodology for Conducting Watershed Analysis (WFPB 1994). In addition, DNR expects that limiting the amount of new road construction and improving drainages on existing roads will reduce the potential for augmenting peak flows. Furthermore, the unzoned-forest approach to conserving habitat for listed species likely will lead to forest conditions, within about 35 years, that will assure hydrologic maturity in at least 70 percent of each Type 3 basin. Because current knowledge is incomplete, a priority research direction for the OESF is to investigate the relationships between forest management and hydrology in order to improve scientific understanding leading to effective management of water quantity.

IMPLEMENTING THE RIPARIAN CONSERVATION STRATEGY

The OESF riparian conservation strategy will be in effect throughout the life of this HCP. Landscape plans are the vehicle for implementing commodity production and conservation strategies in the Experimental Forest. Riparian buffers will serve as the foundation for landscape plans, around which forest management, conservation, and research activities will be designed. A primary objective of the Experimental Forest will be to support natural restorative processes of streams and streamside forests

by whatever means necessary, so that riparian environments can recover suf-ficiently to sustain both commercial forest enterprises and healthy ecosystems.

Prior to landscape planning in each of the 11 landscape planning units in the Experimental Forest, watershed conditions will be evaluated and monitored through a 12-step watershed assessment procedure (described later). Results from assessments of physical and biological conditions obtained from the regulatory watershed-analysis process (WFPB 1994) will be used where possible, in lieu of those assessments required in the 12-step process. Therefore, following the implementation of the OESF, preliminary assessments and management activities will occur before landscape planning in most landscape planning units.

Landscape Planning

Methods and procedures for landscape planning will likely be similar to those developed for the Clallam River Landscape Plan, which was designed for 16,000 acres of state land in the northern part of the Experimental Forest (DNR Olympic Region 1995). In this prototype landscape plan, management, economic, conservation, and recreation objectives were evaluated simultaneously. Maps of riparian buffers, designed to protect unstable ground and key ecological features, served as the primary planning layer around which other management and conservation strategies evolved. The riparian layer was built into a harvest planning model so that designs for harvest units, logging settings, and roads took into account the conservation objectives for and requirements of riparian protection. In addition, economic analyses and harvest level projections factored in the long-term costs and benefits of protecting riparian areas.

Watershed-assessment techniques used during landscape planning might include those found in the "Forest Agreement Related to the Hoh River, Kalaloch Creek and Nolan Drainages" (Hoh Tribe and DNR, Memorandum of Understanding 1993) and Standard Methodology for Conducting Watershed Analysis (WFPB 1994) and designed for the 12-step watershed assessment (described below). The agency may wish to sponsor a regulatory watershed analysis in lieu of some or all parts of the 12-step process. However, given the watershed concerns in the OESF, DNR likely will go beyond the state Forest Practices Board (WFPB 1994) methods in order to account for issues not addressed in the Forest Practices Board manual. Therefore, additional analyses for any given landscape planning unit might include water quality, wildlife habitat, nontimber commodity production, urban influences, estuarine/near-shore marine conditions, or other relevant issues.

Twelve-step Watershed Assessment Procedure

The objectives of the OESF riparian conservation strategy are to maintain and aid restoration of riparian functions at the watershed scale, rather than at the site-specific level. Implementing these objectives, therefore, requires an evaluation procedure by which the aquatic and streamside conditions at a given site can be assessed in relation to the known influences of physical, biological, and land-use factors throughout the watershed. Effective management and conservation strategies are dictated not only by site conditions but also by cumulative effects of management activities both upstream and downstream of the site. Consequently, the watershed assessment should assure that connectivity between riparian segments is accounted for in the design of long-term management, conservation, and research strategies.

No specific restrictions on management activities are given in the riparian conservation strategy, other than on road-building (described later). Adhering to the objectives of the riparian conservation strategy and implementing the watershed assessment procedure likely will identify specific activities that can be performed with minimum impact to the ecosystem. For example, the number of trees that can be removed from a riparian buffer in a particular watershed will be determined by assessing the potential for that buffer to continue providing coarse woody debris, stream shade, wind-firm stands, nutrients, sediment storage, streamflow moderation, and aquatic and terrestrial habitat for sensitive species.

Figure IV.13 outlines the assessment procedure for meeting riparian management and conservation objectives in the Experimental Forest. The intent is that managers, foresters, and scientists work together through the 12 steps to assure that proposed timber management or research activities do not conflict with the objectives of the riparian conservation strategy. This process will begin with the implementation of the OESF and will occur before landscape planning. The assessment methods may also be used during landscape planning. The steps are:

(1) Initiate the decision making procedure. The need for this procedure is triggered when DNR timber management (i.e., cutting trees, building roads) or manipulative research is proposed within a given Type 3 or larger watershed in the Experimental Forest. Manipulative research includes the removal, alteration, or addition of aquatic or riparian features, including live or dead vegetation, water, aquatic and riparian biota, sediments, bedrock, and artificial structures.

(2) Recognize the conservation objective of managing riparian and aquatic systems in the OESF: to maintain and aid natural restoration of riparian and aquatic functions and processes. Commodity production and riparian research are allowed as long as they are consistent with the conservation objective.

(3) Conduct preliminary assessment of physical and biological watershed conditions using results from the regulatory watershed-analysis process, where available. Table IV.11 lists the components of this assessment, some or all of which might be included in the analysis. Methods and guidelines would be established in agency procedures developed for the OESF. Where advantageous, methods described in the Standard Methods for Conducting Watershed Analysis (WFPB 1994) would be employed. Where possible, methods would yield quantitative data for analysis and future monitoring needs. The assessment would include an evaluation of the probable impact of proposed management or research activities on watershed conditions. This assessment would serve as a baseline for evaluating subsequent activity proposals and cumulative effects in the watershed by providing written record of conditions, decisions, activities, and results of management, research, and conservation efforts; and a scientifically sound rationale for the chosen management, research, and conservation strategies.

(4) Evaluate the degree to which watershed conditions meet the needs for maintaining viable riparian and aquatic processes and functions. Refer to objectives of the riparian conservation strategy, buffer-width recommendations, and Table IV.10.

Figure IV.13: Twelve-step watershed assessment procedure for meeting riparian conservation and management objectives in the Olympic Experimental State Forest

See discussion of each step in the text.

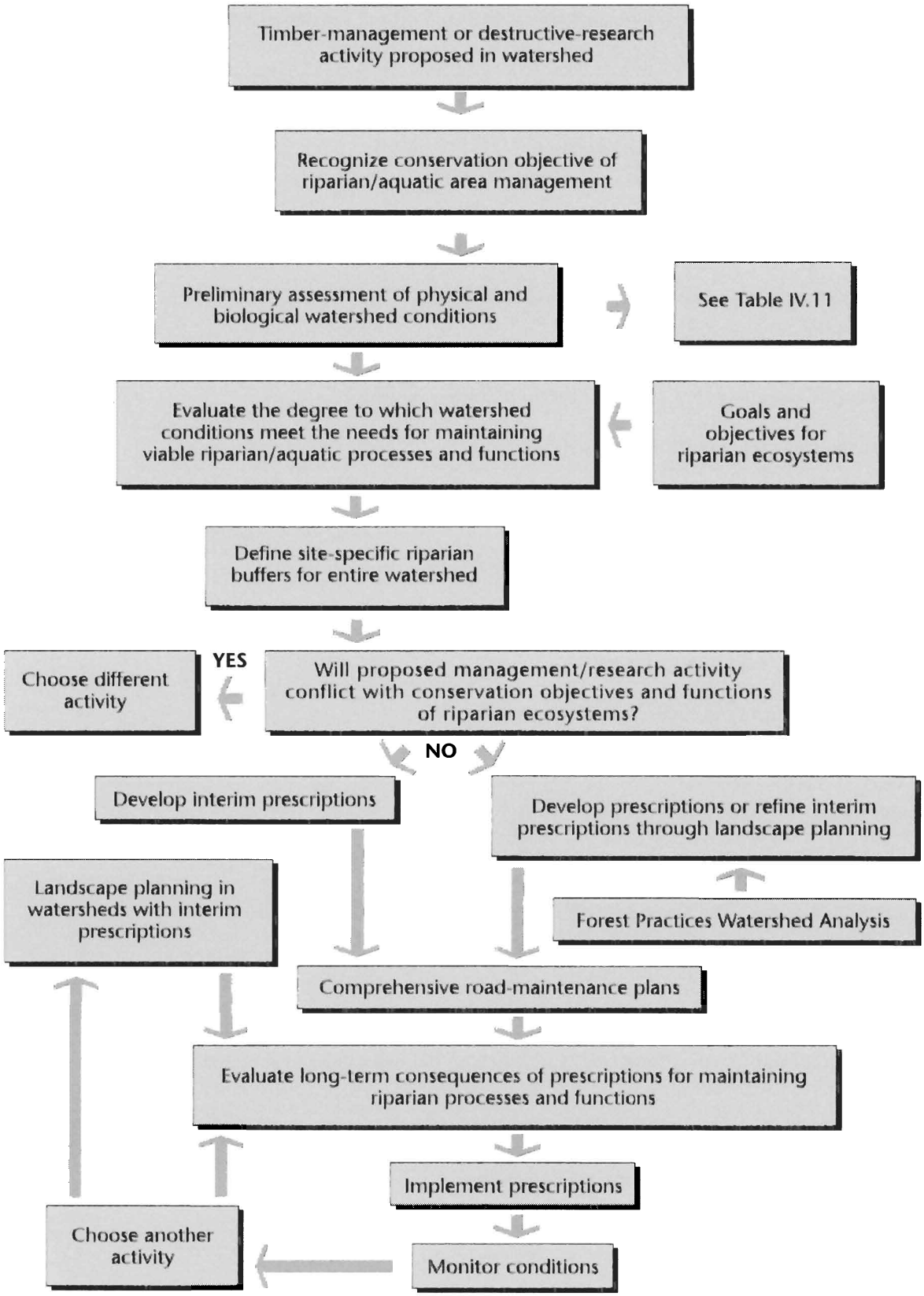

Table IV.11: Components of a preliminary assessment of physical and biological watershed conditions for the 12-step watershed assessment procedure for the Olympic Experimental State Forest

Some or all components might be evaluated, depending on watershed characteristics and the availability of analytical techniques. Methods will be outlined in agency procedures for implementation of the OESF. See step (3) in the text.

Mass wasting — existing and potential sites
Surface erosion — existing and potential sites
Road network densities
Road conditions — use, location, sidecast, and other problems
Road drainage structures — presence and condition
Hillslope hydrology processes (e.g., changes in channel-forming flows, rain-on-snow potential)
Water quality and quantity (e.g., temperatures, turbidity, supply)
Physical stream-channel conditions and processes
Floodplain and channel interactions ▮ physical interactions (e.g., bank erosion, lateral channel migration, hydrology) ▮ biological interactions (e.g., nutrient productivity)
Riparian microclimate (e.g., shade, ambient temperatures)
Coarse-woody-debris recruitment potential
Riparian plant community structure and composition
Riparian forest health
Habitat distribution, quality, and quantity for fish
Habitat distribution, quality, and quantity for fish prey (e.g., macro-invertebrates)
Habitat distribution, quality, and quantity for key riparian-dependent species[1]
Wildlife use of riparian areas (e.g., migration routes, foraging, predation potential)
Wind disturbance patterns (e.g., windthrow potential)
Past and proposed land-use practices (e.g., influence on biological/physical riparian processes)

[1]Key species currently are defined as those that are listed, or are candidates for listing, under the Endangered Species Act or by the Washington Department of Fish and Wildlife, or are listed as threatened, rare, or in need of monitoring by the Department of Natural Resources Natural Heritage Program. Habitat for other unlisted riparian-obligate species will be considered indirectly through consideration of habitat for listed and candidate species.

(5) Using information gathered in the preceding steps, delineate riparian buffers for each stream segment in the watershed so that: (a) conservation objectives for aquatic and riparian protection are met; (b) buffers protect local physical and biological features; and (c) the probable influence of adjacent land-use practices on riparian forests are considered.

(6) Determine whether the proposed management or research activity would conflict with the objectives of the riparian conservation strategy. Choose another management strategy if the proposed activity cannot be accomplished without compromising the long-term sustainability of riparian functions and processes. If no proposed management activity has a high probability of meeting the riparian objectives, then management or manipulative-research activities will be postponed until watershed conditions improve.

(7) Develop interim prescriptions (or long-term prescriptions if this procedure is used as the watershed assessment for landscape planning). Short-term and long-term management and manipulative-research plans would be documented, including proposed schedules for site re-entry and the nature of activities proposed for each entry. Prescriptions might be refined during landscape planning to accommodate new information and technological advances. The riparian conservation strategy will remain in place through the development and implementation of management prescriptions and landscape plans.

(8) Develop a comprehensive road-maintenance plan. In most instances, this plan will be developed for a landscape planning unit prior to landscape planning because the 11 landscape planning units will be evaluated sequentially over the course of several years.

(9) Evaluate the long-term consequences of management prescriptions for each site in maintaining watershed-wide riparian processes and functions, particularly where multiple entries are planned.

(10) Implement interim prescriptions pending landscape plans. On-the-ground implementation will be reviewed by qualified technical experts to assure that conservation objectives are being met.

(11) Monitor riparian conditions on a regular basis (e.g., every two to five years) to evaluate whether conservation objectives continue to be met. Failure to meet these objectives would require restorative or corrective measures and modification of management activities.

(12) Choose another management or research activity in the assessed watershed. Additional proposals will be evaluated using information from the preliminary watershed assessment, landscape planning, monitoring in the watershed, and field investigations of site-specific conditions. Implementing these activities will depend on satisfactory completion of steps (6) and (9) above.

Management activities most likely to occur in the interior-core buffers in the OESF are:

- selective harvest of hardwoods to encourage long-term sources of coniferous woody debris and channel-bank stabilization; harvest would occur on stable ground, where silviculturally feasible and ecologically sound;

- thinning of young stands to promote wind-firm trees;
- restoration efforts, including habitat-enhancement projects;
- research projects, provided that they maintain or improve habitat for aquatic and riparian-dependent species;
- tree pruning to diversify forest structure; and
- single-tree removals, if the number and size of trees removed do not reduce the long-term functions and processes of riparian ecosystems.

Management activities in the interior-core buffers, or forested wetland and their buffers, would exclude herbicide release and new road construction in riparian areas unless, in the case of riparian buffers, stream crossings are essential. Roads in wetlands or their buffers will require on-site and in-kind wetland replacement, in accordance with the Forest Resource Plan (DNR 1992). Crossings will be designed to take the most direct route possible across streams, in order to minimize obstructions to fish passage, peak flows, bank destabilization, and sediment delivery.

Management activities most likely to occur in exterior buffers in the OESF are:

- partial cuts of 33 percent or less by volume, per rotation, aggregated or dispersed, depending on the operational objectives for maintaining wind-firm stands;
- experiments designed to promote wind-firmness of the interior-core buffer; and
- forest-structure modifications, including thinning, pruning, and tree-topping to improve stand wind-firmness.

SUMMARY: BENEFITS OF THE RIPARIAN CONSERVATION STRATEGY

The riparian conservation strategy will benefit the future health of riparian forests in the OESF in several ways:

- Riparian areas will be managed primarily to protect and restore physical and biological processes while allowing some extraction of forest commodities. The conservation's intent is to sustain habitat that is capable of supporting viable populations of salmonids and other aquatic and riparian-dependent species.
- Buffers described in the riparian conservation strategy will be applied to all stream types[2] and on all DNR-managed lands in order to minimize stream sedimentation, stabilize channel banks, reduce windthrow potential, enhance long-term recruitment of coarse woody debris, and protect other key physical and biological functions that maintain habitat complexity for aquatic and riparian-dependent species.
- This strategy ensures that the structural and compositional complexity of riparian habitat will be improved. A goal of this strategy will be to manage hardwood stands such that they regain a conifer-to-hardwood ratio more characteristic of naturally disturbed riparian forests. Approximately 70 percent of riparian areas on

[2]Buffers will be applied to all stream types but not necessarily to all Type 5 streams. See discussions in subsections titled Interior-core Buffers and Exterior Buffers.

DNR-managed lands in the Experimental Forest are dominated by hardwoods or conifer plantations less than 15 years old. The remaining 30 percent are mature second-growth, late successional, or old-growth stands that are highly fragmented; many are susceptible to wind disturbances because they cross exposed hillslopes or valley terraces. Young conifer plantations in riparian areas will be manipulated to promote robust and structurally diverse riparian forests. Management activities will restore long-term sources of coarse woody debris, improve year-round shade potential to streams, diversify riparian habitat, strengthen bank and floodplain stability, and increase wind-firmness of streamside forests.

- This strategy likely will benefit physical and biological conditions of near-shore marine habitat by reducing sediment loads carried from upland sites by river systems and deposited in estuarine and near-shore environments. Estuarine conditions influence salmonid smolting and can govern species survival (e.g., Bisson et al. 1992). Near-shore habitats, including eel-grass and kelp beds, provide shelter and forage for anadromous species and their prey.

- Protecting forested wetlands can improve water quality and aquatic habitat by: (1) minimizing the probability of soil compaction; (2) protecting unstable ground within and adjacent to wetlands; (3) moderating peak and low flows in watersheds; (4) conserving wetland biodiversity; (5) minimizing windthrow; (6) decreasing sediment delivery to wetlands; and (7) providing viable off-channel habitat for salmonids during channel peak-flow events.

Future Riparian Conditions in the OESF

The riparian conservation strategy constitutes a plan for the future in the OESF. Aquatic ecosystems will derive their greatest benefits from restoration of functional forest cover on previously logged, unstable hillslopes and in streamside forests, rather than from concentrating protection measures in existing, mature conifer stands. The intent is to restore riparian areas such that they can be incorporated in the general management strategies for unzoned future forests (see previous discussion in the OESF subsection titled Integrated Approach to Production and Conservation) that will be capable of sustaining both timber production and riparian ecosystem functions. The need for defined buffers will diminish as riparian forests regain the ability to sustain ecological and physical functions without management assistance. Available studies (e.g., Schlichte et al. 1991; Benda 1993; Shaw 1993), however, suggest that this recovery will take several decades to centuries for many river systems in the Experimental Forest.

Statistical analyses of implementing the proposed riparian buffers indicate that approximately 22 percent of the OESF land base will fall inside the interior-core buffer (Table IV.12). DNR currently treats an average of about 18 percent of the land base as no-cut riparian buffers. Therefore, implementing the interior-core buffer strategy on all DNR-managed lands in the OESF will incorporate an additional 4 percent of the land base. For a Type 3 watershed in steep, unstable terrain, this might amount to as much as a 60 percent increase in land placed within the interior-core buffer. However, in contrast with the current no-cut riparian buffers, management activities will be allowed in the OESF riparian buffers as long as these activities are consistent with the conservation objectives. In addition, DNR currently is required to protect all such areas under the Class IV-Special regulations of the state Forest Practices Act (WFPB 1993b). Applying the average recommended exterior riparian buffers increases the acreage in

Table IV.12: Number of acres and percent of land base projected in the Olympic Experimental State Forest riparian interior-core buffer, exterior buffer, and combined (total) buffer, by forest age class

Land base in the OESF totals approximately 264,000 acres. Figures for the total buffer were calculated assuming 33 percent average timber volume removal from the exterior riparian buffer. (See text.)

Forest age class (years)	Interior buffer		Exterior buffer		Total buffer	
	acres	percent	acres	percent	acres	percent
200+	520	0.20	397	0.16	917	0.36
101-199	9,254	3.62	5,164	2.02	14,418	5.64
71-100	3,181	1.24	2,143	0.84	5,324	2.08
51-70	2,369	0.93	1,382	0.54	3,751	1.47
41-50	1,410	0.55	873	0.34	2,283	0.89
31-40	3,265	1.28	1,891	0.74	5,156	2.02
21-30	9,249	3.61	4,985	1.95	14,234	5.56
11-20	16,815	6.57	8,735	3.42	25,550	9.99
0-10	10,653	4.16	5,855	2.29	16,508	6.45
Total	**56,716**	**22.16**	**31,425**	**12.30**	**88,141**	**34.46**

riparian management zones by an estimated 12 percent, although certain harvest activities can occur in these areas (e.g., maximum timber volume removal of 33 percent).

Table IV.12 shows the number of acres and percent of land base in each buffer category, by forest age class, out of 264,000 total acres of DNR-managed land in the OESF. Approximately 35 percent of the total acres, therefore, will contribute to maintaining and restoring riparian functions and processes. These acres also will provide more than 50 percent of the proposed habitat for northern spotted owls and a significant percentage of habitat for marbled murrelets.

Multispecies Conservation Strategy for Unlisted Species in the Olympic Experimental State Forest

INTRODUCTION

It is central to the mission of the Olympic Experimental State Forest to learn how to manage commercial forests that integrate commodity production and species conservation. Management that maintains or restores habitat for populations of native flora and fauna on the Olympic Peninsula is fundamental to the OESF. Plant and animal species for which there is some concern about population viability and features on the landscape that serve important functions as habitat for those species will receive special attention.

The multispecies conservation strategy for DNR-managed lands in the Experimental Forest is different from that for the five west-side planning units because the OESF strategy is based in large part on the unique conservation strategies in the OESF for riparian ecosystems and northern spotted owls and because of the experimental approach to integrated management for forest commodity and ecosystem values that is the mission of the Experimental Forest. (The multispecies conservation strategy for the five west-side planning units is discussed in Section F of this chapter. Neither multispecies strategy will be applied in the east-side planning units under this HCP.)

The strategy proposes conservation objectives for maintaining or restoring a level of habitat capability for unlisted species on DNR-managed lands in the OESF. To achieve these conservation objectives, DNR will develop and test a variety of methods that integrate commercial forest management and maintenance or restoration of habitat for unlisted species and will apply those methods that are most effective and efficient. This habitat management will be planned and implemented at the landscape level. Objectives of this landscape-level management are directed at developing landscapes that produce a mix of robust commercial products and ecosystem outputs across the entire Experimental Forest.

Conservation of habitat for unlisted species will primarily be derived from the integrated, ecosystem-oriented management rather than direct the management. This approach can be stated and implemented as a working hypothesis for evaluation and systematic application and refinement: DNR can meet its objectives for conservation of habitat for unlisted species in the OESF by managing stands and landscapes to meet its conservation objectives for riparian ecosystems, spotted owls, and marbled murrelets and by implementing additional site- or species-specific conservation measures in response to certain circumstances.

The multispecies conservation strategy discusses provision of habitat for animal species of concern and other unlisted species and special landscape features identified as uncommon habitats or habitat elements. For the purposes of the HCP, species of concern are federally listed, state-listed, federal candidate, and state candidate animal species. Federally listed species are addressed in the sections of this chapter on the marbled murrelet (see Section B), other listed species (see Section C), and in the OESF strategy for the northern spotted owl (see earlier in this Section E). The other species of concern are addressed in this subsection, except anadromous salmonids and bull trout, whose habitat is conserved through the OESF riparian conservation strategy (see earlier in this Section E). Other unlisted species include other animal species that may become listed or candidates for listing in the future. Uncommon habitats and habitat elements are talus fields, caves, cliffs, and large, structurally unique trees. (See the subsection titled protection of Uncommon Habitats in Section F of this chapter.)

Within the OESF, 33 animal species are considered species of concern because information indicates they face some risk of at least local extinction: six are federally listed, 10 are federal species of concern, five are state candidates with no federal status, four are sensitive species,and bull trout and seven species of anadromous salmonids have been or are under review for listing by the federal goverment. (The federally listed species are shown in Table III.8,the salmonids in Table III.11, and the other species in Table III.14.) Other species will probably be added to this list in the coming decades, but it is difficult to predict which species are, or will be, at the brink of "at risk."

Federal guidelines (e.g., spotted owl circles) and state rules (WAC 232-12-292, WAC 222-16-080) place species-specific constraints on forest practices for the benefit of federally listed and state-listed species. But, given the large and probably expanding array of listed and candidate species, species-specific forest practices have become an inefficient and impractical means of attaining wildlife conservation objectives and providing income to the trusts. Within the confines of a managed forest, the most effective means for the conservation of wildlife is to provide functional habitat. The Experimental Forest will contribute to the survival of species of concern and other unlisted species through forest management that provides a variety of well-distributed, interconnected habitats.

The multispecies strategy discusses the objectives for conservation of habitat for unlisted species of concern and other unlisted species. Then the benefits to habitat for unlisted species through the other OESF and the marbled murrelet conservation strategies are described. The multispecies strategy closes with a description of conservation of habitat for specific unlisted species of concern and a summary of types of habitat provided on DNR-managed lands in the Experimental Forest.

CONSERVATION OBJECTIVES

The objectives of the strategy for conservation of habitat for unlisted species are:

(1) to develop and implement land-management plans that do not appreciably reduce the likelihood of survival and recovery of unlisted species on the Olympic Peninsula;

(2) to learn to integrate the values of older forest ecosystems and their functions with commercial forest activities; and

(3) to fill critical information gaps related to the composition, structure, and function of aquatic, riparian, and upland ecosystems and the links between these, forest management activities, and conservation of habitat for unlisted species.

DNR anticipates that meeting these objectives will entail a significant effort in forest management, research, and monitoring over an extended period of time. (See the sections titled Monitoring and Research in Chapter V.) Management practices in the near term will be directed by current knowledge and hypotheses, but in time, as knowledge, techniques, and hypotheses change, management practices will adapt to those new circumstances. This is consistent with the mission of the Experimental Forest.

A description of proposed management practices related to conservation of habitat for unlisted species and unique habitat elements follows. Some deviations from these practices will occur in the near term as formal, experimental studies designed to address information needs related to integrating conservation and production. It is also likely that some of the practices may change in the long term as new information, techniques, and other circumstances warrant. Thus, these descriptions are intended to be straightforward ways to characterize a standard level of commitment to conservation while reserving the option to achieve conservation objectives by other means.

For certain species, additional conservation measures are proposed for known nesting, denning, and/or roosting sites. Under this HCP, DNR shall not be required to survey for nests, dens, roosts, or individual occurrences

of unlisted species. Currently, baseline data on many of these species are recorded in the Washington Department of Fish and Wildlife Non-game Database.

The habitats most critical for the conservation of unlisted species on DNR-managed lands in the OESF contain elements of late successional coniferous forest, riparian areas and wetlands, or both. The aggregate landscape-level effects of the Experimental Forest riparian and spotted owl conservation strategies and the HCP marbled murrelet conservation strategy, as described below, are expected to provide habitat for most unlisted species. However, some unlisted species require special landscape features or habitat elements that may not be adequately conserved by the species-specific strategies. Thus, special conservation measures for talus fields, caves, cliffs, large snags, and large, structurally unique trees may be important to these species. The protection of uncommon habitats and habitat elements is described in Section F of in this chapter titled Multispecies Conservation Strategy for Unlisted Species in the Five West-side Planning Units. The specific discussion in that section to be applied in the OESF is called Protection of Uncommon Habitats.

CONSERVATION STRATEGY

The Experimental Forest multispecies conservation strategy is proposed as an outcome of landscape-level management in the OESF. Central to the planning and implementation of landscape management are the proposed conservation measures for riparian ecosystems, spotted owls, and marbled murrelets. The aggregate effect of these conservation strategies is the creation of landscapes centered on healthy riparian ecosystems that contain interconnected patches of late successional, mid-aged, and young forests. Late successional forests consist of both mature (80-200 years old) and old-growth (greater than 200 years old) forest age classes (Thomas et al. 1993; FEMAT 1993; Spies and Franklin 1991).

Riparian Conservation Strategy

(See the earlier part of this section on the Experimental Forest titled Riparian Conservation Strategy.)

The principal components of the riparian conservation strategy are forested buffers to protect stream channels and unstable hillslopes. Management activities within these buffers will be governed by the following conservation objectives:

(1) to maintain and aid restoration of the composition, structure, and function of aquatic, riparian, and associated wetland systems;

(2) to maintain and aid restoration of the physical integrity of stream channels and floodplains;

(3) to maintain and aid restoration of water to the quantity, quality, and timing with which these systems evolved;

(4) to maintain and aid restoration of the sediment regime in which these systems evolved; and

(5) to develop, use, and distribute information on aquatic, riparian, and associated wetland ecosystem processes.

The riparian strategy will result in complex, productive aquatic habitats in streams and wetlands and late successional conifer forest as the predominant cover type along streams and on unstable hillslopes. As a result, this strategy will benefit nearly all aquatic, wetland, riparian obligate, and upland species on DNR-managed lands in the OESF.

The riparian strategy will be implemented by establishing interior-core buffers that minimize disturbance of unstable channel banks and adjacent hillslopes and by establishing exterior buffers that protect the interior-core buffers from wind damage. Additionally, DNR will continue its commitment to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36). Interior-core buffers are estimated to cover 56,000 acres (22 percent) of DNR-managed land in the OESF. Exterior buffers may cover up to (31,000 acres) 12 percent of DNR-managed land in the Experimental Forest.

Management within the exterior (wind) buffer will be largely experimental, and the forest conditions allowed to develop within the exterior buffer will be based on their efficacy in minimizing windthrow. DNR currently hypothesizes that structurally diverse, mature conifer forests that sustain varying degrees of harvest will be the long-term outcome of management in many of the exterior buffers.

Suitable habitat for aquatic and riparian obligate species should be provided in the interior-core riparian buffers, especially as their functions are maintained by exterior buffers. Wetland species will be protected because DNR maintains no overall net loss of naturally occurring wetland acreage and function. For upland species, the long-term benefit of riparian ecosystem conservation is a network of late successional forests in streamside areas and on unstable hillslopes that serve as habitat for nesting, foraging, or resting.

Marbled Murrelet Conservation Strategy

(See Section B of this chapter for the marbled murrelet conservation strategy.)

Landscape conditions outside riparian areas and not on unstable hillslopes will be enhanced by management for marbled murrelets. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some marbled murrelet nesting habitat, and this will increase the amount of late successional forest available to other species.

Spotted Owl Conservation Strategy

(See the earlier part of this section on the OESF titled Conservation Strategy for the Northern Spotted Owl.)

The unzoned spotted owl conservation strategy sets a minimum standard of at least 40 percent of each landscape in young-forest marginal (as defined by Hanson et al. 1993) or better quality habitat and at least half of this, or 20 percent of each landscape planning unit, in old forest (Hanson et al. 1993). Because of the riparian conservation strategy alone, four of the 11 landscape planning units (Reade Hill, Willy-Huel, Upper Clearwater, and Copper Mine — see Map IV.9) are expected to exceed the minimum standard for spotted owl conservation. In the other seven landscape planning units (Kalaloch, Sadie Creek, Clallam, Upper Sol Duc, Goodman Creek, Dickodochtedor, and Queets), the riparian strategy makes a significant contribution toward meeting the spotted owl minimum standard.

DNR-managed lands outside of riparian areas in these landscape planning units will be managed on harvest rotations that provide enough habitat to meet the landscape minimums.

Forest Management in the OESF

The working hypothesis of the OESF is that it is possible to manage forest stands and landscapes for integrated outputs of commodity and ecosystem products. In conjunction with the conservation strategies described for spotted owls, marbled murrelets, riparian ecosystems, and uncommon habitats, a variety of forest stand management prescriptions will be implemented. (See Section H of this chapter titled Forest Land Management Activities.) Some stands may be managed under an even-aged regime of short rotations (50 to 60 years). Other stands may be managed by a series of light, partial cuts that retain the composition, structure, and function of late successional forests throughout all or most of the management cycle. Individual activities will be planned and implemented within the framework of specific landscape-wide plans for each landscape planning unit. These landscape plans will focus and direct the integration of commodity, ecosystem, and information outputs, in part, by mapping and scheduling timber harvests and other silvicultural activities so that their influence on ecosystem processes can be assessed in advance.

After stand-regenerating disturbances such as fire or clearcutting, stand development proceeds through a series of identifiable successional stages. Various systems have been used to describe forest succession. The system of Brown (1985) is based on the structural condition of the stand and identifies six stages: grass/forb, shrub, open sapling/pole, closed sapling/pole/sawtimber, large sawtimber, and old growth. Large sawtimber is approximately equivalent to mature forest. Mature and old-growth forests are considered to be late successional (Thomas et al. 1993). Conifer forest stands are often in the closed sapling/pole/sawtimber stage between about 30 and 80 years of age (Brown 1985), and stands exhibiting such conditions are generally considered to be young forest (Spies and Franklin 1991). Forests subjected to even-aged management and relatively short rotations should provide suitable habitat for species that utilize grass/forb, shrub, open sapling/pole, and closed sapling/pole/sawtimber stages of forest succession. Forests managed under less conventional regimes, e.g., various forms of uneven-aged management, should provide late successional habitat over some portion of the management cycle.

SPECIES BY SPECIES CONSERVATION FOR UNLISTED SPECIES OF CONCERN

Fish

(Habitat for bull trout and anadromous salmonids will be provided through the OESF riparian conservation strategy detailed earlier in this section.)

OLYMPIC MUDMINNOW

The riparian conservation strategy should protect the spawning and rearing habitats of the Olympic mudminnow through:

(1) commiting to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36);

(2) protecting lakes and ponds classified as Types 1, 2, or 3 waters; and

(3) protecting Types 1, 2, 3, and 4 rivers and streams. Additional protection of aquatic habitat will occur through the prohibition of timber harvest on unstable hillslopes and road network management.

Amphibians

VAN DYKE'S SALAMANDER

Van Dyke's salamanders occur primarily in rock rubble near small streams and headwall seepages in the OESF. The interior-core buffers of the riparian conservation strategy are designed to protect these naturally unstable areas. Exterior buffers will protect the functions of interior-core buffers where necessary. Protection of riparian areas and unstable hillslopes as described in the Experimental Forest riparian conservation strategy should provide adequate protection for Van Dyke's salamander habitat within the OESF.

TAILED FROG

Tailed frogs require cool, clean, well-aerated water and a stable microclimate. They primarily inhabitat smaller streams with relatively steep gradients in the OESF. Interior-core buffers of the Experimental Forest riparian conservation strategy were designed to protect these areas from damage to their channel banks or from mass-wasting events at higher elevations in watersheds. Exterior buffers will protect the functions of interior-core buffers where necessary. The OESF riparian conservation strategy should provide adequate protection for tailed frog habitat within the OESF.

CASCADES FROG

Cascades frogs are known both from elevations above DNR-managed lands and from lower elevations in and around the OESF. These frogs occur in and near wetlands and other slow-flowing waters away from the main channels of streams. The OESF riparian conservation strategy is designed to maintain or restore the composition, structure, and function of aquatic, riparian, and associated wetland ecosystems; it incorporates current DNR wetlands policy that states there will be no overall net loss of naturally occurring wetland acreage and function (DNR 1992 p. 36). The OESF riparian conservation strategy and the current DNR policy on wetlands should provide adequate protection for Cascades frog habitat within the OESF.

Birds

HARLEQUIN DUCK

OESF riparian conservation will contribute to the viability of harlequin ducks on the Olympic Peninsula in two ways. First, the maintenance or restoration of mature and old-growth forests within riparian zones, especially along Types 1, 2, and 3 waters, should shelter nest sites from disturbance. Second, the principal foods of the harlequin duck are benthic macro-invertebrates, whose diversity and abundance the riparian conservation strategy is expected to enhance.

NORTHERN GOSHAWK

Under the unzoned spotted owl conservation strategy, at least 40 percent of DNR's forested lands within each landscape planning unit will be young-forest marginal (Hanson et al. 1993) or better quality habitat, and at least 20 percent of DNR's forest lands will be old forest (Hanson et al. 1993) or better. The riparian interior-core and unstable slope protection established under the riparian strategy constitutes, on average, 22 percent of each landscape planning unit, and this will eventually become late successional coniferous forest. These conditions exceed the landscape prescriptions recommended by Reynolds et al. (1992) for northern goshawks. Thus, the combined outcomes of the riparian and spotted owl conservation strategies should provide adequate protection for goshawk habitat within the OESF.

GOLDEN EAGLE

Golden eagles nest in large trees or on cliffs. These uncommon habitats and habitat elements will be protected as described earlier in the discussion on uncommon habitats in the section of this chapter titled Multispecies Conservation in the Five West-side Plannning Units. The combination of the riparian conservation strategy and forest management in the OESF should provide breeding, foraging, and resting habitat for the golden eagle. Many forests on unstable hillslopes will not be harvested and some of these areas will contain large trees. Management within the interior-core riparian buffer is expected to result in the development of late successional forest containing large live trees. Even-aged forest management throughout the OESF will continue to provide openings for foraging habitat.

Golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668, Revised 1978). Under this act, it is unlawful to molest or disturb golden eagles and their nests. RCW 77.16.120 of the Wildlife Code of Washington prohibits destroying the nests of protected wildlife. Consistent with these regulations, trees or snags that contain known active golden eagle nests shall not be harvested. Thus, current laws, regulations, and proposed conservation strategies should provide adequate protection for golden eagles within the OESF.

VAUX'S SWIFT

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for Vaux's swift breeding, foraging, and resting habitat. In concert, these three strategies promote the development of landscapes containing significant amounts of older forests and large trees that will provide nesting, roosting, and foraging habitat. Other foraging habitat will result from general management of upland forests.

Conservation measures for large, structurally unique trees (described in the discussion of uncommon habitats in Section F of this chapter titled Multispecies Conservation Strategy in the Five West-side Planning Units) will retain habitat for nesting and roosting. Consistent with RCW 77.16.120, trees or snags that are known to contain active Vaux's swifts nests shall not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

Additional Mitigation

Trees or snags known to be used by Vaux's swifts for nesting or roosting shall not be harvested, except as formal, experimental studies designed to address information needs related to integrating conservation and production or as other, exceptional circumstances warrant. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

PILEATED WOODPECKER

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for pileated woodpecker breeding, foraging, and resting habitat. In concert, these three strategies promote the development of landscapes containing significant amounts of older forests and large trees that will provide nesting, roosting, and foraging habitat. Other foraging habitat will result from general management of upland forests.

Conservation measures for large snags and large, structurally unique trees (described in the discussion of uncommon habitats in Section F of this chap-

ter titled Multispecies Conservation Strategy in the Five West-side Planning Units) will retain structural elements required by pileated woodpeckers for nesting and roosting. Additional conservation measures for snags (also described in Section F of this chapter) will increase the density of snags, and consequently, opportunities for foraging.

Consistent with RCW 77.16.120, trees or snags that are known to contain active pileated woodpecker nests will not be harvested. In addition, trees or snags that are known to have been used by pileated woodpeckers for nesting will not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

OLIVE-SIDED FLYCATCHER

There are no established management recommendations for the olive-sided flycatcher. The creation of forest edges through clearcutting probably benefits the species, but extensive clearcutting with short harvest rotations would eliminate the mature forests and tall snags which this species requires. The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for olive-sided flycatcher breeding, foraging, and resting habitat. In concert, these three strategies promote the development of landscapes containing significant amounts of older forests and large trees that will provide nesting, roosting, and foraging habitat. Other habitat will result from general management of upland forests. The landscape conditions projected for the OESF are expected to adequately provide for the habitat needs of the olive-sided flycatcher.

LITTLE WILLOW FLYCATCHER

In the OESF, even-aged forest management should provide the type of nesting habitat that the species requires. The landscape conditions projected to occur in the OESF should provide adequately for the nesting, foraging, and other habitat needs of little willow flycatchers.

Mammals

MYOTIS BATS

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for myotis bat breeding, foraging, and resting habitat. In concert, these three strategies promote the development of landscapes containing significant amounts of older forests and large trees for nesting, roosting, and foraging habitat, and productive riparian and wetland ecosystems for foraging habitat. Other habitat will result from general management of upland forests.

Talus fields, cliffs, and caves have been designated priority habitats by the Washington Department of Fish and Wildlife (1995a). Talus fields, cliffs, and caves will be protected (as described in the discussion of uncommon habitats in Section F of this chapter titled Multispecies Conservation Strategy in the Five West-side Planning Units), and DNR will also protect very large old trees as described in that same section.

Additional Mitigation

Live trees or snags that are known to be used by myotis bat species as communal roosts or maternity colonies shall not be harvested, except as formal, experimental studies designed to address information needs related to integrating conservation and production or as other, exceptional circumstances warrant. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

TOWNSEND'S BIG-EARED BAT

There are no confirmed breeding sites for this bat on the western Olympic Peninsula. The species requires caves for nursery colonies and hibernacula. No caves are known to exist in the OESF. Therefore, forest management in the OESF is expected to have little or no impact on Townsend's big-eared bats. In the event that a cave is discovered, it will be protected as described in the discussion on uncommon habitats (found in Section F of this chapter titled Multispecies Conservation Strategy in the Five West-side Planning Units).

FISHER

The aggregate landscape level effects of the riparian, spotted owl, and marbled murrelet conservation strategies, will provide more than 68,000 acres of contiguous fisher habitat across the Willy-Huel, Kalaloch, Copper Mine, Upper Clearwater, and Queets landscape planning units. (See Map IV.9.) This habitat area will also provide a connection between the main body of the Olympic National Park and the National Park's coastal strip. The Olympic National Park contains over 284,300 acres of fisher habitat. The Olympic National Forest currently contains 241,100 acres of fisher habitat and under the President's Forest Plan, it should have approximately 334,200 acres by the year 2074 (Holthausen et al. 1994). The contiguous fisher habitat in the OESF is seen as adjunct to this high-quality habitat on federal land.

DNR-managed roads are routinely closed for cost-effective forest management and protection of public resources, including wildlife (DNR 1992 p. 41). Road closures benefit the fisher population by limiting human disturbance and reducing the likelihood of accidental trapping. Road closures will continue on DNR-managed lands and will be consistent with cost-effective forest management and policies set forth by the Board of Natural Resources.

Additional Mitigation

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 0.5 mile of a known active fisher den site between February 1 and July 31 where such activities would appreciably reduce the likelihood of denning success.

SUMMARY OF HABITAT TYPES PROVIDED ON DNR-MANAGED FOREST LANDS IN THE OLYMPIC EXPERIMENTAL STATE FOREST

See Table IV.7 for an estimate of different habitat types provided in the OESF based on one set of harvest regimes. Refer to footnotes 2-5 of that table for brief explanations of the habitat types.

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F. Multispecies Conservation Strategy for Unlisted Species in the Five West-side Planning Units

Introduction

The multispecies conservation strategy for the five west-side planning units is directed at providing habitat for animal species of concern and other unlisted animal species and at special landscape features identified as uncommon habitats or habitat elements. For the purposes of this HCP, species of concern are federally listed, state-listed, federal candidate, and state candidate animal species. (See Table III.7 for the federally listed species and Table III.13 for the other species of concern excluding anadromous salmonids and bull trout. Those are named in Table III.10.) Other unlisted species include other animal species that may use the types of habitat found within the five west-side planning units and that may become listed or candidates for listing in the future. For the purposes of this HCP, uncommon habitats on DNR-managed lands are talus fields, caves, cliffs, oak woodlands, large snags, balds, mineral springs, and large, structurally unique trees.

Under this HCP, multispecies conservation strategies shall be implemented on DNR-managed lands in the five west-side planning units and the Olympic Experimental State Forest (OESF). The multispecies conservation strategy for the OESF is discussed in Section E of this chapter. Briefly, the OESF strategy differs somewhat from that for the five west-side planning units because:

(1) the emphasis in the OESF on research and systematic application and refinement of knowledge gained to achieve effective and efficient integration of commodity production and conservation will likely lead to changes in conservation strategies over time; and

(2) the conservation strategies for salmonids and the northern spotted owl, which are the foundation of the multispecies conservation strategies, are different for the OESF. (See Section E of this chapter for a complete discussion of the OESF conservation strategies.)

Neither multispecies conservation strategy will be applied in the east-side planning units. But all DNR management activities there will still comply with state Forest Practices Rules and applicable state wildlife regulations and will be consistent with the policies set forth by the Board of Natural Resources.

DNR will continue to participate in watershed analysis according to state Forest Practices Rules (WFPB 1994). If watershed analysis indicates that public resources require a greater level of protection than that specified by the HCP, the prescriptions developed through watershed analysis to provide this additional protection shall be implemented. However, because (as of the writing of this HCP) watershed analysis does not address wildlife, the HCP multispecies conservation strategy shall continue to apply to DNR-managed lands in Watershed Administrative Units (WAU) for which watershed analysis has been conducted, unless stated otherwise elsewhere in this HCP.

For uncommon habitats and certain species of concern, the multispecies conservation strategy specifies special management prescriptions and/or additional mitigation. The management prescriptions and mitigation are

intended to be straightforward ways to provide a standard level of protection. In some instances, these will not be the most efficient means available to provide effective wildlife conservation. Therefore, in places where DNR believes that effective conservation can be provided in a more efficient way, DNR through cooperation with the U.S. Fish and Wildlife Service, may develop a site-specific management plan that provides adequate protection for the species or habitat occurring at that site. When a management plan approved by the U.S. Fish and Wildlife Service is in place, the special management prescriptions and/or additional mitigation specified in this HCP shall be waived.

If, however, DNR discovers some active nesting, denning, or roosting sites in the course of forest management activities, or through voluntary surveys, or such sites are documented by the Washington Department of Fish and Wildlife on DNR-managed lands, DNR shall provide the special protection described in the subsection titled Species by Species Conservation. At the time a new species is proposed for listing, and a written request to add that species to the permit is made by DNR, DNR will evaluate and consider additional protection measures such as seasonal restrictions and protection of nesting/denning sites.

Within the five west-side planning units, 62 animal species are considered species of concern because information indicates they face some risk of extinction: nine are federally listed, two, including the bull trout, are federal candidates, 23 are federal species of concern, two are listed by the state but have no special federal status, 12 are state candidates with no special federal status, seven are sensitive species, and seven species of anadromous salmonids have been or are under review by the federal government for listing. (The federally listed species are shown in Table III.8, the salmonids in Table III.11, and the other species in Table III.14.) Other species will probably be added to this list in the coming decades, but it is difficult to predict which species are at the brink of "at risk."

Federal guidelines (e.g., spotted owl circles) and state rules (WAC 232-12-292, WAC 222-16-080) place species-specific constraints on forest practices for the benefit of federally listed and state-listed species. But, given the large and probably expanding array of listed and candidate species, species-specific forest practices have become an inefficient and impractical means of attaining wildlife conservation objectives and providing income to the trusts. Within the confines of a managed forest, the most effective means for the conservation of wildlife is to provide functional habitat. Under this HCP, DNR will contribute to the survival of species of concern and other unlisted species through forest management that provides a variety of well-distributed, interconnected habitats.

The multispecies strategy discusses the objectives for conservation of habitat for unlisted species of concern and other unlisted species. Then the benefits to habitat of unlisted species through the other HCP conservation strategies are described, followed by a discussion of protection of uncommon habitats. The strategy closes with a description of conservation for habitat of specific unlisted species of concern and a summary of habitat types provided on DNR-managed lands in the five west-side planning units.

Conservation Objectives

DNR had identified three conservation objectives for its multispecies strategy on DNR-managed lands in the five west-side planning units to provide habitat that:

(1) helps maintain the geographic distribution of unlisted species that have small annual or breeding-season home range areas;

(2) contributes to demographic support of populations of unlisted species with large home ranges on federal forest reserves (National Parks, National Forest Wilderness Areas, National Forest Late successional Reserves, etc.); and

(3) facilitates the dispersal of these wide-ranging species among federal forest reserves.

Maintenance of geographic distribution means supporting the continued presence of the species, or its habitat, over as much of its historic range as possible. Therefore, objective (1) requires that habitat supporting the life needs of unlisted species with small ranges be provided throughout the range of the species on DNR-managed lands in the five west-side planning units. Demographic support refers to the continued viability of populations through the reproductive contribution of individuals. Therefore, objective (2) requires that habitat capable of supporting the successful reproduction of wide-ranging unlisted species be provided on DNR-managed lands in the five west-side planning units near federal reserves. Dispersal entails the movement of individuals from one subpopulation to another. Therefore, objective (3) requires that foraging and resting habitat of wide-ranging unlisted species be provided on DNR-managed lands in the five west-side planning units between blocks of federal reserves.

The habitats most critical for the conservation of unlisted species on DNR-managed lands in the five west-side planning units contain elements of late successional coniferous forest, riparian areas and wetlands, or both. The aggregate landscape-level effects of the HCP riparian, spotted owl, and marbled murrelet conservation strategies, as described below, are expected to provide habitat for most unlisted species. However, some unlisted species require special landscape features or habitat elements that may not be adequately conserved by the species-specific strategies. Thus, the special protection of talus fields, caves, cliffs, oak woodlands, and very large old trees are considered necessary to provide conservation for these species. Furthermore, some unlisted species are known or thought to be highly sensitive to human disturbance, and therefore, in the context of a managed forest, special management to reduce human disturbance is warranted.

Conservation Strategy

The HCP multispecies conservation strategy is built upon conservation measures directed at providing habitat for three taxa: salmonids (the riparian strategy), the northern spotted owl, and the marbled murrelet. (See Sections C, A, and B, respectively, of this chapter for more detail on each strategy.) The aggregate effect of this species-specific conservation is the creation of landscapes containing interconnected patches of late successional forest. Late successional forests consist of both mature (80-200 years old) and old-growth (greater than 200 years old) forest age classes (Thomas et al. 1993; FEMAT 1993; Spies and Franklin 1991). In addition, the other managed forests will provide early and mid-seral stage forest habitat.

RIPARIAN CONSERVATION STRATEGY

This strategy benefits nearly all aquatic, wetland, riparian obligate, and upland species that may occupy DNR-managed lands. The riparian management zones established along all Types 1, 2, 3, and 4 waters should provide suitable habitat for aquatic and riparian obligate species. Wetland species will be protected through DNR's continued commitment to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36). For upland species, the long-term benefit of salmonid conservation is a network of riparian corridors connecting upland patches of late successional forest on unstable hillslopes.

The riparian buffer of the riparian management zone is estimated to occupy 69,000 acres along Types 1, 2, 3, and 4 waters (6 percent of DNR-managed forest lands in the five west-side planning units). The riparian management zone will be managed to maintain or restore salmonid habitat. Given this objective, most of the no-harvest and minimal-harvest areas (58,000 acres) in the riparian management zone will likely develop into forest that has old-growth characteristics. The low-harvest area (11,000 acres) is managed according to the same objective, but its distance from water may permit more management activities, and therefore, in most places, the low-harvest area will likely eventually contain forests with a range of late successional characteristics. Unstable hillslopes are estimated to occupy an additional 5 to 10 percent of DNR-managed forest land outside the riparian management zone. Unstable areas will be managed to minimize the risk of mass wasting, and it is likely that little harvest will occur there. Unstable hillslopes should add another 60,000 to 120,000 acres of late successional forest, with some portion being old growth.

Overall, salmonid and riparian conservation is expected to result in the maintenance or restoration of 129,000 to 189,000 acres of forest with mature and old-growth characteristics (11 to 16 percent of the five west-side planning units). However, natural disturbances will cause the amount to vary over time. Approximately 9 percent of these areas are currently in a late successional stage, and 84 percent are expected to be in a late successional stage by the year 2195. The ubiquity of streams, particularly Type 4 waters and Type 5 waters on unstable hillslopes, will ensure connectivity among patches of late successional forest.

Management within the wind buffers of the riparian management zone will be largely experimental, and therefore, the forest conditions within the wind buffer cannot be accurately predicted. Wind buffers may occupy up to 1 percent (10,000 acres) of DNR-managed forest land in the five west-side planning units.

MARBLED MURRELET CONSERVATION STRATEGY

Landscape conditions outside riparian areas and not on unstable hillslopes will be enhanced by management for marbled murrelets. Preliminary estimates of marbled murrelet habitat suggest that between 47,000 and 108,000 acres of habitat exists outside riparian management zones and not on unstable hillslopes — another 4 to 9 percent of the west-side planning units. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some marbled murrelet nesting habitat, and this will increase the amount of late successional forest available to other species.

NORTHERN SPOTTED OWL CONSERVATION STRATEGY

In the five west-side planning units, the spotted owl strategy designates 163,000 acres to be managed as nesting, roosting, and foraging (NRF)

habitat for the spotted owl. There will be two 300-acre nest patches per 5,000 acres of managed forest in NRF management areas, for a total of approximately 20,000 acres. These nest patches will consist of high quality spotted owl nesting habitat with old-growth forest characteristics. The nest patches will occur within a larger, contiguous 500-acre area, of which the remaining 200 acres shall be sub-mature forest (as defined in Hanson et al. 1993) or higher quality habitat. At least 50 percent of the designated NRF management area in each WAU (including the nest patches) will be sub-mature forest or higher quality habitat.

The riparian conservation strategy will result in 11 to 16 percent of the NRF management area in a late successional condition. High-quality spotted owl nesting habitat in nest patches will occupy 12 percent of NRF management areas, but portions of the nests patches will be in riparian areas or on unstable hillslopes. The nest patches are estimated to occupy 10 percent of the NRF management area outside those areas protected by the riparian conservation strategy. The marbled murrelet strategy will contribute additional late successional forest, but an accurate estimate of amount cannot be made at this time. Nest patches and the riparian conservation strategy will result in late successional forest over 21 to 26 percent of designated NRF management areas. Therefore, on average, another 24 to 29 percent of the area designated for NRF management in each WAU will need to be submature forest or better to meet the 50 percent requirement for each WAU with designated NRF habitat.

A working hypothesis of the spotted owl conservation strategy is that the development of spotted owl habitat may be accelerated through special forest management. The calculation of harvest rotations are based on the assumption that managed forests can attain sub-mature characteristics at approximately age 70 years. Designated NRF management areas may be managed under an even-aged regulated forest system, and under such management, the 50 percent sub-mature forest prescription would require a harvest rotation of at least 100 years. Consequently, an additional 14 to 21 percent of the area designated for NRF management in each WAU will be mature forest (i.e., more than 80 years old). On average, 40 to 42 percent of the designated NRF management area in each WAU will be late successional forest, with some portion possessing old-growth characteristics.

In the five west-side planning units, the spotted owl strategy designates 117,000 acres to be managed as spotted owl dispersal habitat, which supports the movement of juvenile spotted owls among sub-populations on federal reserves. Dispersal habitat must provide foraging and roosting opportunities in amounts adequate to promote the survival of spotted owls. At least 50 percent of the designated dispersal management areas in each WAU will meet the minimum specifications for dispersal habitat.

Using the average site productivity of DNR-managed forests on the west side, dispersal habitat characteristics are estimated to be attained at approximately 40 years of age. Dispersal habitat areas will be managed under an even-aged regulated forest system, and therefore, the 50 percent prescription will require a harvest rotation greater than 40 years. The riparian conservation strategy will result in 11 to 16 percent of the land base in a late successional forest. The marbled murrelet strategy will contribute additional late successional forest, but an accurate estimate of amount cannot be made at this time. To meet the 50 percent prescription, another 34 to 39 percent of the land base must be dispersal or higher quality owl habitat, and therefore, a harvest rotation between 65 and 70 years is necessary.

OTHER MANAGED FORESTS

In conjunction with the conservation strategies described for spotted owls, marbled murrelets, riparian ecosystems (salmonids), and uncommon habitats, DNR will continue with a wide range of forest land management activities. (See Section H of this chapter, titled Forest Land Management Activities, for more discussion.) Typically, even-aged management is based on either an economic rotation or a maximum volume rotation. Currently, the most widely used harvest age is based on the economic rotation, which is approximately 50 to 60 years in west-side forests. Maximum volume rotations are approximately 80 to 100 years, the age at which stands reach maturity.

After a natural disturbance, such as fire, a stand regenerates and develops through a succession of seral stages. Managed forests often follow a similar, yet altered, pattern of sucession after a clearcut timber harvest. Various systems have been used to describe forest succession. The system used by Brown (1985) is based on the structural condition of the stand and identifies six stages: grass/forb, shrub, open sapling/pole, closed sapling/pole/sawtimber, large sawtimber, and old growth. Large saw timber is approximately equivalent to mature forest. Mature and old-growth forests are considered to be late successional (Thomas et al. 1993). Conifer forest stands develop closed sapling/pole/sawtimber structural conditions at approximately 30 to 80 years of age (Brown 1985), and stands exhibiting such conditions are generally considered to be young forest (Spies and Franklin 1991). Forests managed on an economic or maximum volume rotation should provide suitable habitat for species that utilize grass/forb, shrub, open sapling/pole, and closed sapling/pole/sawtimber stages of forest succession.

Benefits of the Species-Specific Strategies to Unlisted Species

A population's extinction risk, or conversely, its viability, is primarily a function of population size. Larger populations are more resilient to adverse environmental changes, whether such changes are natural or human-caused. Reductions in a species' habitat quality or quantity are necessarily followed by a decrease in population size, and a substantial decrease in population size increases the risk of extinction. Improving habitat quality or quantity should, in theory, lead to a larger population and decreased risk of extinction.

Geographic distribution is also a factor in risk of extinction. Maintaining a species over a large geographic area decreases the risk of extinction caused by environmental change. Over a sufficiently large area, it is unlikely that catastrophic disturbances (e.g., forest fires), harsh weather, or disease will directly affect all sub-populations. Ecological distribution may also play a role in long-term population viability. Exposing sub-populations to a range of ecological conditions maintains the genetic variation in a population. Genetic variation at the population level is essential for adaptation to changing environmental conditions.

DNR-managed forests on the west side are distributed from the Canadian border to the Columbia River Gorge and from the Cascade crest to the Pacific Coast. The five west-side planning units include portions of five physiographic provinces (Northern Cascades, Southern Washington Cascades, Puget Trough, Olympic Peninsula, and the Coast Ranges — see Map III.1), three major vegetational zones (Sitka spruce, western hemlock, and silver fir — see discussion in the section of Chapter I titled Land Covered by the HCP), and a range of climatic conditions (Franklin

and Dyrness 1973; see also section of Chapter I titled Land Covered). This mix of soils, vegetation, and climate exposes sub-populations to a range of ecological conditions. The large geographic area covered by the five west-side planning units and the range of ecological conditions within them will contribute to the long-term viability of unlisted species populations.

The conservation strategies for salmonids and marbled murrelets should serve to reduce the risk of extinction for many unlisted species, in particular those that have small home ranges and depend on riparian/wetland ecosystems or late successional forests. The riparian (salmonid) strategy will maintain or restore the quantity, quality, and geographic distribution of riparian/wetland habitats. The murrelet strategy is expected to result in the retention of a significant amount of late successional forest. Even-aged forest management will provide habitat for species that utilize young forests. Some unlisted species depend on special landscape features or habitat elements that have yet to be addressed. The conservation measures for talus fields, caves, cliffs, oak woodlands, large snags, balds, mineral springs, and large, structurally unique trees described later in this section are intended to provide habitat for these species.

The spotted owl conservation strategy positions large landscapes of mature and old-growth forest within 2 miles of federal reserves (National Parks, National Forest Wilderness Areas, National Forest Late successional Reserves, etc.). For wide-ranging species (northern goshawk, Pacific fisher, California wolverine, grizzly bear, gray wolf), the conservation benefits of this HCP are seen as adjunct to those provided by federal reserves. Wildlife populations on federal lands will benefit from the proximity of additional riparian and late successional forests on DNR-managed lands. The HCP conservation strategies will broaden the geographic distribution of late successional forest and improve connectivity between noncontiguous blocks of federal land. For those unlisted species sensitive to human disturbance, special management as described below will enhance the reproductive success of individuals.

Protection of Uncommon Habitats

The conservation strategies for salmonids, spotted owls, and marbled murrelets protect habitat for many unlisted species, particularly those associated with late successional forests or riparian ecosystems. For species that rely on uncommon habitats or habitat elements, additional measures are necessary to meet the conservation objectives of the HCP. These measures specifically address talus, caves, cliffs, oak woodlands, large snags, and large, structurally unique trees. The protection of talus, caves, cliffs, and oak woodlands is important because once altered or destroyed, these habitats are difficult to restore or recreate. Large snags and large, structurally unique trees are essential habitat elements that are generally scarce in managed forest

TALUS

Talus has been designated a priority habitat by the Washington Department of Fish and Wildlife (WDFW 1995). It is a homogenous area of rock rubble ranging in size from 1 inch to 6.5 feet (WDFW 1995a; Herrington and Larsen 1985). Naturally occurring talus fields often develop at the base of cliffs or steep hillslopes as gravitational forces act upon disintegrating rock. As more rock accumulates, talus fields expand into adjacent areas of vegetation. Organic soils and pioneering vegetation may also begin to appear in some portions of talus fields in the primary stage of forest succession.

The Larch Mountain salamander requires talus in upland areas (Leonard et al. 1993). Dunn's and Van Dyke's salamanders are also known to inhabit the moist spaces between and under the rocks in talus fields (WDW 1991). Several bat species of concern use rock crevices in large talus for solitary roosts (Christy and West 1993; Holroyd et al. 1994). The microclimatic conditions and shelter provided in the spaces between and under rocks are the elements that make talus an important habitat. Because talus with a high soil content lacks such spaces, it is less important as habitat.

The rock rubble that forms talus fields accumulates where the slope is less than the angle of repose. Although talus provides habitat for some species, the talus fields are also used as road beds and the rocks are used to build roads. (Forty-seven percent is the average angle of repose for unconsolidated materials). The stability of these areas, as evidenced by these accumulations, often make them highly suitable for road beds. Routing roads around all talus fields to preserve them as habitat would mean building on less stable parts of a hillslope, creating the potential for mass wasting and sedimentation. This would be contrary to the riparian conservation strategy, which seeks to reduce the adverse impacts of roads on salmonid habitat.

Much talus is composed of hard rock, which may be suitable material for road construction. Mining talus fields for road construction can result in both short-term and long-term minimization of adverse impacts to salmonid habitat. Heavy trucks hauling construction materials can cause a short-term increase in road erosion and stream sediment concentrations, which can be lessened by using rocks from nearby talus fields (Cederholm et al. 1981). In addition, the use of construction materials inferior to hard rock talus can lead to increased risk of road failure and long-term increases in stream sedimentation caused by surface erosion. Therefore, the protection of all talus fields would conflict with the riparian conservation strategy, which requires that the adverse affects of upland management activities on salmonid habitat be minimized. Besides which, the hauling of materials to a road construction site can be prohibitively expensive compared to the mining of talus.

The conservation objectives for the talus habitat are to maintain its physical integrity and minimize microclimatic change. To meet these objectives, avoid conflict with the conservation of salmonid habitat, and promote cost effective forest management, naturally occurring talus fields shall be protected as follows:

(1) Nonforested Talus - defined as exposed talus with 30 percent or less canopy closure.

- No timber harvest will occur in talus fields greater than or equal to 1 acre.

- No timber harvest will occur in talus fields greater than 1/4 acre in spotted owl NRF and dispersal habitat management areas in the Columbia Planning Unit, except for the western half of the Siouxon Block and 2 isolated sections near Highway 12 where no timber harvest will occur in talus fields greater than 1 acre.

- A 100-foot-wide timber buffer will be applied around talus fields identified above. The buffer will be measured from the edge of the nonforested talus field, i.e. where canopy closure first exceeds 30 percent.

- Timber harvest in the buffer must retain at least 60 percent canopy closure. Any yarding within the buffer will protect the integrity of the talus field.

(2) Forested Talus - defined as exposed talus with greater than 30 percent canopy closure.

- Timber harvest may not remove more than one-third of standing timber volume each harvest rotation from forested talus not located in talus buffers.

(3) Nonforested and Forested Talus

- Road construction through talus fields and buffers will be avoided, provided that the routing of roads will be accomplished in a practicable and economically feasible manner, that is consistent with other objectives of a comprehensive landscape-based road network planning process.

- The mining of rock from talus fields and buffers for road construction will be avoided, provided construction materials can be acquired in a practicable manner, consistent with other objectives of a comprehensive road network planning process.

If a functional relationship between relative density and canopy closure can be demonstrated, then relative density can be substituted for canopy closure in the above definitions of talus.

CAVES

The Washington Department of Fish and Wildlife (1995) defines cave as "a naturally occurring cavity, recess, void, or system of interconnected passages which occurs under the earth in soils, rock, ice, or other geological formations, and is large enough to contain a human." This landscape feature has been designated a priority habitat by the Washington Department of Fish and Wildlife (1995a). Caves possess unique microclimates: constant high humidity levels, low evaporation rates, stable temperatures, and an absence of light. The archetypal cave possesses three zones: entrance zone, twilight zone, and dark zone. The entrance zone receives direct light and commonly has a vegetative component. The twilight and dark zones lie beyond the entrance zone in cave passages, i.e., the corridors and chambers that constitute a cave. The twilight zone receives no direct light, but light is detectable. Shade tolerant plants may inhabit this zone. The dark zone is devoid of light and photosynthetic plant life. In terms of species richness, the cave ecosystem is relatively simple, and therefore it is more vulnerable to environmental disturbances.

Species associated with caves in western Washington include the Larch Mountain salamander (WDW 1991), Townsend's big-eared bat (WDW 1991), long-legged myotis, long-eared myotis, fringed myotis, and Yuma myotis (Christy and West 1993). Only six caves are known on DNR-managed land (WDFW Priority Habitats Database 1995). Most caves in western Washington are lava tubes, which are long passages typically close to the surface.

The Washington Department of Fish and Wildlife definition of a cave is extraordinarily broad, and it is unlikely that all geomorphological features that fit this definition are important to wildlife. Under this HCP, when a cave is found, DNR shall determine, in cooperation with the the U.S. Fish

and Wildlife Service, whether it is important to wildlife habitat, and only those caves identified as important habitat shall be protected. The conservation objectives for such caves are to:

(1) maintain the microclimate at the cave entrance;

(2) maintain the physical integrity of cave passages; and

(3) minimize human disturbance to bat hibernacula and maternity colonies.

Caves and cave passages that have been identified as important wildlife habitat shall be protected as follows:

- A 250-foot-wide buffer shall be established around cave entrances. No disturbance of soils or vegetation shall occur within these buffers.
- Where surface activities may disturb a cave passage, a 100-foot-wide buffer shall be established on both sides of the cave passage. No disturbance of soils or vegetation shall occur within these buffers.
- Roads shall not be constructed within 0.25 mile of a cave entrance, provided that the routing of roads around caves can be accomplished in a practicable manner, consistent with other objectives of a comprehensive landscape-based road network planning process.
- Where surface activities may disturb a cave passage, roads shall not be constructed within 300 feet of the cave passage, provided that the routing of roads around caves can be accomplished in a practicable manner, consistent with other objectives of a comprehensive landscape-based road network planning process.
- Newly discovered caves shall be explored and mapped before forest management activities in their vicinity may commence. Explorations will be timed to avoid active maternity colonies or hibernacula.
- The location of caves will be kept confidential by DNR, to the extent permitted by law.

CLIFFS

Cliffs are steep, vertical, or overhanging rock faces; those greater than 25 feet tall and below 5,000 feet in elevation are considered a priority habitat by Washington Department of Fish and Wildlife (1995a). Ledges provide important nesting sites for peregrine falcons. Fissures and overhanging rock provide roosting and hibernation sites for several unlisted bat species of concern (Sarell et al. 1993).

Cliffs are often composed of hard rock that is suitable for road construction. The occasional proximity of cliffs to road construction reduces the hauling distance of road construction materials. The use of construction materials inferior to hard rock can lead to increased risk of road failure and long-term increases in stream sedimentation caused by surface erosion. Furthermore, the acquisition and hauling of materials to a road construction site can be prohibitively expensive compared to the mining of cliffs.

The conservation objectives for cliff habitat are to minimize disturbance to geomorphic features and to protect species that inhabit cliffs. However, few

management practices have been specifically developed for cliffs in managed forests. Therefore, management prescriptions to meet these objectives shall be developed on a site-specific basis with consideration given to the following:

(1) During planning for harvest activities around cliffs greater than 25 feet tall and below 5,000 feet in elevation, DNR shall evaluate the cliff to determine if use by wildlife is likely (e.g., are fissures/overhangs present suitable for bats, are ledges/perch trees present suitable for nesting raptors, etc.) and, if so, provide adequate protection measures including, but not limited to:

   a. protection of integrity of cliffs judged suitable and likely for wildlife use (e.g., during felling/yarding, logs should not be allowed to disturb cliff face);

   b. retention of trees on cliff benches and along the base and top of cliffs judged suitable for nesting raptors, especially perch trees along the top of cliffs; and

   c. avoidance of damage to significant cavities, fissures, and ledges.

(2) All cliffs in excess of 150 feet in height will be evaluated for peregrine falcon use as described elsewhere in this HCP (see Minimization and Mitigation for Other Federally Listed Species in All Planning Units)

(3) All cliffs with known peregrine falcon aeries will be protected according to Forest Practice regulations and the commitments contained in this HCP for peregrines (see Minimization and Mitigation for Other Federally Listed Species in All HCP Planning Units).

The mining of rock from cliffs for road construction shall be avoided, provided construction materials can be acquired in a practicable manner, and is consistent with other objectives of a comprehensive landscape-based road-network planning process.

OAK WOODLANDS

Oak woodlands have been designated a priority habitat by the Washington Department of Fish and Wildlife (1995a). Oregon white oak (*Quercus garryana*) is the only native oak in Washington. The center of its range is the Willamette Valley of Oregon; the northern limit of its range is along the lower east slopes of the central Washington Cascades. Scattered Oregon white oak woodlands occur in the Puget Trough, the Columbia Gorge, and along the east slope of the southern Washington Cascades (Franklin and Dyrness 1973). Oregon white oak is also an important component of some ponderosa pine stands along the east slope of the southern and central Washington Cascades (Franklin and Dyrness 1973). In the area covered by the HCP, DNR manages about 4,000 acres of oak woodland (e.g., where oak is the primary tree species) and an additional 7,000 acres of mostly ponderosa pine stands in which oak is a significant associate (e.g., where oak is a secondary or tertiary tree species), but only about 500 acres of oak woodland are in the five west-side planning units (DNR GIS 1995).

Fire is believed to have had a crucial role in the maintenance of oak woodlands by limiting and reducing the number of encroaching conifers. Fire may also stimulate sprouting in Oregon white oaks and enhance the growth of seedlings by removing competing herbaceous vegetation. Without natural wildfires or managed periodic burns, the vegetative composition of the

woodland changes. Douglas fir becomes established, and within three to four decades, the rapidly growing conifer overtops the oak, at which point the plant community may be irreversibly altered.

Oak woodlands are a rare plant community in Washington and provide important habitat for several high priority species, including Lewis' woodpecker and the western gray squirrel, which is listed by the state as threatened. Species that find significant habitat in these areas are primarily those that are at the center of their ranges farther south.

The conservation objectives for this habitat are to:

(1) maintain the current quality and distribution of oak habitat to the extent possible considering air quality, fire management, and other constraints; and

(2) restore the quality and distribution of oak habitat where consistent with the above constraints.

Oak woodlands shall be managed as follows:

(1) Partial harvest may occur in oak woodlands. Such harvest will:

- retain all very large dominant oaks (greater than 20 inches dbh);
- maintain 25 to 50 percent canopy cover;
- remove encroaching conifers, except western white pine; and
- retain standing dead and dying oak trees.

(2) Prescribed underburns shall be conducted where appropriate.

(3) Road construction through oak woodlands shall be avoided, provided that the routing of roads around oak woodlands can be accomplished in a practicable manner, consistent with other objectives of a comprehensive landscape-based road network planning process.

LARGE, STRUCTURALLY UNIQUE TREES

Very large trees with certain structural characteristics are important habitat elements in conifer forests of western Washington. Individual trees most valuable for wildlife possess large strong limbs, open crowns, large hollow trunks, and broken tops or limbs. Many live trees that exhibit such characteristics are described by foresters as "deformed" or "defective". These trees provide important, perhaps essential, nesting and/or roosting habitat for two listed species, the marbled murrelet and bald eagle, and several bird species of concern including Vaux's swift, and the pileated woodpecker, as well as forest bats. In western Washington, three species of trees attain enormous size, are very long-lived, and are generally quite wind-firm persisting through numerous disturbances — Sitka spruce (*Picea sitchensis*), Douglas fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*). According to Waring and Franklin (1979), on "better sites" in the Pacific Northwest, Douglas fir, Sitka spruce, and western redcedar can attain typically large diameters, from 60 to 87 inches, 70 to 90 inches, and 60 to 118 inches, respectively. In a managed forest, the largest examples of such trees are sometimes referred to as old-growth remnants.

The conservation objectives for this habitat element are to:

(1) retain very large trees with certain structural characteristics important to wildlife, and

(2) retain large trees that may develop these structural characteristics.

Research on animal species using large, structurally unique trees provides guidance for retention criteria. In western Washington, the mean diameter of Douglas fir used for nesting by bald eagles was 50 inches dbh (n = 70) and ranged from 24 to 90 inches dbh (Anthony et al. 1982). Bald eagles used Sitka spruce that ranged from 41 to 109 inches dbh and averaged 75 inches dbh (n = 17) (Anthony et al. 1982). Raley et al. (1994) found more than two-thirds of the roost trees used by radio-tagged pileated woodpeckers were large hollow western redcedars (mean diameter = 81 inches dbh). Vaux's swifts have been found roosting and nesting in hollow western redcedars similar to those used by pileated woodpeckers. Hamer and Nelson (1995) found that in Washington, marbled murrelets nest in trees that average 60 inches dbh (n = 6) and range in size from 35 to 87 inches dbh.

DNR shall conserve the habitat elements provided by large, structurally unique trees as follows:

- When selecting trees for retention, a preference shall be shown for large trees with structural characteristics important to wildlife, or those considered to be old-growth remnants.
- At least 1 tree per acre selected for retention shall belong to the largest diameter class of living trees in the management unit before harvest (by 2-inch increments). At least 1 other tree per acre shall belong to the dominant crown class.
- The trees selected for retention will be left in the harvest unit where practicable, and may be clumped to improve wildlife habitat, protect trees from severe weather, or facilitate operational efficiency, but where practicable, the density of clumps may not be less than 1 clump per 5 acres.
- Trees selected for retention will pose no hazard to workers during harvest operations per the safety standards of the Washington Department of Labor and Industries (WAC 296-54).

SNAGS

DNR shall conserve the habitat elements provided by large snags as follows:

- At least three snags shall be retained for each acre harvested, on average. DNR will try to leave all snags where safe and practical.
- If available, snags retained will be at least 15 inches dbh and 30 feet tall. DNR will try to leave all snags where safe and practical.
- Priority for retention will be given to large hollow snags, hard snags with bark, and snags that are at least 20 inches dbh and 40 feet tall.
- At least five live trees shall be retained permanently for each acre harvested, on average. Two of these trees will be as described in the section on large, structurally unique trees. The other three trees per acre will belong to the dominant, codominant, or intermediate crown classes, and, when available, will have at least one-third of their height in live crown.
- Priority for retention will be given to tree species which have a propensity to develop cavities (e.g., maple), but the stand tree species diversity after harvest should be generally representative of the tree species diversity prior to harvest.

- If fewer than three snags per acre are available prior to harvest, or if fewer than three snags can be left because of safety concerns, additional live trees will be retained so that the total number of stems per acre retained after harvest is, on average, at least 8 per acre. If additional live trees belong to the co-dominant or intermediate crown classes, and when available, will have at least one-third of their height in live crown. If intermediate crown-class trees are retained, shade-tolerant species with at least one-third of their height in live crown will be selected.

- Snags and trees selected for retention within the harvest units may be clumped to improve wildlife habitat, protect trees from severe weather, or facilitate operational efficiency, but where practicable, the density of clumps may not be less than one clump per five acres.

- Snags and trees selected for retention will pose no hazard to workers during harvest operations per safety standards of the Washington Department of Labor and Industries (WAC 296-54).

BALDS

Road construction through balds shall be avoided, provided that the routing of roads around balds can be accomplished in a practicable manner and is consistent with other objectives of a comprehensive landscape-based road network planning process.

MINERAL SPRINGS

Mineral springs provide important resources for certain animal species, e.g., the band-tailed pigeon (*Columbia fasciata).* To prevent or reduce adverse impacts to this landscape feature and the wildlife species associated with it, DNR will cooperate with the U.S. Fish and Wildlife Service in planning management activities within 200 feet of known mineral springs. Such activities will be designed to: (1) retain adequate trees for perching; and (2) maintain berry, fruit, and mast producing shrubs and trees, particularly in openings near mineral springs. Trees harvested near mineral springs will be felled away from the spring. DNR will avoid crossing mineral springs with yarding equipment and will prohibit the crossing of mineral springs by ground-based logging equipment. Residual large green trees and snags within 25 feet of mineral springs will be left, and either clumped or scattered depending upon operational feasibility. In addition, DNR will continue to minimize the use of herbicides as directed by Forest Resource Plan Policy No. 33.

Species by Species Conservation for Unlisted Species of Concern

Habitat for these species will be protected through the conservation strategies for the northern spotted owl and the marbled murrelet, and particularly through the riparian conservation strategy. Please refer to the full descriptions of these strategies as discussed in Sections A, B, and C, respectively, of this chapter for more details.

MOLLUSKS

Newcomb's Littorine Snail

DNR manages several parcels of land near the southern shores of Grays Harbor. The riparian conservation strategy of the HCP is expected to provide protection of the estuarine and wetland habitats considered

important to the Newcomb's littorine snail. This protection will be achieved primarily through:

(1) the application of the riparian management zone to estuaries, all of which are shorelines of the state (RCW 90.58.030) and therefore Type 1 waters; and

(2) riparian buffers along Types 1, 2, 3, and 4 waters. Riparian buffers will mediate the delivery of sediment, detrital nutrients, and large woody debris from inland areas to estuaries.

Furthermore, although no specific HCP strategies have been designed for the protection of estuarine areas, some additional protection is expected through DNR's compliance with the Shoreline Management Act (RCW 90.58) and the guidelines for forest management practices promulgated under this Act (WAC 173-16-060).

California Floater and Great Columbia River Spire Snail

DNR expects the riparian conservation strategy of the HCP to protect the rivers and large streams (Types 1, 2 and 3 waters) considered important to the California floater and the great Columbia River spire snail.

ARTHROPODS

Beller's Ground Beetle, Long-horned Leaf Beetle, and Hatch's Click Beetle

DNR expects the riparian conservation strategy of the HCP to protect the sphagnum bog habitat in which these three species of beetles occur through a commitment to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p 36). Sphagnum bogs associated with low-elevation lakes will be provided further protection when the lake is a Type 1, 2, or 3 water.

Fender's Soliperlan Stonefly and Lynn's Clubtail

DNR expects the riparian conservation strategy of the HCP to protect the aquatic habitats considered important to the Fender's soliperlan stonefly and Lynn's clubtail. The riparian conservation strategy should facilitate the redevelopment of riparian plant communities and the natural variability of the aquatic environment. The natural mix of conifer and deciduous species within the riparian buffer should occur through ecosystem restoration. Also, natural disturbances, such as floods and channel migration will continue to create the silty waters that Lynn's clubtail uses for breeding.

FISH

Olympic Mudminnow

The riparian conservation strategy is expected to protect the spawning and rearing habitats of the Olympic mudminnow through:

(1) committing to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36);

(2) protecting lakes and ponds classifies as Types 1, 2, and 3 waters;

(3) protecting Types 1, 2, 3, and 4 rivers and streams; and

(4) treating Type 4 and 5 waters documented to contain fish that are proposed candidates for federal listing as Type 3 waters, if appropriate.

Additional protection of aquatic habitat will occur through the prohibition of timber harvest on unstable hillslopes and road network management that minimizes adverse impacts to salmonid habitat.

Pacific Lamprey and River Lamprey

The riparian conservation strategy as described above for the Olympic mudminnow should protect the spawning and rearing habitats of the Pacific and river lampreys.

Green Sturgeon

Green sturgeon spawning and juvenile rearing habitats are not known to occur in Washington, and thus are out of the bounds of the area covered by the HCP. However, some adult habitat occurs in Grays Harbor, Willapa Bay, and along the Columbia River and its estuaries. This habitat would receive some protection through the riparian conservation strategy as described above for Newcomb's littorine snail.

AMPHIBIANS

Larch Mountain Salamander

This species is strongly associated with talus. Talus fields that are 1 acre or larger in size will be protected as previously described in the subsection titled Protection of Uncommon Habitats. Also, DNR expects the riparian conservation strategy to protect talus fields within or immediately below unstable areas because no harvest will occur on hillslopes with a high risk of mass wasting. In addition, the riparian management zone along Types 1, 2, 3, and 4 waters may encompass some talus fields.

Dunn's and Van Dyke's Salamanders and the Tailed Frog

The riparian conservation strategy is expected to protect the breeding, foraging, and resting habitats of Dunn's and Van Dyke's salamanders and the tailed frog. Riparian buffers along Types 1, 2, and 3 waters will be approximately equal to the site potential height of trees in a mature conifer stand, or 100 feet, whichever is greater. A riparian buffer 100 feet wide will be applied to both sides of Type 4 waters. Management of the no-harvest and minimal-harvest areas of the riparian buffer is anticipated to maintain or restore forests with mature or old-growth characteristics.

Some seeps will be protected through Type 5 stream protection. Type 5 waters that flow through an area with a high risk for mass wasting will be protected under the riparian conservation strategy, and other Type 5 waters will be protected where necessary for key nontimber resources, such as water quality, fish, wildlife habitat, and sensitive plant species (DNR 1992 p. 35).

Dunn's and Van Dyke's salamanders are occasionally found in upland talus (WDW 1991). Talus fields that are 1 acre or larger will be protected as described previously in the subsection titled Uncommon Habitats.

Northern Red-legged Frog, Cascades Frog, and Spotted Frog

The riparian conservation strategy is expected to protect the breeding, foraging, and resting habitats of the northern red-legged, Cascades, and spotted frogs through:

(1) committing to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36);

(2) protecting lakes and ponds classified as Types 1, 2, or 3 waters; and

(3) protecting Types 1, 2, 3, and 4 rivers and streams.

The riparian conservation strategy should facilitate the redevelopment of riparian plant communities and the natural variability of the aquatic environment. The natural mix of conifer and deciduous species within the riparian buffer should occur through ecosystem restoration.

REPTILES

Northwestern Pond Turtle

The riparian conservation strategy is expected to protect the breeding, foraging, and resting habitats of the northwestern pond turtle through:

(1) committing to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36);

(2) protecting lakes and ponds classified as Types 1, 2, or 3 waters; and

(3) protecting Types 1, 2, 3, and 4 rivers and streams.

In addition, under WAC 222-16-080 of the state Forest Practices Rules, harvesting, road construction, aerial application of pesticides, or site preparation within 0.25 mile of a known individual occurrence, documented by the Washington Department of Fish and Wildlife, of a northwestern pond turtle are Class IV-Special forest practices and require an environmental checklist in compliance with the State Environmental Policy Act. The environmental checklist may indicate a need for further protection of the species' critical wildlife habitat.

California Mountain Kingsnake

The California mountain kingsnake occupies oak and pine forests. Oak woodlands have been designated a priority habitat by the Washington Department of Fish and Wildlife (1995a). Oak woodlands will be protected as described previously in the subsection titled Protection of Uncommon Habitats.

The riparian conservation strategy is expected to provide protection of the habitat of the California mountain kingsnake. No harvest will occur on hillslopes with a high risk of mass wasting, and some oak forest exists within unstable areas. The riparian management zone along Types 1, 2, 3, and 4 waters may also encompass some oak forest.

BIRDS

Harlequin Duck

The riparian conservation strategy is expected to protect the breeding, foraging, and resting habitats of the harlequin duck. Buffers along Types 1, 2, and 3 waters will be approximately equal to the site potential height of trees in a mature conifer stand, or 100 feet, whichever is greater. A riparian buffer 100 feet wide will be applied to both sides of Type 4 waters. Management of the no-harvest and minimal-harvest areas of the riparian buffer is anticipated to maintain or restore forests with mature or old-growth characteristics.

Forest management in the riparian buffer must maintain or restore the quality of salmonid habitat, and the resulting conditions should also be conducive to natural densities of aquatic macro-invertebrates upon which the Harlequin duck feeds. The adverse impacts of human disturbance will be minimized by the riparian buffer, which is estimated to have an average width of 150 to 160 feet. Human disturbance will be further reduced by the wind buffer that will be placed where needed along the windward side of many reaches of Types 1, 2, and 3 waters.

ADDITIONAL MITIGATION

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 165 feet of a known active harlequin duck nest site between May 1 and September 1 where such activities would appreciably reduce the likelihood of nesting success.

Northern Goshawk

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies is expected to provide forest conditions suitable for northern goshawk breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large landscapes of mature and old-growth forest. In spotted owl NRF management areas, there will be two 300-acre nest patches per 5,000 acres of managed forest. These nest patches will consist of high quality spotted owl nesting habitat that has old-growth characteristics. The nest patches will occur within a larger, contiguous 500-acre area, of which the remaining 200 acres shall be sub-mature forest or higher quality habitat. At least 50 percent of the designated NRF management areas in each WAU (including the nest patches) will be sub-mature forest (as defined in Hanson et al. 1993) or higher quality habitat. On average, 40 to 42 percent of the designated NRF management area in each WAU will be mature or old-growth forest. The landscape conditions in the NRF management areas will meet or exceed the habitat recommendations made by Reynolds et al. (1992) for northern goshawks.

In the five west-side planning units, the spotted owl strategy designates 117,000 acres to be managed as spotted owl dispersal habitat, which supports the movement of juvenile spotted owls among sub-populations on federal reserves. It is likely the availability of this habitat will enhance the survival of dispersing juvenile goshawks as well. At least 50 percent of the designated dispersal management areas in each WAU will meet the minimum specifications for spotted owl dispersal habitat.

Outside the spotted owl NRF management areas, the riparian and murrelet conservation strategies will protect goshawk breeding, foraging, and resting habitat. Management within the riparian buffer, particularly in the no-harvest and minimal-harvest areas, should eventually result in forests with mature and old-growth characteristics. Mature and old-growth forests will also exist on hillslopes with a high risk of mass wasting. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some late successional forest. Consistent with RCW 77.16.120, outside NRF management areas, trees or snags that are known to contain active goshawk nests will not be harvested.

To meet the objective of providing habitat for demographic support of goshawk populations on federal forest reserves, additional mitigation is necessary to ensure the reproductive success of goshawk breeding pairs in

DNR-managed forests. In particular, special management is necessary to minimize human disturbance around active nest sites.

ADDITIONAL MITIGATION

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 0.55 mile of a known active northern goshawk nest site located in a NRF management area between April 1 and August 31 where such activities would appreciably reduce the likelihood of nesting success. A circle of radius 0.55 mile will circumscribe the entire post-fledgling family area (600 acres).

Sandhill Crane and Black Tern

The riparian conservation strategy is expected to protect the wetland habitats of the sandhill crane and black tern through: (1) committing to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36), and (2) protecting lakes and ponds classified as Types 1, 2, or 3 waters.

In addition, under WAC 222-16-080 of the state Forest Practices Rules, harvesting, road construction, aerial application of pesticides, or site preparation within 0.25 mile of a known active nesting area, documented by the Washington Department of Fish and Wildlife, of a sandhill crane are Class IV-Special forest practices and require an environmental checklist in compliance with the State Environmental Policy Act. The environmental checklist may indicate a need for further protection of the species' critical wildlife habitat.

Olive-sided Flycatcher

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for olive-sided flycatcher breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large contiguous landscapes of mature and old-growth forest. At least 50 percent of the designated NRF management areas in each WAU (including the spotted owl nest patches) will be sub-mature forest (as defined in Hanson et al. 1993) or higher quality habitat. On average, 40 to 42 percent of the designated NRF management area in each WAU will be mature or old-growth forest.

Outside spotted owl NRF management areas, the riparian and murrelet conservation strategies will protect breeding, foraging, and resting habitat. Management within the riparian buffer, particularly in the no-harvest and minimal-harvest areas, should eventually result in forests with mature and old-growth characteristics. Mature and old-growth forests will also exist on hillslopes with a high risk of mass wasting. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some late successional forest.

Little Willow Flycatcher

The riparian conservation strategy and forest management in the five west-side planning units are expected to provide breeding, foraging, and resting habitat for the little willow flycatcher. Buffers along Types 1, 2, and 3 waters will be approximately equal to the site potential height of trees in a mature conifer stand, or 100 feet, whichever is greater. A riparian buffer 100 feet wide will be applied to both sides of Type 4 waters. The natural mix of conifer and deciduous species should occur through ecosystem restoration. Also, natural disturbances such as floods, and channel migration will

continue to create the alder and willow riparian habitat preferred by this species.

Even-aged forest management throughout the five west-side planning units will continue to provide shrubby habitats in regenerating clearcuts and sapling stands.

Common Loon

The riparian conservation strategy is expected to protect the loon's lake habitat. The adverse impacts of human disturbance will be minimized by the riparian buffer, which is estimated to have an average width of 150 to 160 feet and will be applied along the shoreline of Types 1, 2, and 3 lakes and ponds. Human disturbance will be further reduced by the wind buffer that will be placed where needed along the riparian buffer on the windward side of Types 1, 2, and 3 waters. In order to meet the conservation objectives, further mitigation is required to reduce the adverse affects of human disturbance.

ADDITIONAL MITIGATION

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 500 feet of a known active common loon nest site between April 1 and September 1 where such activities would appreciably reduce the likelihood of nesting success.

Golden Eagle

Golden eagles nest in large trees or on cliffs. These uncommon habitats and habitat elements will be protected as described earlier in this section. The combination of the riparian conservation strategy and forest management in the five west-side planning units should provide breeding, foraging, and resting habitat for the golden eagle. Many forests on unstable hillslopes will not be harvested and some of these areas will contain large trees. Buffers along Types 1, 2, and 3 waters will be approximately equal to the site potential height of trees in a mature conifer stand, or 100 feet, whichever is greater. A riparian buffer 100 feet wide will be applied to both sides of Type 4 waters. Management within the riparian buffer is expected to result in the development of late successional forest containing large live trees. Even-aged forest management throughout the five west-side planning units will continue to provide openings for foraging habitat.

Golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668, Revised 1978). Under this Act, it is unlawful to molest or disturb golden eagles and their nests. RCW 77.16.120 of the Wildlife Code of Washington prohibits destroying the nests of protected wildlife. Consistent with these regulations, trees or snags that contain known active golden eagle nests shall not be harvested.

Vaux's Swift

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies is expected to provide forest conditions suitable for Vaux's swift breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large contiguous landscapes of mature and old-growth forests containing large live tree and snags. In spotted owl NRF management areas, there will be two 300-acre nest patches per 5,000 acres of managed forest. These nest patches will consist of high quality spotted owl nesting habitat, which will have old-growth forest characteristics. The nest patches will occur within a larger, contiguous 500-acre area, of which

the remaining 200 acres shall be sub-mature forest or higher quality habitat. At least 50 percent of the designated NRF management areas in each WAU (including the nest patches) will be sub-mature forest or higher quality habitat.

Even-aged forest management will provide a full range of seral stages for foraging. No harvest will occur on unstable hillslopes with a high risk of mass wasting, and some of these areas will contain large live trees and large snags. Management activities within the riparian buffer are expected to result in the development of late successional forest containing large live trees.

Outside the NRF management areas, the riparian and murrelet conservation strategies will protect breeding and resting habitat. Management within the riparian buffer, particularly in the no-harvest and minimal-harvest areas, should eventually result in forests with mature and old-growth characteristics. Mature and old-growth forests will also exist on hillslopes with a high risk of mass wasting. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some late successional forest.

Large, structurally unique trees and large hollow snags will be protected as described previously in the subsection titled Protection of Uncommon Habitat. In addition, consistent with RCW 77.16.120, trees or snags that are known to contain active Vaux's swift nests shall not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

ADDITIONAL MITIGATION

Live trees or snags that are known to be used by Vaux's swifts as night roosts shall not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

Lewis' Woodpecker

Oak woodlands are used for breeding, foraging, and resting habitat by Lewis' woodpecker. Oak woodlands have been designated a priority habitat by the Washington Department of Fish and Wildlife (1995a) and will be protected as described previously in the subsection titled Protection of Uncommon Habitats. The riparian conservation strategy is expected to guarantee some protection of this habitat within unstable areas because no harvest will occur on hillslopes with a high risk of mass wasting areas. The riparian management zone along Types 1, 2, 3, and 4 waters may also encompass some oak forests.

The riparian conservation strategy should protect some deciduous riparian habitat. Buffers along Types 1, 2, and 3 waters will be approximately equal to the site potential height of trees in a mature conifer stand. A riparian buffer 100 feet wide will be applied to both sides of Type 4 waters. DNR expects this management to result in the development of late successional forest containing large snags. The natural mix of conifer and deciduous species should occur through ecosystem restoration, and natural disturbances, such as floods, and channel migration will continue to create the cottonwood riparian habitat preferred by this species.

Pileated Woodpecker

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies is expected to provide forest conditions suitable for pileated woodpecker breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large contiguous landscapes of mature and old-growth forest containing large live tree and snags. At least 50 percent of the NRF management area in each WAU will be sub-mature forest (as defined in Hanson et al. 1993) or higher quality. There will be two 300-acre nest patches per 5,000 acres of managed forest in NRF management areas. These nest patches will consist of high quality spotted owl nesting habitat, which has old-growth forest characteristics. The nest patches will occur within a larger, contiguous 500-acre area, of which the remaining 200 acres shall be sub-mature forest or higher quality habitat. On average, 40 to 42 percent of the designated NRF management area in each WAU will be mature or old-growth forest.

Outside of spotted owl NRF management areas, the riparian and murrelet conservation strategies will protect breeding and resting habitat. Management within the riparian buffer, particularly in the no-harvest and minimal-harvest areas, should eventually result in forests with mature and old-growth characteristics. Mature and old-growth forests will also exist on hillslopes with a high risk of mass wasting. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some late successional forest.

Snags will be retained according to state Forest Practices Rules. Under WAC 222-30-020(11), three wildlife reserve trees (typically snags) are left for each acre harvested in western Washington. The wildlife reserve trees must be 10 or more feet in height and 12 or more inches dbh. These minimum sizes do not guarantee that wildlife trees suitable for pileated woodpeckers will be retained. The retention of large, structurally unique trees, as described previously in the subsection titled Protection of Uncommon Habitats, will provide a source for large snags.

Conservation measures for large snags and large, structurally unique trees will retain structural elements required by pileated woodpeckers for nesting and roosting. Additional conservation measures for snags will increase the density of snags, and consequently, opportunities for foraging.

Consistent with RCW 77.16.120, trees or snags that are known to contain active pileated woodpecker nests will not be harvested. In addition, trees or snags that are known to have been used by pileated woodpeckers for nesting will not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

Purple Martin

The riparian conservation strategy is expected to protect the open riparian/wetland habitat of purple martins through:

(1) committing to "no overall net loss of naturally occurring wetland acreage and function" (DNR 1992 p. 36); and

(2) the protection of lakes and ponds classified as Types 1, 2, or 3 waters.

Conservation measures for large snags and large, structurally unique trees will retain structural elements required by purple martins for nesting.

In addition, consistent with RCW 77.16.120, trees or snags that are known to contain active purple martin nests will not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

Western Bluebird

Even-aged forest management throughout the five west-side planning units will continue to provide openings suitable for breeding, foraging, and resting habitat. Conservation measures for large snags and large, structurally unique trees will retain structural elements required by western bluebirds for nesting.

In addition, consistent with RCW 77.16.120, trees or snags that are known to contain active western bluebird nests will not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

MAMMALS

Myotis Bats

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies should provide forest conditions suitable for myotis bat breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large contiguous landscapes of mature and old-growth forest. On average, 40 to 42 percent of the designated NRF management area in each WAU will be mature or old-growth forest.

Outside of spotted owl NRF management areas, the riparian and murrelet conservation strategies will protect breeding and resting habitat. Management within the riparian buffer, particularly in the no-harvest and minimal-harvest areas, should eventually result in forests with mature and old-growth characteristics. Mature and old-growth forests will also exist on hillslopes with a high risk of mass wasting. The long-term murrelet conservation strategy is not yet developed, but it will quite likely entail the preservation of some late successional forest.

Talus fields, cliffs, and caves will be protected as described previously in the subsection titled Protection of Uncommon Habitats, and DNR will also protect large, structurally unique trees and large snags as described in the same subsection.

ADDITIONAL MITIGATION

Live trees or snags that are known to be used by myotis bat species as communal roosts or maternity colonies shall not be harvested. Green tree and snag retention are subject to the safety standards of the Department of Labor and Industries (WAC 296-54).

Townsend's Big-eared Bat

Caves will be protected as described previously in the subsection titled Protection of Uncommon Habitats.

California Wolverine

There is very little montane forest on DNR-managed lands. But some parcels of DNR-managed forest are positioned adjacent to federal wilderness areas and federal Late successional Reserves that may serve as refugia for wolverines. Therefore, it is possible that wolverines could now or in the future be present in DNR-managed forests. The combination of the riparian, spotted owl, and marbled murrelet conservation strategies is expected to provide forest conditions suitable for wolverine breeding, foraging, and resting habitat. In concert, these three strategies should ensure the development of large landscapes of mature and old-growth forest. Forest management will create a range of habitat types from grass-forb to late-successional forest.

To meet the objective of providing habitat for demographic support of populations on federal forest reserves additional mitigation is necessary to ensure the reproductive success of breeding adults in DNR-managed forests. In particular, special management is necessary to minimize human disturbance around active den sites and eliminate trapping mortality.

DNR-managed roads are routinely closed for cost-effective forest management and protection of public resources, including wildlife (DNR 1992 p. 41). Road closures benefit the wolverine population by limiting human disturbance and reducing the likelihood of accidental trapping. Road closures will continue on DNR-managed lands and will be consistent with cost-effective forest management and policies set forth by the Board of Natural Resources.

ADDITIONAL MITIGATION

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 0.5 mile of a known active wolverine den site located in a spotted owl NRF management area between January 1 and July 31 where such activities would appreciably reduce the likelihood of denning success.

Pacific Fisher

The combination of the riparian, spotted owl, and marbled murrelet conservation strategies is expected to provide forest conditions suitable for fisher breeding, foraging, and resting habitat. In concert, these three strategies ensure the development of large landscapes of mature and old-growth forest. At least 50 percent of the designated NRF management areas in each WAU (inclusive of the nest patches) will be sub-mature forest (as defined in Hanson et al. 1993) or higher quality habitat. The high-quality owl nesting habitat in nest patches will have old-growth forest characteristics. On average, 40 to 42 percent of the designated NRF management area in each WAU will be mature or old-growth forest.

In the five west-side planning units, the spotted owl strategy designates 117,000 acres to be managed as spotted owl dispersal habitat. At least 50 percent of the designated dispersal management area in each WAU will meet the minimum specifications for spotted dispersal habitat. The purpose of dispersal habitat is to support the movement of juvenile spotted owls between sub-populations on federal reserves, and it is likely the availability of this habitat may also enhance the survival of dispersing juvenile fishers.

The geographical distribution of areas managed for spotted owl breeding habitat will maintain some of the elevational range of fisher habitat. DNR-managed forests are generally located at a lower elevation than federal

lands. To meet the objective of providing habitat for demographic support of populations on federal forest reserves, additional mitigation is necessary to ensure the reproductive success of breeding adults in DNR-managed forests. In particular, special management is necessary to minimize human disturbance around active den sites and eliminate trapping mortality.

DNR-managed roads are routinely closed for cost-effective forest management and protection of public resources including wildlife (DNR 1992 p. 41). Road closures benefit the fisher population by limiting human disturbance and reducing the likelihood of accidental trapping. Road closures will continue on DNR-managed lands and will be consistent with cost-effective forest management and policies set forth by the Board of Natural Resources.

Conservation measures for large snags and large, structurally unique trees will retain structural elements required by fishers for denning and resting.

ADDITIONAL MITIGATION

DNR shall place restrictions in its contracts for sales of timber and other valuable materials, as well as in its grants of rights of way and easements, to prohibit activities within 0.5 mile of a known active fisher den site located in a spotted owl NRF management area between February 1 and July 31 where such activities would appreciably reduce the likelihood of denning success.

Western Gray Squirrel

Oak woodlands are the breeding, foraging, and resting habitat of the western gray squirrel. Oak woodlands have been designated a priority habitat by the Washington Department of Fish and Wildlife (1995a), and will be protected as described previously in the subsection titled Protection of Uncommon Habitats.

The riparian conservation strategy is expected to provide some protection of the breeding, foraging, and resting habitat of the western gray squirrel. No harvest will occur on hillslopes with a high risk of mass wasting, and some oak forest will exist within unstable areas. The riparian management zone along Types 1, 2, 3, and 4 waters may also encompass some oak forest.

In addition, under WAC 222-16-080 of the state Forest Practices Rules, the Forest Practices Board may adopt rules pertaining to management activities which impact western gray squirrels. These rules would provide further protection of the species' critical wildlife habitat.

Lynx

Although the lynx may potentially occur in the area covered by the HCP, it is not known to occur in the five west-side planning units. Therefore, it is not discussed in this section.

California Bighorn Sheep

Although the California bighorn sheep may potentially occur in the area covered by the HCP, it is not known to occur in the five west-side planning units. Therefore, it is not discussed in this section.

Summary of Habitat Types Provided on DNR-managed Lands in the Five West-Side Planning Units

The type and distribution of habitat available during the term of this HCP will be the result of commitments under the HCP, natural events, forest management policies of the Board of Natural Resources and DNR, technological developments that influence management practices, and land transactions.

HABITATS TO BE MAINTAINED OR RESTORED UNDER THE HCP

Spotted Owl Nesting, Roosting, and Foraging (NRF) Areas

Two types of habitat are required within designated NRF areas:

(1) high quality nesting habitat; and

(2) areas that, at a minimum, meet the sub-mature habitat definition.

In every 5,000 acres, there shall be two 300-acre nest patches of high quality spotted owl nesting habitat that has old-growth characteristics. These nest patches will occur within a larger, contiguous 500-acre area, of which the remaining 200 acres shall be sub-mature forest or higher quality habitat. At least 50 percent of the designated NRF management areas in each WAU (Watershed Administrative Unit) shall be sub-mature, including the nest patches.

See Section A of Chapter IV on spotted owl mitigation for a full description of these habitats, their distribution, and the amount required. The definitions of these habitats are summarized below:

- High quality nesting habitat (average condition over a 300-acre nesting habitat patch)
  - at least 31 trees per acre greater than or equal to 21 inches dbh with at least 15 trees per acre greater than or equal to 31 inches dbh;
  - at least three trees from the above group of 31 trees have broken tops;
  - at least 12 snags per acre larger than 21 inches dbh;
  - a minimum of 70 percent canopy closure; and
  - a minimum of 5 percent ground cover of large woody debris.
- Sub-mature habitat (applied as average stand conditions)
  - forest community dominated by conifers or in mixed conifer/hardwood forest, the community is composed of at least 30 percent conifers (measured as stems per acre dominant, co-dominant, and intermediate trees);
  - at least 70 percent canopy closure;
  - tree density of between 115 and 280 trees per acre greater than 4 inches dbh;

- dominant and co-dominant trees at least 85 feet tall;
- at least three snags or cavity trees per acre that are at least 20 inches dbh; and
- a minimum of 5 percent ground cover of large down woody debris.

Spotted Owl Dispersal Areas

Within designated spotted owl dispersal areas, 50 percent of the area shall be maintained in stands that meet the dispersal habitat definition. See Section A of Chapter IV on spotted owl mitigation for a full description of this habitat. The definition of dispersal habitat is summarized below:

- canopy cover of at least 70 percent;
- quadratic mean diameter of at least 11 inches dbh for the 100 largest trees in a stand;
- top height of at least 85 feet; and
- at least four trees per acre from the largest size class retained for future snag and cavity trees.

Marbled Murrelet Habitat Blocks

The interim conservation strategy for the marbled murrelet calls for deferring harvest on suitable habitat blocks while studies are conducted to provide information for developing a long-term conservation strategy. The amount of habitat required for murrelets in the long-term strategy is expected to be less than is identified using the current definition. See Section B of Chapter IV for a complete discussion of the mitigation for marbled murrelets. Suitable marbled murrelet habitat that will be used for identifying blocks to be deferred is defined as a contiguous forested area meeting all of the following three criteria:

- at least five acres in size;
- containing an average of at least two potential nesting platforms per acre; and
- within 50 miles of marine waters.

Riparian Management Zones

Management activities allowed within riparian management zones will influence the type of habitat provided. The requirements for no harvest within the first 25 feet of the active channel margin and minimal harvest in the next 75 feet will tend to leave, or develop over time, timber stands with a range of mature to old-growth characteristics. Through restoration efforts consistent with the riparian conservation objective of maintaining or restoring salmonid freshwater habitat on DNR-managed lands, most riparian management zones will be coniferous with minor hardwood components. Hardwoods will be maintained on sites that are not environmentally suited to conifers. See Section D of Chapter IV for a detailed discussion of riparian management zones.

Wetlands

DNR will allow no overall net loss of naturally occurring wetland acreage or function. This applies to nonforested and forested wetlands. See Section D of Chapter IV on the riparian conservation strategy for a detailed discussion of wetland management activities and habitat. For forested wetlands and buffers of nonforested wetlands, timber harvests shall be designed to maintain the perpetuate stands that:

- are as wind-firm as possible;
- have large root systems to maintain the uptake and transpiration of ground water; and
- have a minimum basal area of 120 square feet per acre.

Uncommon Habitats

See Section F of Chapter IV on the multispecies conservation strategy for a discussion of uncommon habitats on DNR-managed lands. The following uncommon habitats will be identified and protected:

- cliffs;
- caves and cave passages that have been identified as important wildlife habitat;
- oak woodlands
  (Oak woodlands are very limited in the five west-side planning units. Where they occur, they will be managed to maintain the current quality and distribution of the habitat to the extent possible considering air quality, fire management, and other constraints and to restore the quality and distribution of this habitat where consistent with these constraints.); and
- talus fields that are one acre or larger.

HABITATS PROVIDED ON DNR-MANAGED LANDS

After a natural disturbance, such as fire, a stand regenerates and develops through a succession of seral stages. Managed forests follow a similar pattern of succession following clearcut timber harvest. A variety of wildlife habitats on DNR-managed lands will occur in the different seral stages (Brown 1985) described below:

- Grass/forb
  Grass/forb-dominated areas develop quickly on cleared lands and are common for a few years after harvest or site preparation activities. In cases where a significant shrub layer existed under the timber that was harvested, a grass/forb condition frequently will not develop. Generally, a grass/forb condition exists at the time sites are planted or develops shortly after planting.
- Shrub
  Shrubs develop on a site following harvests, including thinnings, or start developing at the same time as grasses and forbs. However, shrubs generally take a few years to develop to the point of dominating a site. The length of time shrubs dominate an area depends primarily on the development of trees. Tree seedlings are generally present on these sites but are not tall enough to impact the shrubs.

- Open sapling/pole
  In the open sapling/pole condition, shrubs are frequently the dominant vegetation, but trees are tall enough to prevent being suppressed by shrubs.

- Closed sapling/pole/sawtimber
  This condition is marked by very dense tree canopies which limit all ground vegetation. Thinning commonly opens the canopy sufficiently to allow shrubs to redevelop.

- Large sawtimber
  Large sawtimber is frequently defined as stands with an average diameter greater than 21 inches. In managed stands, trees often have a relatively uniform size and may approach the tree sizes found in old-growth stands. However, these stands generally lack characteristics such as snags, down woody debris, and the two or more canopy layers that are found in old-growth stands.

- Old growth
  Old-growth stands are characterized by the presence of snags, down woody debris, and two or more canopy layers that develop as a result of the mortality of overstory trees. Stand diameters may be similar to or larger than large sawtimber stands.

Table IV.13 lists the types of habitat expected to be provided under the HCP on DNR-managed lands in the five west-side planning units. Examples of representative species that might use that habitat type, management activities that may be conducted, potential negative impacts that may result from the management activities, and benefits expected to accrue from the HCP are given for each habitat type. Additional details regarding the management activities are included in Section H (Forest Land Management Activities) of this chapter.

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units

(Source: Brown 1985, Thomas et al. (1993), Parsons et al. (1991), and Pyle (1989)).

Type of habitat	Representative species that can use these habitat types
Spotted owl high quality nesting habitat	dusky shrew, long-eared myotis, northern flying squirrel, Pacific fisher, wood duck, northern goshawk, barred owl, pileated woodpecker, olive-sided flycatcher, northern spotted owl, hoary bat, bushy-tailed woodrat, red tree vole, harlequin duck, marbled murrelet, Vaux's swift, red-breasted nuthatch, Dunn's salamander, Larch Mountain salamander, Van Dyke's salamander, tailed frog, pine white butterfly, Johnson's hairstreak butterfly, *Acalypta saudersi* (a lace bug), *Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)
Spotted owl sub-mature habitat	dusky shrew, long-legged myotis, northern flying squirrel, Pacific fisher, wood duck, hairy woodpecker, northern goshawk, barred owl, olive-sided flycatcher, northern spotted owl, hoary bat, bushy-tailed woodrat, red tree vole, red-breasted nuthatch, Dunn's salamander, northwestern salamander, Van Dyke's salamander, tailed frog, northern alligator lizard, pine white butterfly, coral hairstreak butterfly, California hairstreak butterfly, *Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)
Spotted owl dispersal habitat	Douglas' squirrel, sharp-shinned hawk, Swainson's thrush, evening grosbeak, dusky shrew, northern spotted owl, long-legged myotis, mountain beaver, creeping vole, bobcat, elk, Vaux's swift, orange-crowned vireo, northern alligator lizard, rubber boa, long-toed salamander,

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units *(continued)*

Type of habitat	Representative species that can use these habitat types
Spotted owl dispersal habitat *(continued)*	*Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)
Marbled murrelet habitat	dusky shrew, long-legged myotis, northern flying squirrel, Pacific fisher, wood duck, northern goshawk, barred owl, hairy woodpecker, Oliver-sided flycatcher, marbled murrelet, hoary bat, bushy-tailed woodrat, red tree vole, harlequin duck, Vaux's swift, red-breasted nuthatch, Dunn's salamander, Larch Mountain salamander, Van Dyke's salamander, tailed frog, pine white butterfly, Johnson's hair-streak butterfly, *Acalypta saudersi* (a lace bug), *Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)
Conifer-dominated riparian ecosystems	long-legged myotis, Pacific fisher, mink, wood duck, sharp-shinned hawk, ruffed grouse, olive-sided flycatcher, purple martin, Dunn's salamander, Van Dyke's salamander, salamander, tailed frog, dusky shrew, Trowbridge's shrew, southern red-backed vole, river otter, Barrow's goldeneye, band-tailed pigeon, long-eared owl, red-breasted sapsucker, hermit thrush, evening grosbeak, Cascade frog, bull trout, coho salmon, steelhead salmon, mayflies, stoneflies, caddisflies, midges, arborvitae hair-streak butterfly
Hardwood-dominated riparian ecosystems	long-legged myotis, mink, wood duck, purple martin, northwestern pond turtle, common garter snake, Dunn's salamander, northern red-legged frog, ruffed grouse, dusky shrew, shrew mole, yellowpine chimunk, river otter,

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units *(continued)*

Type of habitat	Representative species that can use these habitat types
Hardwood-dominated riparian ecosystem *(continued)*	Barrow's goldeneye, Cooper's hawk, band-tailed pigeon, downy woodpecker, black-headed grosbeak, Olympic salamander, Olympic mudminnow, mayflies, stoneflies, caddisflies, dreamy duskywing butterfly, western tiger swallowtail
Nonforested wetland	northern harrier, common snipe, northwestern pond turtle, northern red-legged frog, spotted frog, Beller's ground beetle, long-horned leaf beetle, Hatch's click beetle, mallard, mink, dusky shrew, Pacific shrew, coast mole, Yuma myotis, long-tailed vole, American bittern, little willow flycatcher, common loon, sandhill crane, black tern, coho salmon, Olympic mudminnow, dragonflies, damselflies, sonora skipper butterfly
Forested wetland	long-legged myotis, Pacific fisher, ruffed grouse, sharp-shinned hawk, barred owl, olive-sided flycatcher, purple martin, Van Dyke's salamander, northern red-legged frog, mink, spotted frog, dusky shrew, water shrew, bushy-tailed woodrat, common merganser, band-tailed pigeon, northern saw-whet owl, red-breasted sapsucker, western toad, dragonflies, flies, cad-disflies, pale tiger swallowtail butterfly
Cliffs	fringed myotis, long-legged myotis, Yuma myotis, mountain goat, peregrine falcon, turkey vulture, black swift, cliff swallow, western fence lizard, bushy-tailed woodrat, golden eagle, wasps, shorttailed black swallowtail butterfly

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units *(continued)*

Type of habitat	Representative species that can use these habitat types
Caves	Townsend's big-eared bat, fringed myotis, long-legged myotis, Yuma myotis, coyote, California wolverine, mountain lion, bobcat, black swift, Larch Mountain salamander, crickets
Oak woodland	western gray squirrel, Lewis' woodpecker, California mountain kingsnake, Propertius' duskywing butterfly, Oregon green hairstreak butterfly
Talus	Cascade golden-mantled ground squirrel, mountain goat, Pacific fisher, California wolverine, bobcat, white-tailed ptarmigan, common nighthawk, rosy finch, western fence lizard, Larch Mountain salamander, Dunn's salamander, Van Dyke's salamander, wolf spiders, jumping spiders, small-footed myotis
Grass/forb forest stage	coast mole, vagrant shrew, Townsend's vole, coyote, long-tailed weasel, black-tailed deer, common nighthawk, white-crowned sparrow, northwestern garter snake, western fence lizard, northwestern salamander, western bluebird, wolf spiders, grasshoppers, mariposa copper butterfly, silvery blue butterfly, Blackmore's blue butterfly, western meadow fritillary butterfly, *Oncocnemis dunbari* (a moth), *Formica neorufibarbis* (an ant)
Shrub forest stage	coast mole, Townsend's vole, mountain beaver, coyote, long-tailed weasel, black-tailed deer, common nighthawk, blue grouse, rufous hummingbird, hermit thrush, white-crowned sparrow, rufous-sided towhee, northwestern garter snake, western fence lizard,

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units *(continued)*

Type of habitat	Representative species that can use these habitat types
Shrub forest stage *(continued)*	northwestern salamander, western bluebird, Pacuvius' duskywing butterfly, satyr anglewing butterfly
Open sapling/pole forest stage	coast mole, Douglas' squirrel, mountain beaver, black-tailed deer, long-tailed weasel, coyote, blue grouse, rufous hummingbird, American robin, hermit thrush, rufous-sided towhee, western fence lizard, western bluebird, Phoebus parnassian butterfly, golden hairstreak butterfly, western tailed blue butterfly, bobcat, snowshoe hare
Closed sapling/pole/sawtimber forest stage	Douglas' squirrel, sharp-shinned hawk, Swainson's thrush, evening grosbeak, dusky shrew, long-legged myotis, mountain beaver, creeping vole, bobcat, elk, Vaux's swift, orange-crowned vireo, northern alligator lizard, rubber boa, long-toed salamander, *Cychrustuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)
Large sawtimber forest stage	dusky shrew, long-legged myotis, northern flying squirrel, Pacific fisher, wood duck, hairy woodpecker, northern goshawk, barred owl, olive-sided flycatcher, hoary bat, bushy-tailed woodrat, red tree vole, red-breasted nuthatch, Dunn's salamander, northwestern salamander, Van Dyke's salamander, tailed frog, northern alligator lizard, coral hairstreak butterfly, pine white butterfly, California hairstreak butterfly, *Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle)

Table IV.13: Habitats and representative wildlife species covered by this HCP for the west-side planning units *(continued)*

Type of habitat	Representative species that can use these habitat types
Old-growth forest stage	Johnson's hairstreak butterfly, pine white butterfly, *Acalypta saudersi* (a lace bug), *Cychrus tuberculatus* (a carabid beetle), *Lobosoma horridum* (a weevil), *Omus dejeani* (a tiger beetle); and see list for spotted owl high quality nesting habitat

Provision of a Range of Forest Types Across the HCP Landscape

DNR management activities that will occur under the HCP will ensure a range of forest types in adequate amounts to provide for multi-species conservation across the landscape covered by the HCP. DNR has modeled the age-class distribution that will likely result from expected management under the HCP and existing policies. Results from this modeling have been used to develop a table (see Table IV.14) of expected percentages of each of several forest habitat/structural types, using age-class as a surrogate, that would likely exist 100 years following implementation of such management.

Table IV.14: DNR HCP stand structure objectives at year 100 (in percent of land area)

Stand Stage[1]	West-side Planning Units Excluding the OESF	OESF Planning Unit
Open (0-10 Years)[2]	5-10	5-15
Regeneration (10-20 years)[2]	5-15	5-15
Pole (20-40 years)[2]	15-25	5-15
Closed (40-70 years)[2]	25-35	5-15
Complex (at least 70 years)[2]	25-35	60-70
Fully Functional	(At least 150 years)	(At least 200 years)
(Subset of Complex)	10-15	10-15

[1]Stand stages are defined as:
Open- earliest seral stage; overstory has been removed; dominated by herbs and shrubs with some young conifer and deciduous trees present.

Regeneration-shrubs and saplings; branches beginning to intertwine; dense canopies from ground-level upwards.

Pole - early stages of stem exclusion; stems closely spaced and numerous; little understory; limited self-pruning; and insufficient canopy lift to allow larger birds to penetrate.

Closed - have undergone some stem exclusion and competition mortality; have achieved some canopy lift from self-pruning; have well-developed, deep canopies; and lacking complex structural characteristics of older types.

Complex - stocked with large trees with a variety of diameters and heights evident; mortality within the stand (or residual trees, snags, and logs) provides cavities in standing snags, downed logs, deformities in standing live trees; large horizontal branches; and a complex canopy with conifer establishment occurring under opening in the canopy.

Fully Functional - a subset of complex forests but more mature and structurally complex.

[2]Age-classes shown are a surrogate for stand structure. If and when it can be shown that appropriate structure can be obtained at a different age, different age classes may be used.

The information in the above table was derived from modeling that contained assumptions based on the Forest Resource Plan policies. These assumptions are described in Appendix 5 of the Final EIS (available from DNR). The FRP states that the goal for average rotation age for west-side conifer dominated forests will be 60 years. At present, DNR expects to continue this policy and information regarding the average rotation age will be provided to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service at scheduled inter-agency HCP reviews. However, as long as DNR can show that reaching the stand structure objectives is likely, other rotation ages may be used. Additionally, DNR maintains the flexibility to harvest specific stands at an earlier age to address specific silvicultural situations (i.e., a 30- to 35-year old stand that was not thinned at an appropriate age may be more quickly converted into a healthy, productive stand by clear-cutting the stand and "starting over").

Subsequent to the modeling exercise, DNR, the U.S. Fish & Wildlife Service and the National Marine Fisheries Service negotiated a 70-year term for this HCP, with provisions for up to three, 10-year extensions. (See the Implementation Agreement in Appendix B of this document.) Such exten-

sions could occur at DNR's option if commitments of the HCP are met at year 70, or at the U.S. Fish and Wildlife Service's option if commitments have not been met at year 70. Currently no projections are available for the forest structure expected at year 70. However, during the first year following approval of the HCP, additional modeling will be conducted by DNR. The modeling will be by decade and the results will be provided to the U.S. Fish and Wildlife Service at, or by, the first annual review. These decadal projections will be used by DNR as part of its monitoring process.

The projections for year 70 will be a part of the U.S. Fish and Wildlife Service's evaluation of whether DNR has met the commitments of the HCP at year 70. In that evaluation, the U.S. Fish and Wildlife Service will also review DNR's progress in meeting the conservation objectives included in Chapter IV of this HCP. DNR's HCP provides for the conservation of both listed and unlisted species. Detailed, specific conservation measures are described elsewhere in this chapter for the northern spotted owl and a long-term strategy will be developed for the marbled murrelet. Additional important, but more limited, measures will be described for certain other listed species. Conservation measures affecting the unlisted species include those undertaken for listed species with additional measures described for certain important habitat types. The most important conservation measures affecting unlisted species are those associated with the riparian conservation strategy.

Of the HCP's three primary conservation components (spotted owl conservation strategy, marbled murrelet conservation strategy, and riparian conservation strategy), the marbled murrelet strategy is the only one that is interim in nature. A long-term strategy will not be developed for a number of years. An adequate and appropriate means of evaluating commitments for the marbled murrelet at year 70 cannot be described, at this time, except in terms of compliance with the strategy described in Chapter IV.

The riparian conservation strategy will be implemented in the five west-side planning units and the OESF. DNR's compliance and effectiveness monitoring plan for the riparian areas should provide sufficient information for the U.S. Fish and Wildlife Service to determine whether commitments in this area have been met at year 70.

The spotted owl conservation strategy sets specific goals for developing and maintaining NRF and dispersal habitat in specific amounts and locations (by WAU). Approximately 200,000 acres are designated for a NRF habitat role and 125,000 of those acres (62.5 percent) are in WAUs that are already at or above the goals set in this HCP. The conditions in the WAUs that are not currently at or above the goal, will be reviewed by the U.S. Fish and Wildlife Service at year 70, when evaluating whether DNR has met its obligations under the HCP.

As described above, the 70 year term should be sufficient for all species based upon the anticipated habitats resulting from the HCP management strategies. Riparian areas and uncommon/special habitats (e.g., talus, caves, wetlands) are expected to provide improved wildlife habitat over the life of the plan. Older stand structures (i.e., structurally complex forests and fully functional forests) increase or remain constant when comparing the current conditions with those anticipated at the end of the permit period. Healthy riparian systems, mature forest with structure, and uncommon/special habitats comprise the major concerns regarding adequacy of habitats. Younger forests (between 40 and 70 years) will continue to be provided as a result of timber management. In addition, the long-term plan

for murrelets will be developed in consideration of the 70-year permit term to ensure its adequacy. Finally, as mentioned above in this section, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service will review DNR's progress in meeting the conservation objectives and may require an extension of the HCP if it can be demonstrated that DNR failed to achieve the commitments of the HCP.

183 G. CONSERVATION ASSESSMENTS FOR FEDERALLY LISTED PLANT SPECIES, CANDIDATE PLANT SPECIES, AND PLANT SPECIES OF CONCERN

183 Federally Listed Plant Species

183 *Arenaria paludicola*

183 *Howellia aquatilis*

183 *Lomatium bradshawii*

184 *Sidalcea nelsoniana*

184 Plant Species Proposed for Federal Listing

184 *Castilleja levisecta*

184 Federal Candidate Plant Species

184 *Sidalcea oregana var. calva*

184 Plant Species of Concern

185 *Abronia umbellata* ssp. *acutalata*

185 *Artemisia campestris* ssp. *borealis* var. *wormskioldii*

185 *Aster curtus*

185 *Astragalus australis var. olympicus*

185 *Astragalus pulsiferae var. suksdorfii*

185 *Astragalus sinuatus*

185 *Botrychium ascendens*

185 *Calochortus longebarbatus* var. *longebarbatus*

186 *Castilleja cryptantha*

186 *Cimicifuga elata*

186 *Corydalis aquae-gelidae*

186 *Cypripedium Fasciculatum*

186 *Delphinium leucophaeum*

186 *Delphinium viridescens*

186 *Dodecatheon austrofrigidum*

186 *Erigeron howellii*

187 *Erigeron oreganus*

187 *Filipendula occidentalis*

187 *Hackelia venusta*

187 *Lathyrus torreyi*

187 *Lomatium suksdorfii*

187 *Lomatium tuberosum*

187 *Lupinus sulphureus* var. *kincaidii*

188 *Meconella oregana*

188 *Mimulus jungermannioides*

188 *Penstemon barrettiae*

188 *Petrophytum cinerascens*

188 *Ranunculus reconditus*

188 *Rorippa columbiae*

188 *Silene seelyi*

188 *Sisyrinchium sarmentosum*

189 *Sullivantia oregana*

189 *Tauschia hooveri*

189 *Trifolium thompsonii*

G. Conservation Assessments for Federally Listed Plant Species, Candidate Plant Species, and Plant Species of Concern

In general, the federally listed and proposed endangered and threatened plant taxa described below have very limited ranges and narrow habitat requirements and are restricted to very small areas. Because of these factors, it is anticipated that they can be effectively managed while meeting other land-management objectives. DNR maintains a database on these species, including both site-specific and species-specific information, that will be useful in locating and protecting known sites and potential habitat. However, no comprehensive inventories of these species exist for DNR-managed lands.

Federally Listed Plant Species

Brief statements about each species are provided below; additional information can be obtained from either the U.S. Fish and Wildlife Service's Endangered Species Office in Olympia or DNR's Natural Heritage Program.

ARENARIA PALUDICOLA

Swamp sandwort was historically known to occur in "swamps near Tacoma" but has not been seen or collected in Washington since the late 1800s. Reports from several other western Washington locations have been determined to be misidentifications. However, additional inventory in Washington is needed, primarily in wetlands within the Puget Lowlands. The only known extant site in the world is found in a brackish wetland in California. However, this species could occur in wetlands near the Pacific Coast, Willapa Bay, or Puget Sound. The HCP for the five west-side planning units and the OESF would likely provide better protection of this species' habitat because of their better overall wetland and riparian protections.

HOWELLIA AQUATILIS

Water howellia is an aquatic annual generally found in vernal ponds or portions of ponds in which there is a significant seasonal draw down of the water level. All known ponds have a deciduous tree component around their perimeters; most have conifers as well. The species is currently known to occur in Washington, Idaho, and Montana. In Washington, it has been found in Clark, Pierce and Spokane Counties. Historically it was also known to occur in Thurston and Mason Counties, as well as in Oregon and California. There has been no inventory of water howellia on DNR-managed lands, but if water howellia does occur in the planning area, then the HCP would reduce adverse effects because it offers better overall wetlands protection.

LOMATIUM BRADSHAWII

Bradshaw's lomatium was thought to be endemic to the Willamette Valley in Oregon until 1994, when it was discovered in Clark County, Washington. The one site in Washington is a seasonally flooded wetland dominated by grasses, sedges and rushes. As far as is now known within the HCP planning area, this species is restricted to wetlands in flood-plain habitats at low elevations in the Columbia Planning Unit. Although not known to occur on DNR-managed lands, some DNR-managed lands may provide potential habitat. The HCP provides better protection of this species' habitat because

of its better overall wetland and riparian protections. The OESF would have no effect, as the species is not known or expected to occur in the planning unit.

SIDALCEA NELSONIANA

Nelson's checkermallow was also thought to be restricted to Oregon until relatively recently. There are known sites in Cowlitz and Lewis counties, Washington. These sites are in low elevation, moist meadows within the South Coast and Columbia HCP planning units. These sites may qualify as wetlands. There is a limited amount of DNR-managed land that contains suitable habitat. There is expected to be no change regarding the effects of management on this species due to its restriction to open, moist meadow habitats.

Plant Species Proposed for Federal Listing

CASTILLEJA LEVISECTA

Golden paintbrush occurs from Thurston County northward to Vancouver Island. Historically it was also known to occur in the Willamette Valley in Oregon and in Clark County, Washington. The species is restricted to grasslands and areas dominated by a mixture of grasses and shrubs. Although this species occurs in grasslands, it could be affected by timber harvest through road building, yarding, or decking logs on adjacent grasslands. Where conifers invade *C. levisecta* habitat, the removal of trees is beneficial to the species. There are only 10 known sites with *C. levisecta* in the world, eight of which are in Washington and one of these is a DNR-managed natural area preserve. All sites are quite small in area and are subject to a variety of threats, the most serious of which is the invasion by a mixture of Douglas-fir, Scot's broom, blackberries, and roses. It is not known to occur, nor is it expected to occur within the OESF. There is little to no DNR-managed land adjacent to sites that harbor this species. The HCP is not expected to have any effect on this species.

Federal Candidate Plant Species

There is one vascular plant species that is a candidate for listing (as of February 1996) under the federal ESA which is known to occur, or is reasonably suspected of occurring, within the HCP planning area. Additional information about this species can be obtained from DNR's Natural Heritage Program.

SIDALCEA OREGANA VAR. CALVA

This taxon is restricted to the Chelan Planning Unit. It may occur on DNR-managed forest land. It can occur along small riparian areas and some of the sites would qualify as wetlands. The HCP can be expected to provide better protection due to the overall better riparian zone and wetlands protections. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

Plant Species of Concern

There are a number of vascular plant taxa that are species of concern to the U.S. Fish and Wildlife Service (as of February 1996) which are known to occur, or are reasonably suspected of occurring, within the HCP Planning Area. Additional information about these species can be obtained from DNR's Natural Heritage Program.

ABRONIA UMBELLATA SSP. ACUTALATA

This taxon is thought to be extirpated from the state of Washington. The historic locations were coastal sand dunes. Timber management under the HCP and OESF would have no effect.

ARTEMISIA CAMPESTRIS SSP. BOREALIS VAR. WORMSKIOLDII

This taxon is restricted to areas immediately adjacent to the Columbia River in Grant and Klickitat counties. The areas do not support conifers and are far enough removed from DNR forest management that management activities are not likely to have any impact.

ASTER CURTUS

This taxon is restricted to grassland habitats in the lowlands of the Puget trough. It may occur in grasslands adjacent to DNR-managed forest land. It is not known nor expected to occur on the OESF. Because the plant is generally restricted to nonforested habitats, the HCP and the OESF are expected to have little effect on this species.

ASTRAGALUS AUSTRALIS VAR. OLYMPICUS

This taxon is restricted to relatively high elevations in the northeastern portion of the Olympic Peninsula. It is only known to occur in the Olympic National Park and Olympic National Forest.

ASTRAGALUS PULSIFERAE VAR. SUKSDORFII

In Washington, this taxon is restricted to the Klickitat Planning Unit and occurs in somewhat open ponderosa pine stands with a relatively sparse understory. The one known site of *A. pulsiferae* on DNR-managed land is within a designated dispersal habitat management area. Higher harvest levels may provide better habitat protection for this taxon than lower harvest levels. However, increased harvest levels may not be a recommended method for enhancing the habitat for this taxon; prescribed burns, or allowing natural fires to burn, would likely be a preferable method. The OESF would not be affected, as the taxon is not known or expected to occur there.

ASTRAGALUS SINUATUS

This taxon does not occur within the HCP Planning Area. It is restricted to a very small range east of the planning area in Chelan County.

BOTRYCHIUM ASCENDENS

This taxon appears to have a fairly broad ecological amplitude and wide geographic range. However, there is insufficient information available regarding its response to timber harvest activities to evaluate the HCP and its effects.

CALOCHORTUS LONGEBARBATUS VAR. LONGEBARBATUS

In Washington, this taxon is restricted to the Klickitat Planning Unit. It could occur on DNR-managed lands. It occurs primarily in open grasslands, but occasionally extends into open forest stands. Within the Yakama Indian Reservation, it can be found within harvested units and along roadway openings. Although this taxon could benefit from timber harvest in areas adjacent to meadow openings, it is anticipated that there will be no change regarding the effects of management on this species. The OESF will have no effect since the taxon is not known or expected to occur on the OESF.

CASTILLEJA CRYPTANTHA

This taxon does not occur and is not expected to occur, on DNR-managed lands within the HCP Planning Area. It is restricted to subalpine and alpine meadows around the northern perimeter of Mt. Rainier.

CIMICIFUGA ELATA

This taxon occurs in DNR Dispersal management areas and potentially within NRF management areas. The taxon occurs within the North Coast, Straits, South Puget, South Coast, and Columbia planning units. The HCP is expected to be beneficial due to the lower timber harvest levels in NRF and Dispersal management areas. The OESF would have no effect, since the taxon is not known or expected to occur on the OESF.

CORYDALIS AQUAE-GELIDAE

This taxon occurs primarily along Types 3 through 5 waters, including small seeps, and is restricted to the Columbia Planning Unit. It could occur on DNR-managed lands. The HCP is expected to provide better protection due to the overall better riparian zone protections.

CYPRIPEDIUM FASCICULATUM

This taxon occurs within a variety of coniferous stands within the Klickitat, Yakima, and Chelan planning units. It could occur on DNR-managed lands. There is insufficient information available regarding this species' response to timber harvest activities to evaluate the HCP and its effects.

DELPHINIUM LEUCOPHAEUM

This taxon is essentially a grassland species and is restricted to the South Coast Planning Unit. It could occur on DNR-managed lands. The HCP is expected to have no effect on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

DELPHINIUM VIRIDESCENS

This taxon is restricted to the Chelan and Yakima planning units. It may occur on DNR-managed lands. It can occur along small riparian areas and some of the sites would qualify as wetlands. The HCP can be expected to provide better protection due to the overall better riparian zone and wetlands protections. The OESF is expected to have no effect since the taxon is not known or expected to occur on the OESF.

DODECATHEON AUSTROFRIGIDUM

In Washington, this taxon is currently known only to occur in the Mt. Colonel Bob Wilderness Area of the Olympic National Forest. However, in Oregon it is known to occur in lower elevation riparian areas. The HCP and the OESF would presumably provide better protection due to overall better riparian zone protections.

ERIGERON HOWELLII

In Washington, this taxon is restricted to the Columbia Planning Unit. It generally occurs in open areas. Canopy removal is not expected to have a negative impact, but ground-disturbing activity might. There is insufficient information to analyze how the HCP would affect this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

ERIGERON OREGANUS

In Washington, this taxon is restricted to the Columbia Planning Unit. It occurs within owl dispersal habitat; however, it is found primarily on exposed rock. Canopy removal will not generally have a negative impact. There is probably no change regarding the effects of management on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

FILIPENDULA OCCIDENTALIS

In Washington, this taxon is restricted to river and creek banks in southwest Washington, in the Columbia and South Coast HCP planning units. Some DNR-managed land is relatively close to known sites for this taxon. It is expected that the HCP could provide more protection because of its better riparian protections. The deferrals and protections for the marbled murrelet provided by the HCP could also benefit this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

HACKELIA VENUSTA

This taxon is restricted to the Chelan Planning Unit. All known sites are on U.S. Forest Service lands. Some DNR-managed land occurs within the range of this species. Canopy removal would not have a negative impact and in fact might be beneficial. However, ground-disturbing activities could have a negative impact. At present, there is insufficient data to analyze the HCP and its potential effects on this species.

LATHYRUS TORREYI

This taxon was thought to be extirpated from the state of Washington. The historic locations were scattered in Clark and Pierce counties. The only extant site is at McChord Air Force Base, where it inhabits a mature conifer stand with an open understory. Timber management on DNR-managed lands under the HCP and OESF is unlikely to have an adverse effect.

LOMATIUM SUKSDORFII

In Washington, this taxon is restricted to the Klickitat Planning Unit. It may occur on DNR-managed lands. It can occur within riparian areas, but it is not restricted to such areas. It occurs on slopes that may support scattered individual conifers, on the edges of conifer stands, or in stand openings. There is likely no change regarding the effects of management on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

LOMATIUM TUBEROSUM

This taxon is restricted to talus slopes, mostly in nonforested areas, although there can be trees adjacent to the talus. Conservation measures for talus slopes will benefit this species. Within the HCP Planning Area, this taxon is known only to occur within the Yakima Planning Unit.

LUPINUS SULPHUREUS VAR. KINCAIDII

This taxon is essentially a grassland species and, in Washington, is restricted to the South Coast Planning Unit. It is unlikely to occur on DNR-managed lands. The HCP is expected to have no effect on this species. The OESF is expected to have no effect since the taxon is not known or expected to occur on the OESF.

MECONELLA OREGANA
This taxon occurs in grasslands, sometimes adjacent to forested areas, although generally in somewhat savannah-like conditions. It is expected that there would no change regarding the effects of management on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

MIMULUS JUNGERMANNIOIDES
This taxon was historically known to occur in the Klickitat Planning Unit, but is currently thought to be extirpated from the state of Washington. It is restricted to seepage areas in exposed basalt. It is unlikely to occur on DNR-managed lands. The HCP is not expected to have any impact on this taxon. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

PENSTEMON BARRETTIAE
This taxon occurs primarily on exposed basalt in Washington and is known to occur only in the Klickitat Planning Unit. It may occur on DNR-managed lands. It may occur within riparian areas, although it is not restricted to riparian areas. There is expected to be no change regarding the effects of management on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

PETROPHYTUM CINERASCENS
This taxon is within the very eastern edge of the Chelan Planning Unit. In fact, it is restricted to rock outcrops adjacent to the Columbia River.

RANUNCULUS RECONDITUS
This taxon is known to occur in Klickitat County, but not within the HCP planning area.

RORIPPA COLUMBIAE
This taxon is restricted to the immediate shores of the Columbia River and islands in the Columbia River along the Hanford Reach and in Skamania County. No DNR-managed lands are known to harbor this species and timber management under the HCP is not expected to have an impact.

SILENE SEELYI
This taxon is restricted to cracks in exposed rock in a small portion of the Chelan, and maybe the Yakima, planning units. Although it is not known to occur on DNR-managed lands, some DNR-managed lands are in close proximity to known locations for this species. The species is probably not affected to any great degree by canopy removal. It is expected that there would be no change regarding the effects of management on this species.

SISYRINCHIUM SARMENTOSUM
In Washington, this taxon is restricted to the Klickitat Planning Unit. It may occur on DNR-managed lands. It occurs in moist meadows and small forest openings, and it may be occur in riparian and/or wetland areas. The HCP can be expected to provide better protection due to the better riparian and wetland protections. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

SULLIVANTIA OREGANA

In Washington, this taxon is known to occur only in the Columbia Planning Unit and occurs within waterfall spray zones and seepage areas. A site with *S. oregana* is located in a DNR-managed natural area preserve, and other sites may occur in DNR-managed parcels adjacent to the preserve. The HCP is expected to provide better protection because of its better riparian and wetland protections The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

TAUSCHIA HOOVERI

This taxon is restricted to lithosolic, nonforested habitats. It is known to occur on DNR-managed land. It occurs mostly east of the HCP Planning Area, although some sites are within the Yakima and perhaps the Klickitat planning units.

TRIFOLIUM THOMPSONII

This taxon is known to occur only in the Chelan Planning Unit. It is a grassland species, but it also occurs on the edge of forest stands. Fire is important in maintaining its habitat. This species is known to occur on DNR-managed lands. There is expected to be no change regarding the effects of management on this species. The OESF would have no effect since the taxon is not known or expected to occur on the OESF.

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H. Forest Land Management Activities

Introduction

This section describes common forest practices that will occur during the first decade on DNR-managed lands in the area covered by the HCP. Ranges of the level of the various activities are estimated. Some forest management activities described herein reflect the silvicultural regimes used in the harvest simulator model that projected estimates of harvest levels for DNR-managed lands under the HCP[1]. Other forest management activities described are not part of those silvicultural regimes used for harvest calculations but are important elements of forest management under the HCP.

The level of activity estimated in this section should not be confused with the minimization and mitigation required in the HCP. Rather, these forest management activities will be used to achieve the habitat goals that constitute the minimization and mitigation under the HCP as well as to increase the productivity and value of forest products from DNR-managed lands in the area covered by the HCP.

The ranges of activity level (summarized in Table IV.15 at the end of this section) are based upon (1) historical levels, (2) estimates of activity required to achieve conservation objectives in the harvest simulator model, (3) evaluation of current criteria for selecting potential forest stands for various silvicultural treatments, and (4) estimates from DNR Regions of the level of activity that could occur operationally over the next decade. Harvest calculations are based upon typical silvicultural regimes, estimated to achieve the habitat objectives described in the conservation strategies as well as to increase the commercial productivity of DNR-managed lands in the area covered by the HCP.

However, it is neither practical nor prudent to commit to specific levels of silvicultural practices as part of this HCP. Optimizing silvicultural investments is a process that is ongoing and subject to site-specific evaluation of alternatives for limited management fund investments.

Forest land management activities on DNR-managed lands will be guided by the various applicable state and federal regulations, DNR policies such as the Forest Resource Plan of 1992, and the provisions of this plan and the incidental take permit. These guiding regulations and policies shape DNR's forest land management priorities and budget. The priorities, pace, and level of activity will depend upon, among other things, the level of budget available.

The discussion in this section describes first, activities common to all planning units and then, those specific to each of the three major planning areas covered by the HCP: the east-side planning units, the five west-side planning units, and the Olympic Experimental State Forest (OESF) Planning Unit, as defined in the section in Chapter I titled Organization of the Planning Area. (See also Map I.4.)

Activities Common to All Planning Units

Many forest land management activities are common to all of the planning areas. Management of special use areas such as Natural Resource Conservation Areas, Natural Area Preserves, DNR-managed recreation sites and other public use areas will continue under current policies and regulations.

[1] DNR projected harvest levels based on the HCP conservation strategies, using a set of forest regimes to model stand growth. These projections were presented to the Board of Natural Resources on October 10, 1996.

LANDSCAPE PLANNING

DNR expects landscape planning to be part of the process for implementing conservation strategies on DNR-managed lands in the permit area. DNR's Forest Resource Plan of 1992 (Policy No. 16, p. 30) established landscape planning as a management approach. While the landscape planning process described in the Forest Resource Plan will be an ongoing process, only a few plans will be completed at the time the HCP is implemented. However, landscape assessments utilizing the concepts of landscape planning can be useful and successful at many levels. For example, a plan based on a landscape assessment can be as simple as a computerized geographic information system report that displays resource information that indicates forest stands available for various silvicultural activities, or as complex as a detailed documentation of the physical, natural, and cultural resources along with a specific schedule of activities through time to reach highly focused, multiple objectives.

During the first decade of the permit, DNR will base management of forest lands in the permit area on some level of landscape assessment in designated dispersal and nesting, roosting, and foraging areas. The priority and complexity of landscape assessment will depend upon the needs of DNR and availability of budget. The most efficient and precise application of the conservation strategies will be accomplished through landscape planning.

RESOURCE INFORMATION

In order to apply the conservation strategies efficiently, accurate updated information will be required. Forest resource information in the permit area will be continually updated, verified, and documented during the first decade of the permit.

Activities carried out on DNR-managed lands that change the forest condition, such as road building, harvesting, precommercial thinning and reforestation, will be tracked and documented in DNR's geographic information system.

DNR intends to finish its new Forest Resource Inventory during the first decade of the permit. The Forest Resource Inventory will provide, for the first time, computerized information on various forest structures important for wildlife conservation, such as snags, vegetative ground cover, and certain noncommercial plant species.

Field verification of habitat will occur as a part of landscape planning during the first decade of this permit. Current conditions will be verified for designated nesting, roosting, and foraging habitat and dispersal habitat for spotted owls. Changing habitat conditions over time will be tracked.

LAND REPOSITIONING

Land transactions are carried out to increase the asset value of the trusts or to move lands into more appropriate use, such as parks, Natural Area Preserves, or Natural Resource Conservation Areas, with compensation to the trusts. Over the last decade, an active era for land transactions, DNR disposed of about 259,000 acres and acquired about 234,000 acres. DNR will continue to pursue land repositioning in order to meet these objectives at a level that will meet the needs of the trusts. The rate of land transactions will be influenced by opportunity and funding. (See the Implementation Agreement.) Land transactions are not expected to increase the level of take for any species covered by the incidental take permit. DNR commits to maintaining the conservation objectives described in Chapter IV of the HCP in the course of its land disposition program, as outlined in the

Implementation Agreement. In the event that a land disposition increases the level of take, or if land disposed of by DNR does not remain subject to the HCP and the cumulative impact of the disposition would have a significant adverse effect on a particular species, DNR will follow the process for making a major amendment to the HCP and the Incidental Take Permit as outlined in the Implementation Agreement. The land transaction program is not intended to alter DNR's obligations for mitigation as set forth in this HCP.

NONTIMBER RESOURCES

All planning units will continue to be managed for nontimber resources, guided by applicable regulations, DNR policies such as the Forest Resource Plan of 1992, and the conditions of the HCP and the permit. DNR markets nontimber resources that include but are not limited to road use permits, sand and gravel sales, sales of special forest products such as boughs and brush, prospecting leases and mining contracts, oil and gas leases, grazing permits and leases, electronic site leases, and other special permits, licenses, sales, and leases. At the 1996 level of these activities, no take, or insignificant (i.e., *de minimis*) take is occurring. Beginning no later than January 1, 1999, new/renewed permits, contracts, or leases for such activities will include the commitments of the HCP, such that they will not increase the level of take beyond a *de minimis* level. The level of impact resulting from these activities will be reviewed by DNR and the U.S. Fish and Wildlife Service and National Marine Fisheries Service during the annual meetings as described in subsection 16.2b of the Implementation Agreement. DNR will monitor the level of such activities and provide this information to the U.S. Fish and Wildlife Service and National Marine Fisheries Service prior to their annual meetings.

Many nontimber resource activities are subject to review under SEPA (WAC 197-11). Except for those actions that are categorically exempt (WAC 197-11-800), other government agencies and interested parties are notified of proposed actions as required by SEPA. As a matter of course, DNR notifies the Washington Department of Fish and Wildlife, Washington Department of Ecology, and the appropriate county and tribal governments. Government agencies and interested parties are notified by issuing either a determination of nonsignificance, a mitigated determination of nonsignificance, a public scoping notice, or a draft EIS. Agencies and interested parties can comment on and appeal the findings of the SEPA determination.

Current DNR nontimber resource uses are described, including the current level of each activity, below:

Rights-of-way - Policy No. 26 of the Forest Resource Plan addresses granting public rights-of-way. It says:

> "The department will grant rights of way to private individuals or entities when there is an opportunity for enhancing trust assets and when detriments are offset."

Easements for rights-of-way are granted for roads, powerlines, and pipelines. During the 9-year period between 1983 and 1991, approximately 2,100 rights-of-way were issued. These involved approximately 105 miles of new road construction and removed approximately 2,500 acres from timber production. Typically, these roads are part of the same road network used for forest management and would be subject to the same conservation measures for design, construction, use, maintenance, and abandonment described in the HCP. Large powerline and pipeline rights-of-way are subject to review under SEPA.

DNR has adopted the following SEPA policy for granting rights-of-way (WAC 332-41-665):

> "Recognizing that construction and/or reconstruction under upland right of way grants can create adverse impacts to the elements of the environment, it is the policy of the department to condition grants where necessary:
>
> (i) to protect all surface resources including but not limited to soil and water, through authorized right of way operation on public lands, and to cause rehabilitation or reestablishment on a continuing basis the vegetative cover, soil stability, and water condition appropriate to intended subsequent use of the area;
>
> (ii) to meet air quality standards; and
>
> (iii) to protect recreational and special use areas under lease by requiring mitigating action."

Special Forest Products - Policy No. 8 of the Forest Resource Plan addresses special forest products. It says:

> "The department will encourage and promote the sale of special forest products where appropriate and will market them in a manner consistent with the overall policies of this plan."

WESTERN GREENS — (salal, beargrass, huckleberry, rushes, ferns, mosses)
Currently there are approximately 65 leases covering 30,000 acres (average 460 acres/lease) and 240 one-year individual, nonexclusive permits for designated blocks of DNR-managed land. Over the term of the HCP, it is expected that individual permits will slightly increase and the amount of leased acreage will decrease. The long-term decrease in leased acreage is projected from the current trend in decreasing the U.S. share of the international market in floral greens. Collection of branches from salal, evergreen huckleberry, and ferns is a self-limiting process because only part of the foliage of any plant meets commercial quality standards. Thus, harvesting practices result in retention of most of the plant, and consequently a photosynthetic base for the regeneration of new foliage (Amaranthus and Pilz 1996). No significant environmental damage has been observed as a result of DNR leases, though no formal assessment has been conducted. The long-term ecological effects of floral green collection are unknown. Monitoring of such activities would allow for adjustment of lease conditions should adverse environmental impacts be documented. Collection of moss has potential negative environmental impacts (FEMAT 1993). Collection of moss from DNR-managed lands is not currently a large program. Should this situation change, however, some monitoring of effects of moss collection and/or regulation of moss collection may be needed. Leases for brush picking are categorically exempt from SEPA review (WAC 197-11-800). Actions or activities that are categorically exempt are those that would not normally have significant adverse environmental impacts. An action or activity that is categorically exempt may be subject to review under SEPA if it occurs in an environmentally sensitive area. For example, a categorically exempt action occurring in a wetland or in an area with a state listed species may be subject to review under SEPA.

CHRISTMAS GREENS — (cut noble fir, silver fir, white pine, red cedar, and Douglas fir boughs)

There are 14 current 1- to 3-year sales involving 9,000 acres total and three, 10-year leases involving 3,000 acres total. Additionally, small volumes under $1,000 in value and involving less than 1,000 acres are permitted to approximately 15 individuals or small companies per year. A determination of nonsignificance was issued under SEPA for the collection of Christmas greens.

MUSHROOMS

No commercial harvesting is allowed. Recreational harvesting is allowed with restrictions on quantity. Recreational harvest is limited to 3 gallons per person per day of a single species and no more than 9 gallons per person per day total. Compliance is not currently monitored and some commercial-scale harvest may be occurring on DNR-managed lands. Most mushroom harvesting on DNR-managed lands occurs in the South Puget Sound Planning Unit, with some occurring on the Olympic Peninsula and in the western portion of the Klickitat Planning Unit. Individual commercial permits are currently under consideration. Over the term of the HCP, it is expected that harvest from the wild will increase. It is likely that access to lands for mushroom collection will diminish due to road closures. Mushroom collection does not appear to occur very distant from roads. Most edible mushrooms are the fruiting bodies of ectomycorrhizal fungi, which play important roles in forest ecosystem processes, including providing forage for northern flying squirrels, which are an important prey item of spotted owls. The long-term ecological effects of mushroom collection are unknown (FEMAT 1993). No environmental impact assessment of mushroom collection has been conducted specifically on DNR-managed lands. It is thought that the highest potential for negative damage to the resource could come from disruptive collection methods such as raking (Amaranthus and Pliz 1996). This type of collection method has not been widely observed on DNR-managed lands. Monitoring of mushroom collection levels and utilization of any relevant research on the ecological effects of mushroom harvesting would assist in HCP implementation.

CHRISTMAS TREES

There are currently 5 leases to grow Christmas trees on DNR-managed lands covering less than 600 acres. All current leases expire within the next 8 years. It is not expected that this program will expand in the future, and may be eliminated altogether due to lack of market demand. Leases for Christmas tree harvesting are categorically exempt from SEPA review (WAC 197-11-800).

MEDICINALS

DNR is not involved in any medicinal research or management at this time. There are 1 to 2 small-value annual permits (for example, cascara bark).

FIREWOOD

The Revised Code of Washington (RCW 76.20) requires that DNR offer free firewood, up to 6 cords per person per year, and authorizes direct sales and bid/auction sales. In most Regions, demand for free personal use firewood is greater than supply. The Regions make available what they can and there is no estimate available for the amount of material removed or the acreage involved. Wood collected as personal use firewood is generally down logs located near roads or landings. Over the course of the HCP, it is expected that firewood removal will decrease due to more restrictions on woodstove use in urban areas and concerns for wildlife and biomass loss. At present, licenses or approvals for firewood removal are categorically exempt from SEPA review (WAC 197-11-800).

Valuable Material Sales- Sand and gravel sales are handled under sale contracts. Current contracts cover approximately 30 to 40 acres each and total less than 1,000 acres. Most commercial contracts do not apply to forested areas. However, 15 to 20 commercial contracts are in forested areas, including some smaller pits that are primarily for DNR use but from which occasional loads are sold to other forest land managers. If the sand or gravel material is sold, then the activity is subject to review under SEPA, and the purchaser is responsible for obtaining all necessary permits. DNR has adopted a SEPA policy for surface mining (WAC 332-41-665), described below, that applies to sand and gravel mines which are subject to SEPA.

Water quality in the vicinity of sand and gravel mines is protected through the National Pollutant Discharge Elimination System Permit Program (NPDES) (WAC 173-220). The Washington Department of Ecology administers this program and issues NPDES permits only to facilities that can meet the surface and groundwater standards described in WAC 173-201A and WAC 173-200, respectively.

The purchaser must file a plan of operations that is reviewed by the DNR administrative Region. Under the HCP, the plan of operations would be reviewed to ensure compliance with the commitments of the HCP. Exploration holes drilled on DNR-managed land in search of sand and gravel deposits are plugged and the site restored. For example, if the site was used for timber production before exploration, then, where feasible, the site is restored for continued timber production. The reclamation of surface mines, excluding those used for on-site forest road construction or maintenance, is regulated by the Surface Mining Act (RCW 78.44), which is enforced by DNR.

Prospecting Leases/Mining Contracts - A mineral prospecting lease permits the lessee to prospect for metallic and industrial (nonmetallic) minerals. The lease must be converted to a mining contract before mine development or operations commence. There are 13 existing leases in the HCP Planning Area. Most prospecting leases are 500 to 600 acres. Activities conducted under mineral prospecting leases are exempt from SEPA requirements, unless it is determined that a specific activity needs to undergo a SEPA review. The lessee is responsible for obtaining all necessary permits, although there are limited permits required for exploration. Before any surface disturbing work is conducted on a leased area, the lessee must file a plan of operations that is reviewed by the DNR administrative Region. Under the HCP, the plan of operations would be reviewed to ensure compliance with the commitments of the HCP. Exploration holes drilled on DNR-managed land in search of mineral deposits are plugged and the site restored. Roads may be constructed during mineral exploration. Typically, these roads are part of the same road network used for forest management and would be subject to the same conservation measures for design, construction, use, maintenance, and abandonment described in the HCP.

There are 17 mining contracts in the HCP Planning Area, but there are no active open-pit metallic or open-pit industrial mineral mines or underground mines on DNR-managed land. The only activity occuring under these contracts is exploration. Conversion of a mineral prospecting lease to a mining contract requires a phased review under SEPA. This review is phased since the location and scope of future activities is not known. An EIS may be required if large-scale mining is contemplated. DNR has adopted the following SEPA policy for surface mining (WAC 332-41-665):

"To provide that the usefulness, productivity, and scenic values of all lands and waters involved in surface mining within the state will receive the greatest practical degree of protection and restoration, the following aspects of surface mining may be conditioned:

(i) Proposed practices to protect adjacent surface resources;

(ii) Specifications for surface gradient restoration to a surface suitable for the proposed subsequent use of the land after reclamation is completed, and proposed method of accomplishment;

(iii) Matter and type of revegetation or other surface treatment of disturbed areas;

(iv) Method of prevention or elimination of conditions that will create a public nuisance, endanger public safety, damage property, or be hazardous to vegetative, animal, fish, or human life in or adjacent to the area;

(v) Method of control of contaminants and disposal of surface mining refuse;

(vi) Method of diverting surface waters around the disturbed areas;

(vii) Method of restoration of stream channels and stream banks to a condition minimizing erosion and siltation and other pollution."

Any mining activities would comply with the commitments of the HCP.

Water quality in the vicinity of underground and open pit mines is protected through the NPDES Permit Program (WAC 173-220). The Washington Department of Ecology administers this program and issues NPDES permits only to facilities that can meet the surface and groundwater standards described in WAC 173-201A and WAC 173-200, respectively.

Metals mining and milling is regulated by the Metals Mining and Milling Operations Act (RCW 78.56), which is mainly enforced by the Washington Department of Ecology. An EIS is required for any proposed metal mining and milling operation. Any tailings facility must be designed to prevent the release of pollution and a waste rock management plan that emphasizes pollution prevention must be approved by the Washington Department of Ecology (RCW 78.56.100). In Washington, there is a moratorium on the use of heap leach extraction processes and a prohibition on in situ extraction processes (RCW 78.56.160).

Another type of mining that could occur on DNR-managed forest land over the term of the HCP is placer mining. There are no commercial placer mines on DNR-managed forest lands, nor are there any commercial placer prospecting leases or mining contracts. But, recreational placer mining is growing in popularity. Recreational prospecting permits are issued by DNR (RCW 79.01.651). DNR establishes the rules for the location, equipment, methods, and other appropriate permit conditions of recreational prospecting on DNR-managed lands. Commercial placer prospectors and miners must obtain a hydraulic project approval permit from the Washington Department of Fish and Wildlife (WAC 220-110), a NPDES permit from the Washington Department of Ecology, a permit from the U.S. Army Corps of Engineers, and the action is subject to review under SEPA.

Oil and Gas Leases - There are approximately 77 existing leases and most are in the Puget Sound lowlands. Some are small leases but most leases cover full legal sections. The total acreage affected by all oil and gas leases is approximately 20,000 to 25,000 acres. Much oil and gas exploration is accomplished through a process known as "thumping." Thumping is the measurement of seismological tremors caused by the dropping of extremely large weights or the detonation of explosives. Exploration may also be acomplished through drilling. The on-site operations of exploratory wells can generally be contained in 5 acres or less. Historically, surface disturbance on these sites has been minimal. Only two wells have been drilled on DNR-managed land. One of these wells is currently being used for active exploration, and the other well has been abandoned and plugged. No oil or gas is currently produced on DNR-managed land. In fact, no oil or gas is currently produced in the state of Washington. All oil and gas leases go through a phased review under SEPA before the parcel is auctioned.

Potential adverse impacts of exploration for and extraction of oil and gas on air and water are regulated by the Washington Department of Ecology. Water quality in the vicinity of underground and open pit mines is protected through the NPDES Permit Program (WAC 173-220). The Washington Department of Ecology administers this program and issues individual permits only to facilities that can meet the surface and groundwater standards described in WAC 173-201A and WAC 173-200, respectively.

Oil and gas wells are regulated through the Oil and Gas Conservation Act (RCW 78.52) which is enforced by DNR. Sufficient safeguards to minimize hazards of pollution of all surface and ground waters is required. If acceptable safeguards cannot be provided, then a drilling permit is is not issued (RCW 78.52.125). Exploration holes drilled in search of oil or gas deposits must be plugged in a manner as to prevent the pollution of fresh water supplies (RCW 78.52.150). DNR would also require that the site be restored. For example, if the site was used for timber production before exploration, then, where feasible, the site would be restored for continued timber production.

Because the location and scope of eventual activities are not known, the initial SEPA review does not include details (i.e., the management of riparian zones), but subsequent phased reviews would occur if and when additional activities are planned, and the depth of the review would depend on the activities planned. Before any surface disturbing work is conducted on a leased area, the lessee must file a plan of operations that is reviewed by the DNR administrative Region. Under the HCP, the activities would be reviewed to ensure compliance with the commitments of the HCP. Roads may be constructed during oil and gas exploration or extraction. Typically, these roads are part of the same road network used for forest management and would be subject to the same conservation measures for design, construction, use, maintenance, and abandonment described in the HCP. Oil or gas produced at a well site may be transported by truck or by pipeline. Pipeline construction is also subject to SEPA review.

Grazing Permits - There are approximately 15 permit and 6 leased ranges located in Yakima and Klickitat counties (approximately 100,000 acres) and the Methow Valley (approximately 5,000 acres). Grazing occurs only on DNR-managed lands east of the Cascade crest where DNR is not applying for unlisted species agreements.

Electronic Site Leases - There are 427 leases with 100 sites, totaling 106 acres, currently extant. Hence, electronic sites average only about 1 acre in

size. Approximately 80 percent of the sites are on non-forested mountain tops and the remaining 20 percent are on second-growth highway corridors. Roads are constructed to access electronic sites, but these roads are part of the same road network used for forest management and would be subject to the same conservation measures for design, construction, use, maintenance, and abandonment described in this HCP. Occasional disturbance to wildlife may occur during periodic visits for maintenance and improvements. On DNR-managed lands the impacts of electronic site leases relative to the impacts of timber management are *de minimus*.

Recreational Sites - Policy No. 29 of the Forest Resource Plan addresses recreation on state forest lands. It says:

> "The department will allow recreation on state forest land when compatible with the objectives of the Forest Resource Plan. As part of its efforts, the department will continue to comply with the Statewide Comprehensive Outdoor Recreation Plan."

There are approximately 150 total sites, most affecting less than 20 acres, and 2 to 3 large (300 to 600 acres), leased sites. Acreage by DNR administrative Region: Olympic = 141 acres, Central = 696 acres, South Puget Sound = 315 acres, Southwest = 159 acres, Northwest = 515 acres, Northeast =783, and Southeast = 630 acres. Total area of recreational sites is 3,239 acres. Many, if not most, recreational sites have been built in riparian areas. Under the HCP, future development of recreation sites would adhere to the riparian conservation strategy. (See HCP Chapter IV.D.) Recreational activities conducted in DNR-managed forests include hiking, biking, horseback riding, skiing, off-road vehicle use (e.g., motorcycles, snowmobiles, 4-wheel drive trucks), and camping. Some trails, including those used by off-road vehicles, are located within riparian areas. DNR is concerned about damage to aquatic resources caused by recreational activity in high use areas, and has undertaken a program in the Tahuya State Forest to develop and monitor measures that will mitigate these impacts. In general, on DNR-managed lands the impacts of recreational activity relative to the impacts of timber management are *de minimus*.

TRANSPORTATION SYSTEM MANAGEMENT

DNR prioritizes transportation system management by activities such as storm damage repair, current use for commercial hauling of forest products, and public use. Use is regulated through blockage, where practical, and through restricted use agreements with the Washington Department of Fish and Wildlife, tribes, and others. Regular maintenance and replacement activities are scheduled to accommodate access and use needs.

New road construction may occur in conjunction with timber sale activity and other land management needs. Construction decisions will be consistent with mitigation and conservation strategies in the HCP. Reasonable expectations for new, permanent road construction during the first decade are for between 50 and 100 miles in the east-side planning units, 700 and 800 miles in the five west-side planning units, and 80 and 100 miles in the OESF.

PUBLIC USE

Public use of DNR-managed forest lands in the permit area will continue to be guided by applicable regulations and DNR policies. Within this framework, public use may occur at designated sites or in a more dispersed fashion throughout the ownership. Under certain conditions, public use may be restricted or denied, as provided for in applicable regulations and policy. Public use may be addressed in landscape plans or as separate actions required to meet the needs of DNR.

Activities in the East-side Planning Units

This subsection describes typical silvicultural activities that may occur on DNR-managed forest lands covered by the HCP within the range of the northern spotted owl east of the Cascade crest. All of the silvicultural activities described in this section will be guided by state Forest Practice Rules, DNR policies such as the Forest Resource Plan (DNR 1992), and the conditions of the permit.

FOREST HEALTH

Activities that address forest health issues have the potential to become an increasingly important aspect of forest management in the east-side planning units. Examples of these activities are under-burning, applying pesticides, controlling root rot, and salvaging.

Under-burning may be prescribed as a way to reduce fuel loading, encourage regeneration, and control stocking of appropriate tree species. At the writing of this HCP, technical development of under-burning is still under way, and its feasibility and effectiveness are still uncertain. About 500 acres per year of DNR-managed lands in the east-side planning units are currently being under-burned. DNR Regions estimate approximately 2,000 acres per year could benefit from under-burning. However, the developmental nature of this program along with funding limitations will probably limit the program to between 3,000 and 10,000 acres in the east-side planning units during the first decade of the permit. Other silvicultural activities, such as vegetation management, precommercial thinning, and commercial thinning, may be used to achieve the same forest health objectives as under-burning.

Application of biological or chemical agents to control forest insect pests may be required during the first decade of this permit. Insects that may cause major damage to forest stands are monitored annually. Low background levels of loss are accepted as part of a normal condition. When losses build to unacceptable levels, and analysis predicts the persistence of an insect population, a control project may be planned. All projects are required to go through an environmental assessment as a Class IV-Special application under state Forest Practices Rules. These activities may be done as part of a multi-landowner cooperative effort or unilaterally by DNR. The level of these activities is extremely difficult to predict because of variations in natural cycles. However, current insect populations indicate it is reasonable to expect between 2,000 and 15,000 acres of treatment in the east-side planning units during the first decade. Appropriate treatment might include site-specific application of insecticides. At some of these sites the application of insecticides could result in the incidental take of federally listed invertebrate species. Such activities shall be covered under the Incidental Take Permit except for aerial application of pesticides, which shall be covered upon the U.S. Fish and Wildlife Service's approval of a site-specific plan presented by DNR. If the U.S. Fish and Wildlife Service disapproves such a plan, or if approval of such a plan is not forthcoming within 30 days of the U.S. Fish and Wildlife Service's receipt of the plan, a multi-agency science team may be convened to resolve questions regarding the biological basis of the U.S. Fish and Wildlife Service's decision.

Root-rot control is often required in certain stands in the east-side planning units. Direct control commonly consists of pulling or pushing over infected stumps, followed by planting with a conifer species not susceptible to root rot. This activity is expensive and is done only if other alternatives are unavailable. Based on historical levels for this activity, it is reasonable to

expect between 1,000 and 5,000 acres will be treated in the east-side planning units during the first decade of the permit. The application of fertilizer has also been demonstrated to reduce the impacts of root rot. It is estimated that between 4,000 and 10,000 acres will be fertilized during the first decade.

To help restore forest health, salvage of trees killed by fire, insects, or disease is a common silvicultural activity in the east-side planning units. The amount of salvage is, to a large extent, unpredictable. Fires or insect outbreaks can create large acreages to be salvaged in any given year. Based on past history, if there are no catastrophic events, it is reasonable to expect between 5,000 and 10,000 acres of salvage logging to occur during the first decade of the permit.

TIMBER HARVESTING

Timber harvesting on DNR-managed lands in the east-side planning units is carried out in the context of a silvicultural prescription designed to ensure forest productivity and perpetuate or restore forest health. Clearcutting, shelterwood cuts, and selective harvest are all employed in these planning units. Clearcut harvesting removes the trees from a harvest site. According to state Forest Practices Rules and DNR policies, some "leave trees" are left in clumps, along streams, or scattered throughout the harvest unit. Clearcut harvesting prepares the site for reforestation. Planting with bare root stock of a species appropriate for the site, natural regeneration by seeding from adjacent stands, or a combination of both methods are common after clearcut harvesting. Shelterwood harvesting is increasingly used as a way to prepare for regeneration of forest stands. This method leaves and protects a number of trees per acre (usually 10 to 30) to provide a seed source and shade protection for young trees. Once reforestation is complete, the shelterwood trees can be removed in a commercial harvest or they can be retained to provide structural diversity as the stand ages. These trees may be left standing through the entire rotation, providing large-diameter trees in the next harvest. By far the most common of the timber harvesting prescriptions is selective harvesting, which can have important impacts on forest health and may be done with the objective of improving the overall health of the forest by removing certain trees or tree species.

During the first decade of the permit, there will be between 3,000 and 6,000 acres of clearcut harvesting, between 1,000 and 5,000 acres of shelterwood harvesting, and between 25,000 and 35,000 acres of selective harvesting. These harvest levels are consistent with HCP estimated harvest levels and historic harvest patterns. The range of acres for shelterwood is slightly greater than recent experience based on anticipated management through the next decade.

REGENERATION

Re-establishing or regenerating forest stands after fire, disease, insect infestation, or harvest is a part of the silvicultural practices in the east-side planning units. This practice is conducted under a prescription to ensure forest health and productivity in a cost-effective manner. Planting of bare root stock and natural seeding from adjacent stands, from seed trees left in the harvest unit, or from trees remaining after a selective harvest are all successful methods of regeneration in the east-side planning units. By far the most common method is natural seeding from trees remaining after a selective harvest.

It is reasonable to expect between 6,000 and 20,000 acres of planting during the first decade of the permit. Planting levels have historically been at the lower end of this projection. The upper end of the range is based on the opportunity to increase productivity on understocked forest land by more fully utilizing these sites. The increase also reflects supplemental planting in areas that will naturally regenerate in order to ensure a better distribution of seedlings, restock areas in a shorter time, and increase species diversity. Natural seeding is expected to regenerate the balance of harvested acres.

COMMERCIAL THINNING

Thinning young stands so that remaining trees can develop faster and with less competition is employed when favorable markets allow cost-effective operations. Commercial thinning can also benefit forest health and the development of certain types of wildlife habitat. Because harvest operations often combine selective tree harvest with commercial thinning, depending upon the particular stand condition in the harvest area, it is difficult to estimate how many acres of commercial thinning may occur during the first decade of the permit. However, it is reasonable to expect between 4,000 and 10,000 acres of commercial thinning in the east-side planning units in the first 10 years. This increase from historic levels can be attributed to DNR's current emphasis on identifying and commercially thinning stands that would benefit from reduced densities and to the current demand for smaller wood than was historically marketable.

PRECOMMERCIAL THINNING

Precommercial thinning is a silvicultural practice prescribed to space overstocked, even-aged stands of young trees so the remaining trees will have less competition for light and water and thereby have the potential for better growth. If the market will not support the sale of the trees cut from these stands, the operation is termed precommercial. Most forest stands in the east-side planning units are of uneven age and, therefore, do not require precommercial thinning. It is reasonable to expect a range of 3,000 to 10,000 acres of precommercial thinning to be prescribed during the first decade of the permit in the east-side planning units. The lower end of this range represents historic levels. Thinning has tended to be sporadic, varying from no activity to a maximum of about 1,200 acres in a single year. However, DNR Region staff have indicated, on the basis of stand growth and economic evaluation, that thinning about 1,500 acres per year would benefit the trusts. The upper end of the range reflects an expanded program to meet a portion of this potential opportunity.

OTHER SILVICULTURAL ACTIVITIES

Some silvicultural activities not usually associated with east-side forest management are expected to increase significantly in the next decade. These may include site preparation in advance of reforestation, vegetation management designed to reduce competition to young trees from brush, and fertilization calculated to enrich nutrient-poor soils. Although these and other silvicultural activities are unpredictable in scale and timing, DNR expects during the first decade of the permit period to do 2,500 to 14,000 acres of site preparation and 5,000 to 15,000 acres of vegetation management.

Other silvicultural activities may be prescribed in the east-side planning units during the first decade of the permit that are not commonly applied now or that have not been developed. These might include pruning of young trees or certain stand or tree manipulations designed to enhance wildlife

habitat. It is not reasonable to speculate on the quantity or description of these potential activities. Research or demonstration projects on silvicultural techniques may also be done during this time period.

SPOTTED OWL DISPERSAL AND NESTING, ROOSTING, AND FORAGING HABITAT

An important forest management objective in the east-side planning units is the creation or maintenance of habitat for spotted owls (discussed in Section A of this chapter titled Minimization and Mitigation for the Northern Spotted Owl). On landscapes where these conservation objectives are applied, silvicultural practices will be designed to meet the habitat objective as well as the other forest management objectives detailed above. For example, tree selection in partial harvest can move total landscape conditions toward a specified habitat objective by ensuring that remaining stands have specific tree species, spacing, and diameter distribution. All silvicultural practices described for the east-side planning units may be employed to achieve habitat objectives under the permit. At the end of the first decade, it reasonable to expect approximately 25,000 acres of dispersal habitat and approximately 34,000 acres of nesting, roosting, and foraging (NRF) habitat in the east-side planning units.

Activities in the Five West-side Planning Units

This subsection describes typical silvicultural activities that may occur on DNR-managed forest lands covered by the HCP within the range of the northern spotted owl west of the Cascade crest, except in the Olympic Experimental State Forest (described in the next subsection). All of the silvicultural activities described in this section will be guided by state Forest Practices Rules, DNR policies such as the Forest Resource Plan (DNR 1992), and the conditions of the permit.

FOREST HEALTH

Forest health activities are usually limited to protection from wildfire and treatment of root rot. Rarely is control of forest defoliators (leaf-eating insects) required. Healthy forests are usually maintained by controlling tree species on specific sites.

Wildfire is the largest single threat to forest health in the five west-side planning units. Wildfire can have many different ignition sources, although human-caused fires are increasingly common. It is reasonable to expect no significant change in the level of loss from fire during the first decade of the permit.

Stump pushing has been used to control root rot in a few areas. However, the most common situation is to treat root-rot patches in forest stands by clearcut harvesting the affected area and reforesting with an alternate species not susceptible to root rot. This is normally done as part of a timber sale that is not solely targeted at disease control. It is reasonable to expect between 2,500 and 5,000 acres of species conversion for root-rot control during the first decade of the permit. This estimate is based on historical levels and is not expected to change significantly.

Leaf-eating insects, such as hemlock looper, have historically been controlled by aerial spraying of insecticide. Because there have been no major insect infestations on DNR-managed lands in the five west-side planning units for several decades, it is unlikely this treatment will be required or actually carried out during the first decade of the permit. Should unforeseen attacks by forest defoliators occur, they might require appropriate

treatment to be determined at that time. Such appropriate treatment might include site-specific application of insecticides. At some of these sites the application of insecticides could result in the incidental take of federally listed invertebrate species. Such activities shall be covered under the Incidental Take Permit except for aerial application of pesticides, which shall be covered upon the U.S. Fish and Wildlife Service's approval of a site-specific plan presented by DNR. If the U.S. Fish and Wildlife Service disapproves such a plan, or if approval of such a plan is not forthcoming within 30 days of the U.S. Fish and Wildlife Service's receipt of the plan, a multi-agency science team may be convened to resolve questions regarding the biological basis of the U.S. Fish and Wildlife Service's decision.

TIMBER HARVESTING

Timber harvesting is perhaps the most common silvicultural practice carried out in forest stands on DNR-managed lands in the five west-side planning units. Timber harvests are designed to produce commercial products and to prepare the forest site for regeneration. Various harvest methods are used to facilitate various regeneration prescriptions. (See the previous discussion titled Timber Harvesting, in the subsection on the east-side planning units, for a description of clearcut and shelterwood harvesting.)

It is reasonable to expect between 140,000 and 165,000 acres of clearcut harvesting to occur on DNR-managed lands in the five west-side planning units during the first decade of the permit based on DNR's harvest level projections. Acreages were decreased slightly to reflect anticipated increases in other harvest techniques.

It is reasonable to expect between 1,000 and 5,000 acres of shelterwood harvest in the five west-side planning units during the first decade of the permit. The lower end of this estimate reflects historical levels for shelterwood harvests. DNR expects to increase the use of this harvest method as more emphasis is placed on maintaining structural diversity in forest stands.

Seed tree harvest is used less frequently in the five west-side planning units as a method of naturally regenerating a forest stand. Trees to be left to provide seed for regeneration are selected for their superior form and quality and are left scattered throughout the harvest unit. It is reasonable to expect between 500 and 1,000 acres of seed tree harvest to occur in the five west-side planning units during the first decade of the permit. This represents the historical level for this activity, which is not expected to change during the next decade.

Green trees, snags, and down logs are commonly left in harvest units. These structures add diversity to regenerated forest stands, enriching younger stands for wildlife benefits. These structures also help maintain long-term forest productivity. State Forest Practices Rules, DNR's Forest Resource Plan (1992), and the terms of the HCP provide the basis for retaining such structures.

Selective harvest and single tree harvesting can occur where special management objectives make these harvest methods appropriate. Partial cuts can be prescribed in order to develop and maintain a multi-aged, multi-storied stand. Single tree selection may be used to create diversity in an even-aged stand or to remove valuable products from a stand without changing its basic characteristics. During the first decade of this HCP, it is reasonable to expect between 20,000 and 30,000 acres of partial cuts in the five west-side planning units. This range reflects historical levels for

selective harvests with some allowance for an increase in the use of this harvest method in managing NRF areas.

COMMERCIAL THINNING

Commercial thinning removes some trees from forest stands that are spaced too close together, provided a net financial return can be achieved. Creating more space between trees allows them to grow faster, increasing diameter and thus volume per tree. This practice often generates income before final harvest and increases value of the final harvest by improving the quality of the logs produced.

Conifer stands in the five west-side planning units are commonly overstocked, offering candidates for commercial thinning. Many planted stands are invaded by natural seedlings, which produces a species mix and an overstocked condition. Commercial thinning provides an opportunity to select desired species or produce a desired species mix and to initiate a multi-layered stand condition. Commercial thinning also provides an opportunity to manage the stand toward a prescribed condition, such as spotted owl dispersal habitat. It is reasonable to expect between 30,000 and 45,000 acres of commercial thinning to occur in the five west-side planning units during the first decade of the permit.

Commercial thinning had essentially been abandoned by DNR as a silvicultural tool in the mid-1970s. Region interest in the program caused a resurgence several years ago. Since that time, there has been a significant increase in the level of thinning. This activity is included in the regimes modeled for the HCP harvest projections. The larger acreage of the estimate reflects the level from the harvest model; the lower end is a projection of the current level through the next decade.

PRECOMMERCIAL THINNING

Precommercial thinning is prescribed to space young, overstocked stands in order to allow the remaining trees to grow into commercially valuable products sooner than would otherwise occur. Because this operation does not produce products that are valuable enough to cover the cost of the thinning operation, it is not a commercial operation, but rather an investment designed to increase the value of the stand. Additionally, precommercial thinning can accelerate the development of young stands toward certain habitat conditions desirable for wildlife by opening up crowded, dense stands and allowing other types of vegetation to grow, and by accelerating the growth of the remaining trees. Forest stands that are precommercially thinned are likely to become dispersal habitat sooner than those stands not precommercially thinned.

Because precommercial thinning is an investment, it will be accomplished as budget is available, and candidate stands will be prioritized according to the rate of return expected and the landscape needs to develop habitat as described in the HCP conservation strategies. It is reasonable to expect between 100,000 and 200,000 acres of precommercial thinning to be accomplished during the first decade of the permit on DNR-managed lands in the five west-side planning units. The wide range in this estimate reflects the uncertainty in funding. The lower end of the estimate is based on historic levels, whereas the upper end is about two-thirds of the acreage DNR Regions have identified as needing thinning to maintain growth and increase value. The regimes modeled for the HCP harvest projections indicate a probable precommercial thinning level about mid-way in this range. However, the harvest projections did not account for the backlog that exists from previous fluctuations in funding.

SITE PREPARATION

Site preparation is prescribed if an area scheduled for reforestation requires some treatment to ensure success or increase the efficiency of the reforestation effort. Typical preparations include burning forest debris remaining after harvest, applying herbicides in order to reduce vegetation that might compete with seedlings, or mechanically scarifying the ground to expose mineral soil that will aid the establishment of seedlings.

Site preparation on DNR-managed lands will be guided by state Forest Practices Rules and DNR policies such as the Forest Resource Plan (DNR 1992). Burning forest debris, a traditional site preparation practice, has become less common as concerns for air quality have increased and as the need to provide leave trees and snags has been understood. Further, a greater reliance on natural regeneration and various kinds of partial harvest render burning less appropriate as a site preparation tool. Use of herbicides for site preparation is rare for much the same reasons as the decline in burning. During the first decade of the HCP in the five west-side planning units, it is reasonable to expect between 500 and 1,000 acres of debris burning, between 5,000 and 10,000 acres of herbicide treatment as site preparation, and between 1,000 and 3,000 acres of scarification. Site-preparation acreage ranges are a combination of levels from recent history (last five years) and estimates by DNR Regions.

REGENERATION

Regenerating the forest stand after harvest or after natural disturbances is an important part of silviculture on DNR-managed lands in the five west-side planning units. The harvest method (clearcut, shelterwood, or seed tree) generally determines the regeneration method. The most common method in the five west-side planning units is planting with bare root stock of conifer species appropriate for the particular site. Natural seeding often occurs in these plantations as well, creating a young multispecies stand. Regeneration from natural seeding is prescribed where it is reasonable to expect a plentiful seed source from the desired species and other favorable factors. Some naturally seeded areas are supplemented with planted stock to meet reforestation objectives of number of trees per acre within a certain time. It is reasonable to expect between 120,000 and 160,000 acres of reforestation by planting and between 5,000 and 30,000 acres of strictly natural seeding to be accomplished in the five west-side planning units during the first decade of the HCP. Regeneration levels are directly proportional to harvest levels and depend on harvest method. The estimated level of activity is based on restocking all areas that are harvested for regeneration. There will likely be an increase in the use of natural seeding because of shifts in harvest methods and better recognition of natural seed sources.

VEGETATION MANAGEMENT

Vegetation management is prescribed to control competing vegetation in order to increase the survival, growth, and health of conifers. However, the objective of vegetation control is not to rid the plantation of all vegetation except conifer crop trees. The presence of alder or other hardwoods in a conifer plantation is desirable as long as they do not replace the conifers or significantly reduce the growth rate and yield of the intended crop trees.

Various methods can be used to control competing vegetation. Site-specific conditions and management objectives are considered when choosing a control method. Forest Resource Plan Policy No. 33 tacitly directs DNR to minimize the use of herbicides. The policy directs DNR to weigh the

effectiveness of herbicide use against likely adverse effects on public water supplies, public health, fish health, and fish and wildlife habitat. The strategy for minimizing herbicide use presented in Policy No. 33 (DNR 1992) is a conservation measure which is part of DNR's HCP.

Hand slashing or cutting of unwanted vegetation , ground or aerial application of herbicide, and combinations of these methods may be used. The most common type of vegetation control is hand slashing of alder in young forest stands to encourage conifer saplings. DNR expects between 60,000 and 100,000 acres of hand slashing to occur during the first decade in the five west-side planning units. Ground application of herbicides is used to control big leaf maple and other vegetation. It is reasonable to expect between 40,000 and 50,000 acres of ground application of herbicide during the first decade of this HCP. Aerial application of herbicides can be used to control alder and herbaceous plants. It is reasonable to expect between 20,000 and 30,000 acres of aerial applications of herbicides during the first decade of the HCP.

Region input indicates an increased need for vegetation management beyond historic levels. The range for hand slashing reflects historic levels in the lower estimate, whereas the higher value includes an increase based on input from DNR Regions. Aerial application estimates are based on the historic range with no anticipated increases. Ground herbicide use reflects a historic trend of moderately increasing use and is consistent with estimates from DNR Regions.

FERTILIZATION

Application of nitrogen and other mineral nutrients to forest stands can increase growth and be a cost-effective investment for stands growing in certain nutrient-poor soils. This activity is usually done when management funds are available and other investment opportunities in forest productivity are less cost-effective. Large tracts of forest are typically treated once or twice during the harvest rotation. Benefits can be optimized if the applications are done after commercial thinning and about 10 years before final harvest. It is reasonable to expect fertilizer to be applied aerially on 30,000 to 115,000 acres of DNR-managed lands in the five west-side planning units during the first decade of the HCP. The large range in estimated acres of aerial fertilization is due to budget uncertainty. Biosolids are scheduled to be applied in limited areas during the first decade of the HCP. Research on biosolid applications may lead to increased use of this technique in the future.

STAND CONVERSION

Many stands now managed by DNR developed naturally after the original harvest decades ago. Without prescribed silvicultural activities, these stands developed in a variety of ways; for example, some stands developed into brush and hardwood species. When markets support such practices, these stands are harvested and replanted with conifer species. This conversion of stands from low commercial value species to more valuable conifer species is sometimes called stand conversion or stand rehabilitation. Stand conversion is done only on those lands that have supported conifer stands in the past. Lands that are best suited to hardwoods will not be converted. This practice increases the future value of these stands. It is reasonable to expect between 5,000 and 10,000 acres of stand conversion to occur during the first decade in the five west-side planning units.

SPOTTED OWL DISPERSAL AND NESTING, ROOSTING, AND FORAGING HABITAT

An important forest management objective in the five west-side planning units is the creation or maintenance of habitat for northern spotted owls. (See Section A of this chapter for the spotted owl conservation strategy.) On landscapes where these conservation objectives are prescribed, silvicultural practices will be designed to meet the habitat objective as well as the other forest management objectives detailed above. Any or all of the silvicultural practices described for the five west-side planning units may be employed to achieve habitat objectives under the permit. For example, precommercial thinning can accelerate the development of dispersal habitat, whereas commercial thinning can accelerate the development of NRF habitat. Green tree and snag retention can be used to improve the quality of both types of spotted owl habitat to meet conservation objectives. Partial cuts and single tree selection may be applied to existing NRF habitat without degrading the quality of habitat beyond the threshold identified in the HCP. At the end of the first decade of the HCP, it is reasonable to expect approximately 58,000 acres of dispersal habitat and approximately 66,000 acres of NRF habitat in the designated DNR-managed parcels in the five west-side planning units.

MARBLED MURRELET HABITAT

The details of the long-term conservation strategy for marbled murrelets are not known at this time. (See conservation strategy for the marbled murrelet in Section B of this chapter.) However, once the strategy is identified, silvicultural practices described in this section may be applied to meet the conservation objectives for marbled murrelets. Protection of nesting sites may require special silvicultural practices, which will be determined when the long-range conservation strategy is developed.

RIPARIAN MANAGEMENT ZONES

Forest management is allowed in riparian management zones under certain conditions to maintain or restore salmonid freshwater habitat. (See Section D of this chapter titled Riparian Conservation Strategy.) Silvicultural practices that might be appropriate for riparian management zones may include precommercial thinning, commercial thinning, partial cuts, single tree selection harvesting, and stand conversion.

Precommercial thinning and commercial thinning can be used to accelerate the development of riparian forest stands in order to provide essential elements of salmon habitat as well as contribute to upland species habitat needs. Shade and large woody debris can be provided from larger diameter trees that are grown using these practices. Spotted owl habitat and marbled murrelet habitat can be developed faster with the application of these practices in riparian management zones. The complex forest structures resulting from these practices can provide habitat for multiple species. See Table IV.16 at the end of this section for an estimate of the acres of riparian habitat to be developed during the first decade.

Stand conversion can be employed to restore riparian management zones to more natural conditions. Restoration is an activity allowed in the riparian conservation strategy. The most common restoration prescription might be the conversion of streamside hardwood or brush stands, typically created after original logging over the past decades, to conifer stands that can provide a source of large woody debris to the streams. Because a complete inventory of stream miles that could benefit from stand conversion is not available at this time, estimates of acreage to be converted cannot be made.

A program to identify opportunities and accomplish stand conversion along streams may be developed during the first decade of the permit.

Partial cuts and single tree harvest may be appropriate in riparian management zones to increase wind-firmness of the riparian buffers or for other reasons.

Activities in the Olympic Experimental State Forest Planning Unit

This subsection will describe typical silvicultural activities that may occur on DNR-managed forest lands covered by the HCP in the OESF Planning Unit. All silvicultural practices described for the five west-side planning units can be prescribed for the OESF; therefore, they will not be described again in this subsection. Basic silvicultural practices may be modified or emphasized in the OESF, but only the significant differences in silvicultural practices from those described in the subsection on the five west-side planning units will be described here. The forest management activities described in this section will be guided by state Forest Practices Rules, DNR policies such as the Forest Resource Plan (DNR 1992), and the conditions of the permit.

COMMODITY PRODUCTION AND ECOSYSTEM MAINTENANCE

Forest management on DNR-managed lands in the OESF will focus on both commodity production and ecosystem maintenance. Managing the forest ecosystem implies a process by which stand-level decisions regarding silvicultural practices and activities are influenced by larger scale landscape-level ecological goals and objectives to achieve an appropriate balance between using the forest for commodity production and sustaining natural ecological functions. In the OESF, DNR will seek to understand the complexity of forest ecosystems within a commercial forest. This emphasis is what is unique about this planning unit. Where appropriate, knowledge gained will be carried over to DNR-managed lands in other planning units.

SILVICULTURAL PRACTICES

Understanding ecological principles and natural tendencies in the context of tree growth and forest communities should provide better guidance to forest managers as they prescribe silvicultural applications. This is not to imply that management should passively allow nature to take its course. Rather, the OESF will be a place to learn how to manage actively in harmony with natural forest growth and reap the benefits of its inherent ecological and commercial outputs.

Forest growth can be described as having four basic stages or structures. These are stand initiation (an open condition and new regeneration), stem-exclusion (tree competition and mortality), understory reinitiation (undergrowth development and some tree regeneration) and old growth. The primary hypothesis of the OESF is that it is possible to provide and protect ecological values in a managed forest by maintaining an arrangement of forest structures and stand densities.

Silviculture in the OESF should be viewed as a means of manipulating and producing a variety of possible stand structures at the landscape level. The various silvicultural practices described in the previous subsection on the five west-side planning units constitute an array of forest management choices to develop stands and landscapes that will have desirable conditions for both timber production and wildlife habitat. For example, spotted owls

have shown a strong habitat preference for forest that has multi-layered canopies containing trees ranging from young saplings to those with large diameters. Old-growth forests contain large-diameter trees, which have considerable economic value. Where old-growth attributes are desired in the future for both ecological and economic values, management strategies (silvicultural practices) must be initiated to recreate these attributes, because protecting existing old growth is not sufficient to ensure the presence of old growth in the future. It is intended that OESF silvicultural practices will endeavor to enhance stand structure diversity by including plans for maintaining or developing large-diameter trees.

Silvicultural prescriptions that emphasize both commodity production and ecological function begin with stand-level silvicultural operations. These actions will focus increasingly on what is retained as well as what is removed from stands and will prescribe arrangement of structure within and across multiple stands to meet desired patterns that benefit both stand-level and ultimately landscape-level ecological objectives. For example, some of the components of old-growth ecosystems have been described as large, standing trees, both live and dead, large-diameter down wood, and large woody debris in streams. Silvicultural prescriptions promoting these components will satisfy forest-stand diversity objectives and landscape-level diversity of habitat.

Other silvicultural activities (e.g., selective harvest) can develop multiple age-class stand conditions that, over time, can enhance stand-level diversity and provide both small- and large-tree age classes that support favorable economic returns and ecosystem values. Variations of in-stand silvicultural prescriptions for mid-aged stands in the OESF will provide opportunities for immediate commodity production and set a course for future in-stand habitat benefits. The application of various silvicultural prescriptions to test the general hypothesis of the OESF will provide much of the experimentation direction for the forest.

QUANTIFYING SILVICULTURAL PRACTICES

Due to the experimental nature of the OESF, it is difficult to quantify potential management activities. However, based on current inventory, the conservation strategies, and potential harvest opportunities, one can reasonably expect approximate ranges described in Table IV.15 at the end of this section. Potential experimental harvest within some riparian, murrelet, and spotted owl habitat is not included in these estimates but is expected to occur during the first 10 years. These ranges reflect an attempt to capture what could occur as a result of experimenting with many variables, including rotation length, silvicultural treatment options, and experimentation in habitat maintenance and creation in managed stands. The quantity and distribution of harvest among commercial thinning, selective and shelterwood harvesting, and clearcutting may shift as activities are designed to meet site-specific conditions and specific production and conservation objectives. Furthermore, activities estimated for the first decade of the HCP are not necessarily representative of what will occur in subsequent decades.

Learning how to sustain natural ecological functions within the context of a managed forest will lead forest managers to employ silvicultural prescriptions that are most harmonious with natural forest development. Harvesting will focus on retaining structural elements of the original stand, while site preparation and reforestation will be prescribed to minimize disruptions of the natural forest renewal process. For this reason, natural regeneration will be more important in the OESF Planning Unit than in the five west-side planning units. Tree spacing, through both precommercial and commercial

thinning, will be carried out to increase the rate of development of forest stands towards desired target conditions. Selective harvesting may be prescribed more frequently here to develop multi-layered stand structures more quickly. Clearcutting will occur but with more emphasis on structure retention in order to provide structural diversity to future stands. All of the silvicultural prescriptions will be designed to meet landscape goals consistent with the overall objectives of the OESF and the conditions of the permit.

Table IV.15: Estimated amount of forest land management activities on DNR-managed lands in the area covered by the HCP during the first decade of the HCP

Activity	East-side planning units (acres)	West-side planning units (acres)	OESF Planning Unit (acres)
Harvest: clearcut	3,000-6,000	140,000-165,000	3,000-15,000
seed tree	0	500-1,000	0-300
shelterwood	1,000-5,000	1,000-5,000	300-1,000
selective	25,000-35,000	20,000-30,000	8,000-11,300
salvage	5,000-10,000	0	1,500-2,500
commercial thinning	4,000-10,000	30,000-45,000	25,000-35,000
Site preparation: broadcast burn	0-1,000	500-1,000	0-1,000
herbicide	500-5,000	5,000-10,000	0
scarification	2,000-8,000	1,000-3,000	0-1,000
Regeneration: planting	6,000-20,000	120,000-160,000	3,000-15,000
natural seeding	30,000-50,000	5,000-30,000	800-1,200
Vegetation management: hand slashing	0	60,000-100,000	5,000-10,000
ground herbicide	0	40,000-50,000	0-1,000
aerial herbicide	5,000-15,000	20,000-30,000	0-500
Forest health: under-burning	3,000-10,000	0	0-500
root-rot control	1,000-5,000	2,500-5,000	0-500
insect damage control	2,000-15,000	0	0-500
Precommercial thinning	3,000-10,000	100,000-200,000	10,000-25,000
Fertilization	4,000-10,000	30,000-115,000	0-1,000

Table IV.16: Estimated amount of habitat on DNR-managed lands in the area covered by the HCP at the end of the first decade of the HCP

Type of habitat	East-side planning units	West-side planning units	OESF Planning Unit
Dispersal	34,000	58,000	N/A
Nesting, roosting, foraging	25,000	66,000	56,000
Riparian	N/A	23,000	10,000