Chapter 8
Aquatic and Riparian Habitat

8.1. BACKGROUND

8.1.1. Federal Land Commitments to Aquatic and Riparian Functions

In a recently published report on watershed condition under the Northwest Forest Plan, (Gallo et al. 2005) describe federal conservation strategies as follows. "The aquatic conservation strategy is a comprehensive, region-wide strategy designed to maintain, restore, and protect those processes and landforms that create good ecological conditions in watersheds, such as providing high quality habitat for aquatic and riparian organisms and good water quality (USDA Forest Service et al 1993). The strategy contains nine objectives that describe general characteristics of functional aquatic and riparian ecosystems that are intended to maintain and restore good habitat in the context of ecological disturbance. This approach was intended to prevent further degradation and restore habitat over broad landscapes, as opposed to focusing on individual projects or species (USDA Forest Service and USDI Bureau of Land Management 1994 a and b). Aquatic and riparian organisms evolved in a dynamic environment influenced by natural disturbance. The strategy used four components intended to work in concert to maintain and restore the health of aquatic and riparian ecosystems:

1. Watershed analysis—used to characterize watersheds and provide a basis (context) for making management decisions.
2. Riparian reserves—used to enhance habitat for riparian-dependent organisms, to provide good water quality, to provide dispersal corridors for terrestrial species, and to provide connectivity within watersheds.
3. Key watersheds—provide high-quality habitat or refugia for aquatic- and riparian-dependent species or would be able to after restoration.
4. Watershed restoration—designed to recover degraded habitat and maintain existing good conditions. "

Bureau of Land Management (BLM) lands are managed in accordance with the Western Oregon Resource Management Plans, which are currently being revised in response to the American Forest Resource Council lawsuit settlement agreement. The Northwest Forest Plan for Federal Forests currently provides guidelines for management of aquatic and riparian resources on BLM lands.

8.1.2. Aquatic and Riparian Function Conservation on Non-Federal Lands

Long-term viability of aquatic species covered by this Habitat Conservation Plan (HCP) will require non-federal forest landowners to contribute to conservation. The specific contributions necessary from any given non-federal landscape will vary depending on many factors. In general, the contributions to aquatic and riparian conservation from state forest

lands will be to enhance the viability of the local or regional aquatic species by emulating the historical conditions maintained by the natural disturbance regimes under which native species evolved.

In general, the state contributions to conservation will fall into three very broad categories:

1. Manage for proper functioning aquatic systems by providing diverse aquatic and riparian conditions over time and space.
2. Manage for riparian and aquatic conservation at both the landscape and site-specific levels.
3. Use watershed analysis to inform restoration and management decisions.

8.2. CONSERVATION OBJECTIVE

The biological and ecological objectives of the Elliott State Forest Management Plan are to maintain and or restore the ecological functions of aquatic and riparian areas as well as upland areas that directly influence aquatic and riparian areas. Over time, the application of riparian and aquatic landscape strategies is intended to create forest conditions on the landscape that will emulate historic conditions and processes relative to aquatic systems. Landscape strategies are related to stand structure (see Section 5.2), slope stability, and forest road management. Advanced structure will be maintained on 40 to 60 percent of the landscape, intermediate structure on 25 to 55 percent, and early structure on 5 to 15 percent. The site-specific or prescriptive strategies are designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the forest landscape strategies. This blended approach is intended to more closely emulate the historical conditions maintained by the natural disturbance regimes under which native species evolved. Critical to the evaluation and refinement of both the landscape level and site-specific approaches is watershed analysis. The objectives of these components are described below.

- The overall objective of the slope stability strategies are to minimize management-related landslides and chronic erosion, and to manage uplands to ensure that large wood is available in the track of potential debris flows.
- The objective for each watershed analysis is to identify if proper functioning conditions exist in streams and riparian areas. If the aquatic system is not in proper functioning condition, the analysis will evaluate if existing Oregon Department of Forestry (ODF) strategies are likely to remedy the limiting factors, and, if not, if the ODF can take other measures to address the limiting factors.
- The objectives for managing the forest road systems are to keep as much forest land in a natural productive condition as possible, prevent water quality problems and associated impacts on aquatic and riparian resources, minimize disruption of natural drainage patterns, provide adequate fish passage, and minimize exacerbation of natural mass-wasting processes.
- The objective for riparian areas along fish-bearing streams is to achieve conditions associated with mature forests. Once a riparian area has met the desired condition, it will have limited or no management activity within 100 feet of the stream. For riparian areas that do not meet the desired conditions, management strategies will be designed to move the stand toward these conditions in a timely manner.
- The objectives of stream restoration projects vary; in general, however, the objectives involve improvement or restoration of aquatic habitat and functions in stream reaches that otherwise do not meet desired conditions.

8.3. CONSERVATION STRATEGIES

The conservation strategies described in Chapter 5 provide the basis for conservation of aquatic and riparian habitats under this HCP through the following conservation measures:

8.3.1. Aquatic and Riparian Conservation Measures

- Implement Watershed Analysis and use results to inform management and restoration decisions, including the Elliott Watershed Analysis (Biosystems et al. 2003).
- Establish and maintain Riparian Management Areas (RMAs) adjacent to all streams in accordance with the standards and guidelines.
- Use results from the Elliott Watershed Analysis to identify, design, and implement projects to maintain or improve aquatic and riparian habitat.
- Use basin-level assessments to evaluate the need for alternative vegetation treatments
- Where appropriate, plan alternative vegetation treatments, in collaboration with the Oregon Department of Fish and Wildlife (ODFW), that will contribute to achieving properly functioning aquatic habitat conditions in a timely manner.
- Monitor and evaluate alternative vegetation treatment projects over time, using results in an adaptive management context.
- Establish and maintain RMAs adjacent to other aquatic habitat areas in accordance with the standards and guidelines described in this HCP.
- Use watershed analysis (initially completed in October 2003) and other information to enhance current understanding of the processes that influence slope stability in the Elliott State Forest.
- Evaluate alternatives and design operations that can minimize, mitigate for, or avoid risk in high and moderate landslide hazard locations during district implementation and project planning.
- Design, construct, improve, and maintain forest roads in accordance with the processes and standards described in the Forest Roads Manual.
- Identify and prioritize roads for closure and/or vacation using information gained from the comprehensive forest roads inventory, and in accordance with the standards described in the Forest Roads Manual.

Implementation of these measures is anticipated to conserve aquatic species by minimizing effects, protecting conditions, or improving water quality and physical habitat as described in the next Sections 8.3 through 8.5. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have developed a matrix that lists habitat indicators used for evaluating HCPs. Sections 8.3 through 8.5 provide a qualitative discussion of potential forest management effects on those aquatic and riparian habitat indicators. HCP strategies and programs designed to minimize and mitigate these effects are briefly described. Refer to Section 5.6 in Chapter 5 for a precise description of the strategies. For a description of the current conditions using the matrix indicators, see Appendix C.

In general, the strategies and practices described in the HCP are expected to result either in reduced impact, no impact, or minor effect. These conclusions assume that the strategies will:

- Improve functions over time, improve habitat conditions, and result in "reduced effect over time"
- Prevent impacts to aquatic and riparian areas through restrictive best management practices (BMPs), resulting in "no effect"
- Result in sufficiently small impacts (e.g., likely to be immeasurable , short-lived, or off-set by beneficial outcomes), resulting in a "minor effect"

The qualitative assessment is provided in the following text (and is summarized in Table 8-5, at the end of the chapter).

8.4. WATER QUALITY: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.4.1. Stream Temperature

8.4.1.1. Effects

Stream temperature is a function of multiple factors that can be expressed in terms of a "heat budget." In general, sources of heat input include direct solar radiation and convection. Heat is lost through long wave radiation, conduction, and evaporation. However, of all these factors, direct solar radiation is the primary contributor to increases in daily maximum stream temperature (Brown and Krygier 1970; Johnson 2004). Therefore, managing riparian vegetation to maintain shade is an effective tool for reducing stream temperature heat flux (Johnson 2004). Historic forest management that did not require leave trees along streams resulted in dramatic reductions in shade and associated increases in stream temperature (Brown and Krygier 1970; Levno and Rothacher 1967).

Contemporary forest management practices, as described in the Elliott State Forest HCP, are designed to maintain shade along streams to prevent impacts to stream temperature. Studies have evaluated the effects of current forest management as regulated under the Forest Practices Act (FPA). Given that increases in stream temperature are primarily influenced by reductions in shade, Dent (2001) evaluated cover as a surrogate for shade, before and after regeneration harvesting at sites throughout Oregon that are managed under the FPA. The average reductions in cover were 12 percent, 7 percent, and 1 percent for small, medium, and large fish-bearing streams, respectively. The only statistically significant change in average cover was associated with small streams (p-value equals 0.03). In a separate study, Allen and Dent (2001) evaluated stream shade using hemispherical photography on small, medium, and large streams. They compared harvested sites managed under the FPA to unharvested sites. Average shade was approximately 10 percent lower for harvested sites (73 percent, ranging from 51 to 89 percent) than for unharvested sites (84 percent, ranging from 72 to 95 percent). Sample size issues precluded comparisons of differences by stream sizes. HCP strategies are generally more restrictive than FPA requirements; thus, these findings are not directly applicable, but do provide, an index of possible effects.

Channel substrate also has an important influence on spatial and temporal stream temperature trends. Johnson (2004) concluded that bedrock reaches had wide daily summer stream temperate fluctuations, with relatively high maximum and low minimum temperatures. In contrast, stream reaches with gravel bottoms and belowground flows had a much narrower range of daily fluctuations, with higher minimums and lower maximums. Many of the streams in the region managed under the HCP are bedrock dominated, which possibly explains the elevated stream temperatures observed lower down in these basins (see current conditions discussion in Appendix C). A portion of the channel network is expected to have bedrock characteristics with or without management. However, the greater percentage of

bedrock channels in the management area may reflect historic practices such as stream cleaning and splash damming.

The Elliott State Forest contains approximately 771 miles of stream and 10,419 acres of RMAs (Figure 8-1 and 8-2). The majority of stream miles are classified as small perennial non-fish-bearing streams. However there is a greater proportion of riparian acreage associated with fish-bearing streams and large and medium non-fish-bearing streams.

Forest management under the HCP has the potential to decrease shade to streams, thus potentially increasing stream temperature. The potential for stream temperature effects is low for fish-bearing streams, as well as for medium and large non-fish-bearing streams. This is because HCP strategies establish 160-foot RMAs along these streams. No management occurs within the first 25 feet of the stream (stream bank zone). The inner zone (25 to 100 feet) and outer zone (100 to 160 feet) are established with varying management depending on how adjacent uplands are being managed. The inner zones on fish-bearing and medium and large non-fish-bearing streams are managed to meet mature forest condition.

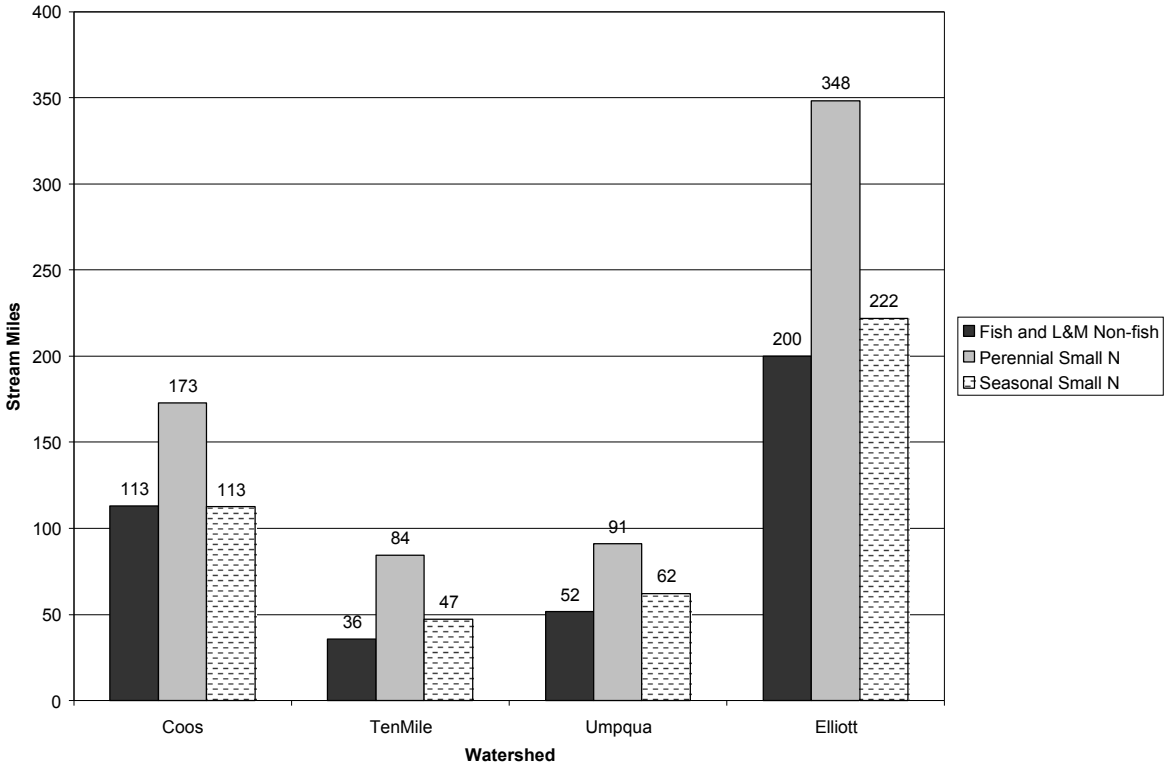

Figure 8-1. Estimated Miles of Stream by Region and for the Elliott State Forest.

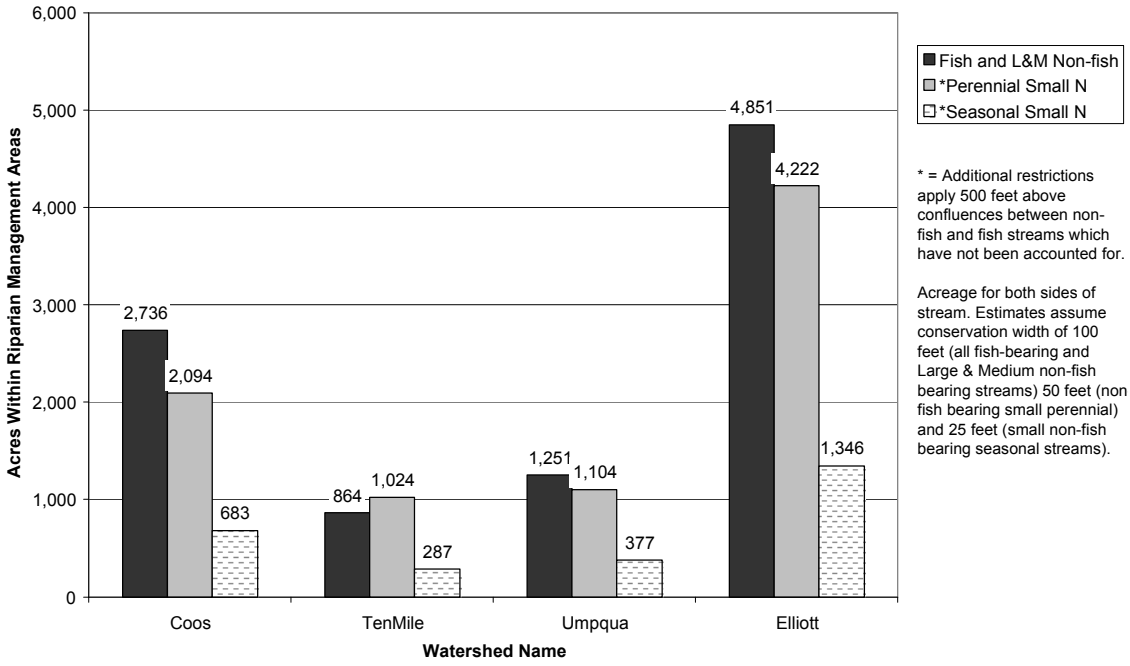

Figure 8-2. Estimated Acres of Riparian Management Area by Region and for the Elliott State Forest

When the adjacent upland is being regeneration harvested, the inner zone is commonly retained as a no-cut buffer along the fish-bearing streams and large/medium non-fish-bearing streams. At least ten conifer trees and snags per acre are retained in the outer zone (100 to 160 feet). If insufficient trees exist in the combined stream bank and inner zone (0 to 100 feet) to meet basal area targets, the outer zone (100 to 160 feet) then serves as an additional search zone to meet the retention requirements (45 conifer trees and snags per acre) of the other two zones. Additional conifer trees and snags are retained in the outer zone regardless of basal area targets.

Management in the inner zone of the riparian area of fish-bearing streams and large/medium non-fish-bearing streams is more common when the adjacent uplands are being thinned. The inner zone (25 to 100 feet) is managed for mature forest condition with basal area targets considered typical for mature forests.

Currently, the acres of mature riparian forests (older than 99 years as defined in the Biosystems 2003 report) range by region, distance from stream, and stream size (Table 8-1). Areas farthest from the stream tend to have an increasing percent of area with mature forest condition (Biosystems 2003). The Umpqua has the greatest percent of riparian forests in mature forest condition, followed by Coos, then Tenmile. On average, forestwide, 31 percent of streams have mature forest condition within 150 feet of the stream. The range is 14 to 36 percent depending on zone, region, and stream size. Within the Umpqua and Coos Region, the average is 25 percent and 36 percent within 50 and 100 feet of the stream, respectively.

Table 8-1
Percent of Riparian Areas with Mature Forest Conditions for Fish-Bearing Streams, by Region [a]

Region	Distance From Stream (feet)	Percent of Riparian Area >99 years old			
		Large Streams (%)	Medium Streams (%)	Small Streams (%)	Average (%)
Coos	0-50	32	24	26	27
	50-100	44	31	32	36
	100-150	51	32	23	35
Umpqua	0-50	21	23	24	23
	50-100	40	40	30	37
	100-150	50	52	34	45
Tenmile	0-50	15	15	13	14
	50-100	25	29	23	26
	100-150	34	40	32	35
Average		**35**	**32**	**26**	**31**

[a] Data from the Elliott Watershed Analysis, Graph 7-3

Within the Tenmile, the average is 14 percent and 26 percent within 50 and 100 feet of the stream, respectively.

If the RMA is hardwood dominated, the inner zone will be left unharvested. The outer zone will be harvested except for conifers needed to meet retention requirements. The exception occurs in reaches, identified through watershed analysis as a priority for conversion to conifer stands. Once RMAs meet mature forest conditions, the HCP does not allow for harvesting within 100 feet of these fish-bearing streams and large/medium non-fish-bearing streams.

Under the Elliott State Forest HCP, trees can be felled in RMAs to create corridors for yarding trees across streams. BMPs require measures to protect channels and RMAs, including minimizing the number and widths of corridors. In 2002, the ODF completed a BMP compliance study that included an evaluation of this practice (Robben and Dent 2002). Sites were randomly selected. The sample was designed to represent compliance on private forest ownership at a state level with a small number of sites selected on state forest ownership. Therefore, findings are not directly applicable to management on the Elliott State Forest. However, study results are the best available information, and are presented here to provide estimates regarding the potential effects of yarding corridors on aquatic and riparian habitat.

The overall occurrence of yarding corridors was low (19 corridors of 93 sites surveyed). Most of the corridors (84 percent) resulted in zero to less than 10 percent overstory disturbance. Of the remaining corridors, two had reductions in overstory cover of 10 to 30 percent and one had reductions in overstory cover greater than 30 percent. Trees were felled in riparian areas in 4 out of 19 corridors (21 percent). Felled trees were left in the RMA in each case. Corridor widths on these four sites were 25, 50, 50, and 123 feet. The remainder of the corridors had no trees felled and an effective corridor width of zero. Similar patterns were observed with regard to understory vegetation. Most of the corridors (89 percent) had no understory vegetation disturbance. In one case, full suspension was not achieved, resulting in potential sediment delivery to waters of the state.

Given the low occurrence of yarding corridors, high rate of compliance with BMPs, and low impacts on riparian and understory vegetation, it is unlikely that felling in riparian corridors presents a substantial risk to riparian and aquatic resources. Anecdotal information from foresters of the Elliott State Forest suggests that yarding corridors may be even less common on the Elliott State Forest, and that, when used, will rarely involve felling trees. Therefore, it is likely that yarding corridor practices on the Elliott State Forest would have similar or fewer effects on riparian and aquatic habitat than demonstrated in the 2002 BMP study. On the Elliott State Forest, when trees are felled within the inner or stream bank zone of streams that have achieved mature forest condition, they will be left in the RMA or stream.

The greatest uncertainties with regard to shade retention under the HCP are associated with small non-fish-bearing streams that have narrower RMAs and fewer leave tree requirements than fish-bearing streams and larger non-fish-bearing streams. The magnitude of reduction, the effects of the shade reduction on stream temperature at the site and watershed scale, and the potential influence on aquatic biota have had little research attention until recently. Preliminary findings from recent studies observed decreases in shade and site-scale increases in stream temperature on very small headwater streams when no trees were retained near the stream (Robison 2006; Skaugset 2006). When temperature increases were observed, Skaugset (2006) did not observe increases in stream temperature in downstream reaches. Furthermore, recent studies also suggest that upslope thinning rather than regeneration harvest may prevent increases in stream temperature and minimize or eliminate changes to microclimate characteristics that can cause stream temperature changes (Chan 2006; Anderson 2006). Biological responses to management around headwater streams suggest that these streams are less sensitive and more resilient that previously thought (Jackson et al. 2006; Olson 2006).

Management under the current HCP is not likely to have negative effects on stream temperature because shade retention will be high from practices such as wide RMAs, managing for mature forest condition within 100 feet of Type F streams and some Type N streams, more types of streams receiving protection (applied to 75 percent of stream reach within the harvest unit), and maintenance of a range of upslope stand structures. These measures will likely maintain shade and stream temperature along Type F streams and some Type N streams. Minor effects are possible on small Type N streams with narrower RMAs and fewer leave tree requirements; however, if increases in temperature occur, they are not likely to be translated downstream.

8.4.1.2. Summary of Minimization Programs

Practices described in Section 5.6 will minimize potential effects on shade, and thus on stream temperature. The aquatic and inner zones contribute substantially to desired stream temperature-related functions, including providing aquatic shade and maintaining riparian microclimate. The outer zone may still contribute to certain riparian functions and processes, but to a lesser extent than the inner zone, particularly in terms of stream temperature. The primary stream temperature-related functions provided by vegetation in this area include additional protection of riparian microclimate. In some cases, the outer zone may also partially buffer the inner zone from disturbance events such as windthrow, further minimizing risks to stream temperature.

Implementation of the HCP riparian and aquatic strategies are expected to shift riparian forest structure more towards advanced structure. On average, forest structure in the near-stream zone of fish-bearing streams is estimated to be predominately intermediate (average of 28 to 36 percent) or advanced stand structure (64 to 72 percent) for the next 50 years across the three watersheds. Similar trends in riparian forest structure are expected for non-fish-bearing streams (Table 8-2). Maintaining adjacent riparian forests (inner zones) in intermediate or advanced structure minimizes potential negative effects of forest management on aquatic and riparian resources by maintaining functions such as shade over streams, riparian microclimates, and large wood recruitment in the near-stream area.

Table 8-2
Forest Structure: Estimated Percent of Riparian Areas in Stand Structure Types by Watershed for Fish-Bearing and Non-Fish-Bearing Streams, Inner Zone (Within 100 Feet and 25 Feet of Fish-Bearing and Small Non-Fish-Bearing Streams)

Forest Structure	Umpqua		Ten Mile		Coos	
	Range (%)	Average (%)	Range (%)	Average (%)	Range (%)	Average (%)
Fish and Large and Medium Non-Fish Within 100 Feet of Stream (Inner)						
Early	0-1%	0%	0-1%	0%	0-1%	0%
Intermediate	18-47%	36%	13-42%	28%	12-53%	35%
Advanced	52-82%	64%	58-87%	72%	46-88%	65%
Small Non-Fish Within 25 feet of stream (Inner)						
Early	0-2%	0%	0-4%	0%	0-12%	2%
Intermediate	21-60%	47%	21-51%	39%	20-66%	50%
Advanced	39-79%	53%	48-79%	61%	30-80%	48%

Note: The range (minimum and maximum) and average as a percent of total inner zone riparian area acres (within 100 feet for fish streams and 25 feet for non-fish streams) were estimated for the plan period. Data were summarized from model outputs prepared for the Oregon Department of Forestry. Source: Model 9u2 outputs (August 3, 2006).

On average, forest structure in the adjacent uplands (100 to 160 feet from streams) of fish-bearing streams is estimated to be in intermediate stand structure (34 to 39 percent) about one-third of the time, and in advanced stand structure (50 to 52 percent) about one-half of the time (Table 8-3). Similar trends are expected for small non-fish-bearing streams with more intermediate and less advanced structure. Maintaining adjacent upland forests (outer zones) in an intermediate or advanced structure further minimizes potential negative effects of forest management by providing additional shade retention to streams and preventing changes in riparian microclimate. These upland landscapes may also contribute to large wood recruitment in the event of a landslide that delivers to the stream system. This is particularly true for small non-fish-bearing streams that otherwise have narrower buffers and fewer leave tree requirements. These benefits of adjacent upland forests to aquatic resources are also important when management takes place within 100 feet of fish-bearing streams.

Table 8-3
Forest Structure: Estimated Percent of Riparian Areas in Stand Structure Types by Watershed for Fish-Bearing and Non-Fish-Bearing Streams, in the Outer Zone (100 to 160 Feet from Stream)

Forest Structure	Umpqua		Ten Mile		Coos	
	Range (%)	Average (%)	Range (%)	Average (%)	Range (%)	Average (%)
Fish and Large and Medium Non-Fish Within 100 to 160 Feet from Stream (Outer)						
Early	2-20%	13%	2-22%	14%	5-17%	13%
Intermediate	3145%	37%	27-42%	34%	32-51%	39%
Advanced	48-53%	50%	49-59%	52%	43-52%	47%
Small Non-Fish Within 100 to 160 feet from stream (Outer)						
Early	3-21%	13%	3-19%	11%	12-20%	16%
Intermediate	35-60%	48%	30-50%	39%	44-61%	53%
Advanced	36-45%	39%	47-54%	49%	27-37%	31%

Note: The range (minimum and maximum) and average as a percent of total inner zone riparian area acres (within 100 feet for fish streams and 25 feet for non-fish streams) were estimated for the plan period. Data were summarized from model outputs prepared for the Oregon Department of Forestry. Source: Model 9u2 outputs (August 3, 2006).

In summary, the riparian and aquatic strategies are likely to be effective at reducing the risks to shade, and thus effects on stream temperature, because:

- No management within the first 25 feet (aquatic zone) ensures retention of the trees most critical to maintaining shade.
- The wide RMAs (160 feet on all fish-bearing streams and medium and large non-fish-bearing streams) and standard management targets designed to mimic mature forest conditions out to 100 feet are expected to maintain shade at comparable levels to the

range of historic conditions. With this approach, stream temperature is likely to be maintained in a distribution consistent with the historic range of conditions.

- The number and widths of yarding corridors are minimized. If riparian trees are felled in stream bank or inner zones of streams with mature forest riparian conditions, they will be left in the RMA or stream.
- Upland strategies maintain 74 to 90 percent of upland conditions in intermediate or advanced structure.

The Elliott State Forest HCP reduces potential impacts on stream temperature of small headwaters streams with the following conservation measures:

- Leave tree requirements 75 percent of the length on perennial and some seasonal non-fish-bearing streams are likely to minimize risk of stream temperature increases locally and prevent potential downstream effects on stream temperature.
- 74 to 90 percent of upland stands adjacent to non-fish-bearing streams will be managed for advanced or intermediate structure, further decreasing potential effects of management on stream temperature.

Monitoring

Given that the greatest uncertainties are associated with small non-fish-bearing streams, the ODF will implement a study focused on these streams to evaluate shade, riparian characteristics, and water quality on small perennial Type N streams. On a subset of harvest units with small perennial Type N streams, the following will be monitored before and after harvesting: riparian and buffer characteristics, shade, and water quality parameters (e.g., stream temperature, macroinvertebrates, sediment). This project will be coordinated with amphibian-related monitoring described in Chapter 9, Section 9.4.12.3.

8.4.2. Suspended Sediment

8.4.2.1. Effects

Sediment can be delivered to streams chronically from erosion of the road surface or episodically from debris flows and road-related landslides. In general road-related, chronic sediment delivery to streams results from moderate-intensity storm events, while landslides and debris flows occur during larger storm events. Both mechanisms can deliver sediment to the stream that, in turn, can be suspended in the water column. However, suspended sediment is most commonly associated with forest roads rather than landslides. This is because road-related sediment, derived from surface erosion, is predominantly composed of small particle sizes that are more easily suspended in moving water. Conversely, landslides in the Elliott State Forest typically are composed of a range of particle sizes, and movement is often by debris flows rather than fluvial mechanisms. However, both mechanisms (surface erosion and landslides) are addressed here to provide comprehensive information on sediment sources and management practices.

Road-associated changes in sediment delivery have no correlation to a natural process; therefore, sediment from roads represents an increase over background. The effects of

increased sediment delivery from roads depend on numerous factors. The nature and timing of sediment delivery, the type of material delivered, and the prior condition of the stream influence the extent to which additional sediment delivery to streams will have a negative effect. Excessive fine sediment deposited in stream channels can cause decreased survival of salmonid eggs and alevin by reducing water flow through streambed gravel, thereby suffocating the eggs or preventing the eggs from hatching. Massive increases in fine sediment delivery and channel deposition can reduce pool frequency, depth, and volume. Alternatively, habitat potentially is enhanced if erosion delivers coarse material to streams where coarse sediment is limiting (Coats et al. 1985; Megahan et al. 1980; Botkin et al. 1995; Everest et al. 1987; Hicks et al. 1991).

Construction, use and maintenance (or lack thereof) of forest roads is the primary source of sediment from forest lands in the western United States. This is especially true during wet season use when they can be a major source of fine sediment and associated stream turbidity (Megahan and Ketcheson 1996; Reid and Dunne 1984; Mills et al. 2003). A number of research and monitoring studies have investigated this issue. In general, lower quality rock results in greater sediment production and delivery of very fine particles (Bilby 1985a; Duncan and Ward 1985; Folz 1996; Bilby et al 1989). Research and monitoring has also shown that use of durable surfacing, road drainage practices, vegetated ditches, and traffic control (wet-weather hauling restrictions) such as required under current BMPs can minimize sediment delivery to streams (Bilby et al. 1989; Bilby 1985a; Sullivan 1985; Mills et al. 2003).

In general, stream crossings present a risk for chronic sediment delivery to streams. There are approximately 475 culvert stream crossings on the Elliott Forest, and an additional 18 bridge crossings. Of the stream crossings, 85 percent are on non-fish-bearing streams, and 12 percent are on fish-bearing streams. Ridgetop roads tend to have fewer stream crossings. Approximately 57 percent of the Elliott roads are located on ridgetops, 33 percent mid-slope, and 10 percent in the valley bottoms or streamside. Among other practices, All-Weather surfacing can reduce road-related sediment delivery to streams. Of the active and restricted access roads in the forest, 52 percent are surfaced to an All-Weather standard. A large portion of the remaining roads have had surfacing applied in the past, but will not support All-Weather traffic at present.

Debris flows are the most common type of landslide in the HCP area, and are of primary focus to aquatic resources. Debris flows are defined as shallow, translational, rapidly-moving landslides commonly transported via stream channels. Debris flows are common throughout most of the Elliott State Forest, as is the case for most of the Oregon Coast Range during infrequent storm events. Where they occur, debris flows overwhelm the sediment budget of both managed and unmanaged watersheds (Dietrich and Dunne 1978; Swanson et al 1987), and have the greatest potential effect on channel morphology. Compared with other types of landslides, debris flows are more prone to the effects of forest management activities because of their shallow and channelized nature.

The effects of debris flows on aquatic species and habitat vary through space and time. Debris flows can dramatically alter aquatic habitat through scour and fill processes, and through transport of wood. Erosion may be accelerated, and decreases in cover may occur (Lyons and Beschta 1983; Kaufmann 1987; Lamberti et al. 1991). However, debris flow

deposits can also provide increased cover and habitat complexity from structure such as boulders and wood. Short-term effects such as scoured tributary channels may be balanced with longer-term benefits such as debris flow deposits at tributary junctions that are associated with high-quality aquatic habitat (Benda and Cundy 1990). Reeves et al. (1995) have suggested a long-term perspective that embraces the dynamic nature of aquatic habitat. For example, in some aquatic environments (e.g., coastal) debris flows represent an important source of coarse sediment and large wood to streams that, in turn, provide high quality habitat for fish. Thus, the goal could be to manage debris flow-prone streams differently to support this unique function.

Multiple studies have examined the differences in landslide rates between forested and recently harvested sites. Several studies in the Oregon coast range have documented that erosion rates are 1.2 to 3.7 times higher in young clearcuts than in unmanaged stands (Swanson et al. 1977; Ketcheson and Froehlich 1978; Robison et al. 1999). Robison et al. (1999) documented higher erosion rates in stands less than ten years old as compared with older forest stands.

Robison et al. (1999) studied road-related landslides following the 1996 storm events in Oregon. These findings include the most current information addressing the adequacy of the forest practice rules in reducing the threats associated with landslides and forest roads. They found that road-related landslides resulting from large storm events (50- to 100-year return interval) constituted a smaller percentage of the total landslides than found in previous studies. While road-related landslides were clearly larger than other landslides, those identified in the Robison et al. (1999) study were smaller than in past studies.

The effect of forest roads on suspended sediment is expected to be minor due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather.

As stand structure shifts across the landscape, there may be periods of increased landslide risks due to harvesting. This is most likely to occur when a greater percentage of the forest is less than ten years old coincident with large storm events. As the percentage of the forest composed of this age class decreases, management influenced landslides rates are also likely to decrease. Additional restrictions around debris flow-prone channels may provide large wood recruitment potential during landslides, reduce run out distances associated with debris flows, and in turn decrease sediment delivery to downstream reaches. However, there will likely be some increases in landslide frequency associated with failures from fills on existing roads.

8.4.2.2. Minimization

The HCP proposes very little new road construction (1.5 miles per year over the life of the HCP). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. For example, the strategies will:

- Use road design and construction BMPs that minimize the occurrence of road-related landslides

- Prevent net increases in road mileage next to streams
- Confine the few miles of road construction to ridgetops away from high landslide hazard locations to the maximum extent feasible
- Keep to a minimum areas of non-forested condition due to road-related disturbance
- Decrease hydrologic connectivity to streams
- Require the use of high-quality rock surface on roads that are hydrologically connected to streams and that are used during wet periods
- Control traffic during wet periods if hauling is contributing to erosion and delivery of sediment to streams
- Require maintenance or proper vacating practices for roads not currently in use

These road practices will minimize negative effects of new roads on water quality and fish habitat by reducing the amount of chronic and episodic erosion sediment that is delivered to streams. Studies conducted to evaluate the effectiveness of road construction and maintenance practices suggest that such BMP regulatory programs for road construction, management, and restoration are effective at minimizing sediment delivery to streams and reducing the size and occurrence of road-related landslides (Bilby et al. 1989; Bilby 1985a; Sullivan 1985; Robison et al. 1999; Mills et al. 2003).

The greatest potential road effects are associated with existing roads. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of existing roads. Older roads may have greater connectivity with streams than newly constructed roads, which increases the potential for sediment to be delivered to streams. Although the greatest concerns are with existing roads, the Watershed Analysis (Biosystems et al. 2003) suggests that a relatively low percentage (4.4 percent near streams and 5.4 percent along valley bottoms) of the road network is located in near-stream areas. Zero to eight percent of the road network is located near streams or on valley bottoms in fifth field watersheds. These relatively low percentages minimize the risk of sediment being delivered to streams.

In managing landslides and slope stability, the objective is to minimize the occurrence of management-induced slope failures and mitigate potential negative effects on aquatic and riparian habitats. This will be accomplished through the application of risk-based management principles and BMPs. In summary, landslide-related conservation measures designed to minimize negative effects of landslides on aquatic habitat include:

- Road practices that reduce the number and size of road-related landslides as well as chronic sources of sediment (described above).
- Leave tree requirements along at least75 percent of debris flow prone, small Type N streams that can deliver to fish-bearing streams (as described below). This will promote delivery of wood with a debris flow to fish-bearing streams and improve aquatic habitat diversity.
- Hazard assessment and risk-based management to reduce the potential for in-unit landslides (described below).

The aquatic/riparian strategies require retention of trees around debris flow-prone channel segments (at least 75 percent of the reach length within the harvest unit) that can deliver

debris flows to fish-bearing streams (Section 5.6.2 and Table 5-3). Potential channelized debris flow track reaches are reaches on seasonal Type N streams that have been determined to have a high likelihood of delivering wood to a Type F stream. ODF field staff will make the determination of the probability that a reach will deliver wood to a Type F stream via a channelized debris flow as described in Section 5.6.2, and will apply standards as shown in Table 5-3. A 160-foot RMA will be established along 75 percent of the debris flow-prone channel. There will be no harvest or ground-based equipment within 25 feet of the stream, and at least ten conifer trees and snags per acre will be retained within 100 feet (inner zone) of the stream. In the outer zone (100 to 160 feet), snags and trees will be retained to meet landscape-scale strategy targets. Leaving trees along these channels is likely to contribute to large wood recruitment during debris flow events and minimize the effects of debris torrents on downstream fish-bearing streams.

The process for identifying high landslide hazard locations is described in detail in Technical Reports Number 2 (Oregon Department of Forestry 2003a) and Number 6 (Oregon Department of Forestry 2003b). High landslide hazard locations are specific sites that are subject to initiation of shallow, rapidly moving landslides because of steepness, shape, and geology of the site. High landslide hazard locations identification is based on physical slope characteristics, and is independent of proposed harvesting or road building practices. The specific criteria for determination of these sites are:

1. The presence, as measured on site, of any slope (excluding competent rock outcrops) that is steeper than 80 percent (75 percent for slopes in the Tyee Core Area); or
2. The presence, as measured on site, of any headwall or draw in western Oregon steeper than 70 percent (65 percent for headwalls or draws in the Tyee Core Area).

Notwithstanding the slopes specified in criterion 1) or 2), field identification of atypical conditions by a geotechnical specialist may be used to develop site-specific slope steepness thresholds for any part of the state in which the hazard is equivalent to 1) or 2), as listed above.

8.4.3. Dissolved Oxygen

8.4.3.1. Effects

Forest management activities that can affect dissolved oxygen (DO) include road construction, road management, and management around landslide initiation sites and debris-flow-prone channels. Fine sediment inputs from road surfaces can reduce DO in gravels if fines deposit in gravel substrates, and can reduce the exchange between subsurface and surface flow.

Landslides are important sources of gravel to streams. In the Elliott State Forest, landslides occur predominantly in the form of debris flows. If debris flows have sources of wood, debris-flow deposits will include both wood and sediment—a condition considered more beneficial to aquatic resources and more likely to result in gravel retention and the development of complex habitat.

Other activities that can affect DO are primarily associated with large wood recruitment. Once in the stream channel, large wood can capture gravels and contribute to gravel-dominated substrates. Depending on the orientation of the wood, it can contribute to velocity profiles that increase DO.

We expect only minor negative effects on DO with this HCP. There should be no effects on DO as it relates to large wood recruitment because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These measures will protect large wood recruitment potential, improve condition of channel substrates, and in turn prevent decreases in intergravel DO. Minor effects are unlikely, but may occur if sediment delivery from roads is higher than expected.

8.4.3.2. Minimization and Mitigation Programs

Management strategies that reduce effects on DO are primarily linked with potential sources of sediment delivery (described in Section 8.3.2) and relationships with large wood (described in Section 8.4.2). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. By minimizing hydrologic connectivity to streams through mitigation projects and new road construction standards, the HCP road management strategies minimize sediment delivery to streams, which in turn minimizes risks to DO. Managing riparian areas and upslope sources for large wood recruitment and mitigation projects such as large wood placement in streams is likely to contribute, maintain, or improve large wood recruitment, which in turn may improve channel substrate characteristics and associated DO levels in a distribution consistent with the historic range of conditions.

8.5. HABITAT: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.5.1. Habitat Access

8.5.1.1. Effects

All new stream crossings must be installed to pass juvenile and adult fish. Therefore, barriers to habitat access on forest land are associated with existing stream crossings. As part of the Oregon Plan, state forest land owners made a commitment to repair existing crossings to the level of the new standards. The best available information on effectiveness of HCP strategies is from conditions across state and private forest ownership throughout Oregon, and from research in Washington.

An ODF compliance study found that 72 to 77 percent of stream crossings were successfully implemented to meet state guidelines in 2000 and 2001 (Oregon Department of Forestry 2002d). Based on the conditions assumed to provide fish passage (Oregon Watershed Enhancement Board 1999), 71 to 74 percent of crossings installed on forest roads from 1996 to 1998 had a high likelihood of passing juvenile fish. Bridges and open arches had the highest success rate (100 percent), followed by those that created a simulated streambed within the culvert (76 to 93 percent). The use of bare culverts at very low gradients (less than 0.5 percent) and baffled culverts had the lowest success rate for fish passage, at 55 and 25 percent, respectively.

Kahler and Quinn (1998) reported that fish were able to exceed both the theoretical limitations and laboratory performances, and pointed to a need for field studies. Based on the results of a small number of studies, the authors reported that simulated natural streambed crossings should not create a barrier to fish passage. They reported that countersunk culverts (embedded) have proved to be better for fish passage than culverts with or without other modifications for fish passage. They tempered this conclusion with the concern that the steepest culverts had not experienced high-flow events (greater than a 10-year flood event), and thus long-term effectiveness was uncertain (Kahler and Quinn 1998). Baffled culverts were found to improve passage of coho and resident trout.

Negative effects of forest management on habitat access will be reduced over time under this HCP because existing roads will be brought up to current standards through restoration activities, which will reduce impacts of current conditions over time. New road construction will have no negative effects on habitat access because all new roads require fish passage. There are approximately 475 culvert stream crossings on the Elliott State Forest, and an additional 18 bridge crossings. Of the stream crossings, 85 percent are on non-fish-bearing streams, and 12 percent are on fish-bearing streams.

8.5.1.2. Minimization Programs

The HCP (Oregon Department of Forestry 1995) and the FPA (Oregon Administrative Rule [OAR] 629-625-0320 (2a) and (2b) and OAR 629-625-600 (8)) both require passage of

juvenile fish at all new stream crossings and existing crossings when replaced. When new roads are built or existing roads are upgraded, they will meet the current fish passage standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000). As with other road-related effects, the greatest risks are posed by existing roads rather than new roads. However, HCP road management strategies include approaches for replacing existing stream crossings that do not pass fish. The strategies are supported by state of the art technical guidance on how to achieve this goal for juvenile fish passage. (Oregon Watershed Enhancement Board 1999; Oregon Department of Forestry 2002b, 2002c)

8.5.1.3. Mitigation Programs

As part of the Oregon Plan, state forestland owners made a commitment to repair existing crossings to meet current fish passage standards. A Memorandum of Understanding between state agencies was signed in 1997 with the goal to achieve these upgrades by 2012. Agencies agreed to use the same criteria and guidelines when designing or consulting on projects that may affect juvenile and adult fish passage. State forestland owners intended to complete upgrades on 100 percent of their crossings with the understanding that it is an ongoing process to maintain passage. The Elliott Watershed Analysis (Biosystems et al. 2003) showed that 14 older culverts likely impede fish passage for at least one life stage. Based on miles of fish habitat upstream, the analysis identified three as a priority for improvement. Most of the stream crossings that had barriers to fish passage have been upgraded with fish passage pipes in the last few years. There are three remaining stream crossing sites to improve; one will be replaced with a bridge, and the other two will be replaced with larger fish passage pipes.

8.5.2. Substrate Character/Embeddedness

8.5.2.1. Effects

Forest management activities that can affect substrate character and embeddedness include road construction and management, riparian management, management around high landslide hazard locations, and management around debris flow-prone channels.

For example, fine sediment inputs from road surfaces can increase embeddedness (see Section 8.3.2). Landslides are important sources of gravel to streams. In the HCP area, landslides occur predominantly in the form of debris flows, which can have a dramatic influence on channel substrate (see Section 8.3.2). If debris flows have sources of wood, debris-flow deposits will include both wood and sediment—a condition considered more beneficial to aquatic resources. Harvesting can increase landslide rates, potentially changing channel substrate character over time and space.

Other activities that can influence substrate character and embeddedness are primarily associated with large wood recruitment (see Section 8.4.2). Once in the stream channel, large wood can capture gravels and contribute to gravel dominated substrates. Harvesting can reduce the amount of large wood recruitment to streams, thus reducing this function.

We expect a range of effects on substrate character and embeddedness with practices described in this HCP. Over time, as riparian and aquatic strategies return riparian areas to desired function (including recruitment of large-diameter wood to streams) and wood is placed in streams, substrate character will improve (e.g., more stream reaches with coarse gravel substrate and fewer bedrock dominated reaches). Minimization programs will prevent degradation from potential sediment input from forest operation with practices such as wide RMAs, managing for mature forest condition within 100 feet of F streams and some N streams, and more types of streams receiving protection, including debris flow-prone channels.

These additional restrictions are likely to maintain large wood recruitment potential, and in turn maintain or improve condition of channel substrates. However, minor effects on substrate may occur from forest roads that can contribute fine sediment to streams. The effect is expected to be low due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels may increase large wood recruitment potential during landslides and reduce run out distances associated with debris flows, thus decreasing sediment delivery to downstream reaches. Landslide frequency can be increased due to harvesting, but BMPs to minimize this impact are described under suspended sediment.

8.5.2.2. Minimization Programs

Minimization programs that might influence substrate character and embeddedness are primarily linked with potential increases in sediment associated with roads (described in Section 8.3.2) and relationships between upland and riparian management, large wood recruitment (described in Section 8.4.2), and channel-forming hydrologic events. When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects to aquatic and riparian resources. By minimizing road-related sediment delivery to streams, the HCP minimizes fine sediment delivery to streams, fine sediment deposition in stream channels, and associated substrate embeddeness. Managing riparian areas and upslope sources for large wood recruitment is likely to maintain or improve substrate characteristics in a distribution consistent with the historic range of conditions. Debris flow-prone channels will have additional leave tree requirements, creating the potential for both additional large wood recruitment and the establishment of debris-flow deposits (wood and sediment, both of which would improve substrate character).

8.5.3. Large Wood

8.5.3.1. Effects

Forest management has the potential to reduce inputs of large wood to streams, through harvesting of riparian areas and trees from upslope and upstream locations. For the sake of clarity, the following terminology, as described in the joint sufficiency analysis by the ODF and the Oregon Department of Environmental Quality (2002) sufficiency analysis, is used to define large wood sources for this discussion.

- **Near-stream Riparian—**Areas directly adjacent to the stream. Large wood is delivered by the tree falling directly into the stream from the adjacent streambank or hillslope.
- **Upstream Riparian—**Near-stream riparian sources upstream of the reach of concern. High water and/or a debris flow transport large wood to its current location after initially falling into the stream from the riparian area.
- **Upslope—**Zero-order channels (zero-order channels are small unbranched draws), hollows, or hillslopes. Areas outside the riparian area. Large wood is delivered by a landslide or landslide-debris flow combination that moves the wood into the stream channel from these areas.

The bulk of the potential *near-stream riparian area* inputs of large wood come from vegetation in close proximity to the channel, with diminishing amounts from distances farther from the stream. The majority of larger pieces of wood, which create key pieces, originate from within a distance of less than 100 feet from the stream (Robison and Beschta 1990). For example, 70 to 99 percent of potential large wood input from adjacent riparian stands originates from within the first 50 to 100 feet of the stream (Van Sickle and Gregory 1990; McDade et al. 1990; Bilby and Bisson 1998; Murphy and Koski 1989). It should be emphasized that these studies did not intend to examine upslope source areas; they analyzed total large wood potential from riparian areas only.

Source areas for potential inputs of large wood are not limited to stream-adjacent locations. Upstream or upslope areas are also important sources of large wood for fish-bearing streams (Keller and Swanson 1979; McGarry 1994; Benda and Sias 1998; May and Gresswell 2003; Reeves et al. 2003). In steep landscapes, such as those included in this HCP, where the occurrence of debris flows is a normal part of the disturbance regime, relatively large pieces of wood in small streams can play an important role in maintaining downstream salmonid habitat (Swanson et al. 1987). High stream flows and debris flows are both mechanisms by which large wood can be transported from relatively small stream channels downstream to larger channels. Debris flows can periodically move very large pieces of wood from a hillslope or hollow downslope to fish-bearing streams where the large wood can interact with the channel and form fish habitat. In these cases, small stream channels can play a significant role in contributing key pieces of large wood to downstream riparian functions. These sources of large wood have been referred to as both “upslope” and “upstream” sources. Available scientific information suggests the relative inputs from upslope and upstream sources can range from 10 to 60 percent (McGarry 1994; McDade et al. 1990; Benda and Sias 1998).

As distance from debris flow source increases, stream flow is the dominant mechanism for transporting large wood downstream. For this population of streams, the hydrologic regime determines the sizes of large wood that will be stable and hydrologically functional in the channel (Bilby 1985b; Bilby and Bisson 1998; Sedell et al. 1982).

Forest management under the HCP has the potential for decreasing *near stream and upstream sources* of large wood recruitment. The potential for decreased large wood recruitment is low for all fish-bearing streams, and for large and medium non-fish-bearing streams. HCP strategies establish 160-foot RMAs along these streams, each with three zones:

stream bank zone, inner zone, and outer zone. The stream bank zone is a no-harvest zone. Management within the inner zone can only occur to move the stand toward a mature forest condition in a more timely manner. Once the mature forest condition is reached, the inner zone is left as a no-cut buffer.

Potential effects are associated with removal of trees in the inner zone that otherwise had the potential to fall into the stream. Beechie et al. (2000) modeled potential wood recruitment of pool-forming wood to streams under various management scenarios. They found that: "thinning of the riparian forest does not increase recruitment of pool-forming LWD where the trees are already large enough to form pools in the adjacent channel and that thinning reduces the availability of adequately sized wood. Thinning increases LWD recruitment where trees are too small to form pools and, because of reduced competition, trees more rapidly attain pool-forming size." The risk associated with thinning in stands where trees are large enough to form pools eliminates suppression mortality, reducing the amount of large woody debris (LWD) recruited to the stream for decades to centuries while the remaining trees grow. However, if the riparian area does not contain large enough conifers to form pools, the recruitment of pool-forming wood to streams occurs more quickly and in greater numbers than if the stands are not managed (Beechie et al. 2000). Therefore, the effect associated with potential management within 100 feet of the stream is assessed as "minor" given the short-term nature of the risk, combined with the long-term benefit of having mature forest conditions in riparian areas, and the policy to only manage in riparian areas when to do so would meet goals faster than no management.

Management near potential landslide locations and debris flow-prone channels influences *upslope* sources of large wood recruitment. The removal of trees in high landslide hazard locations that are located in areas likely to deliver to a stream will reduce this source of large wood recruitment to streams. The HCP will establish leave trees around at least 75 percent of debris flow-prone streams reaches within harvest units. Estimates of RMA acres for the plan area are provided in Table 8-4 as an index of how many near stream acres may be managed along non-fish-bearing streams under this practice. The Elliott State Forest will have a total of 10,419 acres of riparian areas, of which approximately 5,568 acres are along non-fish-bearing streams. Under this HCP, management would be permissible for as many as 1,392 acres of those non-fish-bearing streams. This represents approximately 13 percent of all riparian management acres (for all stream types) in the Elliott State Forest.

Table 8-4
Potential Acres of Small Type N Stream that could be Managed under the Aquatic and Riparian Strategies

Stream Type	Acres of RMA 100% on Fish and Large & Medium Non-Fish-Bearing At least 75% on Small Non-Fish-Bearing				Total Acres in RMAs
	Coos	Ten Mile	Umpqua	Elliott	
Fish-Bearing and Large and Medium Non-Fish-Bearing	2736	864	1251	4851	4851
Small Perennial Type N	1571	768	828	3166	4222
Small Seasonal Type N	512	215	283	1010	1346
Total				**9027**	**10,419**

In summary, we expect a range of effects on large wood recruitment and loading in streams from the HCP. As riparian and aquatic strategies return riparian areas to desired function, including recruitment of large-diameter wood to streams and large wood placement, there should be an improvement of large wood recruitment and eventually wood loading in the stream (which will take much longer). At worst, the aquatic strategies may simply maintain (no effect) current conditions, as research indicates that 70 to 99 percent of streamside sources of wood are provided within RMA widths. Minor negative effects on potential large wood recruitment are expected from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large wood) on some streams. Removal of trees from some high landslide hazard locations initiation sites may reduce large wood recruitment to some Type F streams. HCP strategies minimize this effect by leaving trees along the debris flow-prone reaches (at least 75 percent of reach length in harvest unit) and managing upslope areas for intermediate and advanced forest structure.

8.5.3.2. Minimization Programs

The high landslide hazard locations, debris flow-prone channel, and riparian and aquatic strategies described in Chapter 5 are likely to minimize forest management-related effects on large wood recruitment. The goal to attain mature forest condition in riparian areas within 100 feet of Type F and small and medium Type N streams is likely to meet aquatic and riparian habitat needs by managing for and maintaining large-diameter trees in riparian areas that will be available for recruitment to streams.

In managing landslides and slope stability, the objective is to minimize the occurrence of management-induced slope failures and minimize the potential negative effects on aquatic and riparian habitats. This will be accomplished through application of risk-based management principles and BMPs. Minimization of road-related landslides is fundamental to

this objective. Hazard assessment and risk-based management for in-unit slides, and assurance that large wood is available in the track of potential debris slides and torrents, will promote large wood recruitment for future aquatic habitat inputs. Retaining wood around debris flow-prone channels that are likely to deliver to a fish-bearing stream is likely to reduce effects otherwise associated with debris flows that lack large wood. For example, debris flows may entrain more wood as they move through the channel, which may result in shorter travel distances and increased channel complexity at tributary junctions or other terminal locations. Monitoring and hazard assessment, combined with adaptive management, will ensure that this objective is realized.

Managing approximately 85 percent of upland forests for intermediate or advanced structure further minimizes potential negative effects of forest management on large wood recruitment by maintaining significant levels of mature forest condition over the landscape, including areas that may provide wood during debris flows. This is particularly true for small non-fish-bearing streams that otherwise have narrower buffers and fewer leave tree requirements.

8.5.3.3. Mitigation Programs

Restoration is an important component of the HCP, and will help to mitigate the historic practices that degraded channel conditions. Stream restoration projects will continue to be implemented at or above current levels, as needed, consistent with watershed analysis. For the five-year period from 1999 to 2003, ODF contributed an annual average of $8,400 in cash and $25,900 in-kind toward projects to address fish passage, instream, and riparian improvements. In addition to instream projects, road improvement projects are conducted annually that help improve water quality conditions.

In addition to implementing recommendations from watershed analysis, opportunistic projects associated with harvest operations will be conducted that can take advantage of existing equipment on site. Instream wood placement projects will be conducted on fish-bearing streams within or adjacent to harvest operations when the stream is below the desired level of wood and the operation contains wood meeting the size requirements for the intended stream.

Methods and approaches for restoration activities are described in Section 5.6.3, and include:

1. Watershed assessment to identify potential factors that could be contributing to undesirable aquatic conditions or limiting the recovery of aquatic habitats
2. Identifying, designing, and implementing projects to remedy identified problems in a timely manner

Section 5.6.3 describes restoration strategies designed to improve aquatic habitat through the placement of large wood in streams as well as a summary of watershed analysis recommendations and planned ODF actions. Restoration goals are to promote aquatic habitat conditions that support the short-term survival needs of aquatic organisms, and are intended to correct human-induced conditions in the forest that may contribute to aquatic habitat deficiencies or that may limit desired aquatic habitat conditions.

Using available information such as watershed analysis, the ODF will identify, design, and implement restoration projects in direct consultation with the ODFW and in collaboration

with watershed councils. Aquatic habitat improvement projects will be designed with the intent of resembling natural processes. Project planning and design will consider habitat conditions, stream processes, and the disturbance regime at both the watershed and site-specific scale. Projects will be designed to create conditions and introduce materials sufficient to enhance or re-establish natural physical and biological processes. An emphasis will be placed on projects that re-introduce large "key" pieces of large wood to stream channels in natural configurations. Wood placement activities will utilize materials that are expected to be relatively "stable" yet functional in these dynamic stream systems. The intent is to maximize the functional attributes of large wood, and minimize potential conflicts with public safety in downstream reaches. Reliance on artificial "anchoring" methods (such as cables) will be minimized, and will only be used in cases of significant concern for public safety.

The use of alternative riparian vegetation treatments is another form of restoration designed to address large wood recruitment, and is described in Section 5.6.4, in Chapter 5, page 40. Alternative riparian vegetation treatment refers to the application of silvicultural tools that can be applied in RMAs for the purpose of changing the vegetative community to better achieve the HCP's aquatic and riparian habitat objectives, such as mature riparian forest conditions. The strategy includes three components:

1. Watershed assessment to evaluate whether alternative vegetation treatments are needed to achieve properly functioning aquatic habitat conditions in a timely manner. Where appropriate, this information will be used to plan alternative vegetation treatments.
2. Planning for restoration projects that use a multi-disciplinary approach involving a variety of resource specialists.
3. Monitoring and evaluating projects over time to ensure that objectives are being achieved, and that undesirable affects are minimized. Results will be incorporated in an adaptive management context.

Potential projects include silvicultural treatments such as the conversion of hardwood stands to conifer species; selective removal of hardwoods from mixed-species stands and the establishment of shade-tolerant conifer seedlings; the creation of gaps in hardwood stands to establish conifer seedlings (shade-intolerant and shade-tolerant); and other similar practices not specifically described in the management standards for riparian areas. These beneficial practices establish sources of large coniferous wood recruitment in riparian areas that otherwise do not provide that function.

8.5.4. Pool Frequency and Quality

8.5.4.1. Effects

Pool formation and associated attributes (pool frequency, quality, depth, width-to-depth ratios) are mostly influenced by large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, forest management has the greatest potential to influence inputs of large wood (see Section 8.4.2). The sediment regime can also be influenced by forest management, which in turn can influence pool formation and

associated attributes. Increased frequency and magnitude of landslides and poorly managed forest roads can increase sediment delivery to streams, and in turn influence sediment routing and deposition (see Section 8.3.2).

8.5.4.2. Minimization Programs

Strategies that address pool frequency and quality are primarily linked with reducing or preventing increases in sediment associated with roads and landslides (see Section 8.3.2). Relationships between upland and riparian management to large wood recruitment are also important (see Section 8.4.2). HCP forest management strategies are not likely to influence pool-forming hydrologic events (see Section 8.5.3). When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. By minimizing road-related sediment delivery to streams, the HCP strategies minimize degradation of pool quality and depth. Managing riparian areas and upslope sources for large wood recruitment is likely to maintain pool frequency and quality in a distribution consistent with the historic range of conditions. Management strategies around high landslide hazard locations and debris flow-prone channels further minimize impacts on pool frequency and quality (see Sections 8.3.2 and 8.4.2).

8.5.5. Off-Channel Habitat/Refugia

8.5.5.1. Effects

The formation and maintenance of off-channel habitat is primarily influenced by channel constraint, large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, HCP strategies have the greatest potential to influence inputs of large wood and channel constraint. See Section 8.4.2 for more information on large wood recruitment. Roads located in close proximity to and oriented parallel to stream channels can decrease the potential for off-channel habitat and flood plain interactions in channel types that otherwise have those characteristics.

The greatest potential effects are associated with existing roads because current road construction and management policies prevent new road construction in areas likely to develop off-channel habitat. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of old roads. Existing roads located parallel to streams within RMAs pose a risk to floodplain channel interactions and may reduce off-channel habitat.

8.5.5.2. Minimization Programs

When new roads are built, they will follow the standards described in Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) that minimize effects on aquatic and riparian resources. HCP road construction policies minimize effects primarily by avoiding new road construction in critical locations such as on flood plains. This practice minimizes effects to off-channel habitat by locating roads in non-critical locations that, if located otherwise, would limit floodplain-channel interactions and development of off-channel habitat.

Refer to Section 8.3.2.2 for a detailed description of the Elliott State Forest road network. Relatively low percentages of roads located near streams or valley bottoms in fifth field watersheds minimize potential risks to flood-plain channel interactions and associated off-channel habitat and refugia. RMA boundaries are measured from the outer edge of high-water level, edge of the stream-associated wetland, side channel or channel migration zone (whichever is farthest from the existing channel location). This practice will minimize the effects of forest management on off-channel habitat by minimizing disturbance on floodplains and providing riparian functions around potential future channel locations and existing side channels.

8.5.6. Stream Bank Condition

8.5.6.1. Effects

Stream bank erosion can occur as a result of natural processes such as wind throw, landslides, and high-flow events. Management-induced changes were more common with practices that did not require leave trees along streams. Restrictions such as riparian leave trees, no ground-based equipment and full suspension through RMAs, omitting roads from riparian areas, and minimizing stream crossings have further decreased potential effects on stream bank erosion.

Forest management activities most likely to affect stream bank conditions include road construction near the stream and stream crossings and forest management near the stream.

8.5.6.2. Minimization Programs

Refer to Section 8.3.2.2 for a detailed description of the Elliott State Forest road network. The HCP riparian strategies treat the inner 25 feet of RMAs on all streams (except "other" small seasonal Type N streams) with a no-harvest, no ground-based equipment buffer. In addition, full suspension is required on all fish-bearing streams and large and medium non-fish-bearing streams. All of these conservation programs minimize potential negative effects of harvest on stream bank condition. Other riparian strategies that apply to the inner and outer zones are described in Sections 8.3.1 and 8.4.2.

8.5.7. Floodplain Connectivity

8.5.7.1. Effects

Floodplain connectivity is primarily influenced by channel constraint, large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, HCP strategies have the greatest potential to influence inputs of large wood and channel constraint. See Section 8.4.2 for more information on effects to large wood recruitment. Roads located in close proximity to and oriented parallel to stream channels can decrease the potential for off-channel habitat and flood plain interactions in channel types that otherwise have those characteristics.

8.5.7.2. Minimization Programs

Chapter 5 and the Forest Roads Manual (Oregon Department of Forestry 2000) describe strategies for reducing these effects (see Section 8.3.2). HCP road construction strategies minimize effects primarily by avoiding new road construction in critical locations such as floodplains. This practice minimizes effects to off-channel habitat by locating roads in non-critical locations that, if located otherwise, would limit floodplain-channel connectivity. RMA boundaries are measured from the outer edge of high-water level, edge of the stream-associated wetland, side channel, or channel migration zone (whichever is farthest from the existing channel location). This practice will minimize the effects of forest management on channel/floodplain interactions by minimizing disturbance on floodplains and providing riparian functions around potential future channel locations and existing side channels.

8.6. FLOW/HYDROLOGY: EFFECTS, AND MINIMIZATION AND MITIGATION PROGRAMS

8.6.1. Peak and Base Flows and Increasing Channel Drainage Network

8.6.1.1. Effects

Upland forest management has the potential to influence hydrologic processes. Forest management practices as described in the HCP that have the greatest potential to affect hydrologic processes include landscape-scale strategies such as harvesting and road management. Under the HCP, no more than 5 to 15 percent of the Elliott State Forest will be in an early forest structure.

Available research has evaluated regeneration harvest rates that range from 35 to 100 percent of small watersheds, and rarely separate effects of roads from harvesting. Existing research on changes in peak flows and summer flows that result from forest management suggest that flows with a 0.4- to 5-year return interval are increased when less than 25 percent of the basin is clearcut harvested (Beschta et al. 2000). Increases in summer base flows may also occur, but are not as commonly researched (Beschta et al. 2000). The magnitude of observed changes in peak and low flows are generally small because response flows have low return intervals (Beschta et al. 2000).

Available research on the effects of roads on peak flows suggests that connectivity of roads to streams can increase the channel network, and thus the magnitude of and frequency of peak flows (Wemple et al. 1997). Older road-design standards considered streams to be part of the road drainage system, and directed much of the drainage waters to streams. Wemple et al. (1997) reported that 57 percent of the forest service road network was connected to streams in a study in the Willamette National Forest. Reid and Dunne (1984) reported an even higher value of 75 percent stream connectivity in the Clearwater basin of Washington. Increases in the 25-year return interval were observed as a result of road construction (King and Tennyson 1984). Jones and Grant (1996), Beschta et al. (2000), and Thomas and Megahan (1998) all found increases in peak flows associated with clear-cut harvesting and road building on small watersheds when the peak flow was defined within 0.4- to 5-year return intervals.

Most research has been conducted at small spatial scales (less than 100 hectares). In general, findings from small watersheds cannot be extrapolated to larger watersheds because of differences in hydrologic processes as scale increases (Ziemer 1998). Time frames vary by study and range from 9 to 33 years.

These findings suggest that an effect on peak flows is possible from harvesting as described in the HCP. If one occurs, it is likely to be on small peak flows (half-year to five-year return

intervals) when 25 percent or more of a small basin (0.1 to 1 square kilometers) is in a young stand condition. Research indicates that changes associated with these small basins cannot be extrapolated to larger basins. Furthermore, channel changes associated with increases of these small peak flows are unexpected because of their low stream power. The large peak flows that tend to modify stream channels and transport most of the sediment usually occur during mid-winter. These large events have not been shown to be significantly affected by logging in the HJ Andrews study (Rothacher 1973), Alsea study (Harr 1976; Harris 1977), or Caspar Creek study (Ziemer 1981).

The sensitivity of a stream channel to changes in small peak flows depends on the sediment and wood regime of the watershed (Grant 1987). Grant (1987) writes that "downstream effects of harvest practices on stream channels in the Pacific Northwest suggest that increased sediment delivery (particularly from mass movements) and transport of large woody debris are more important than peak flow increases."

Changes in peak flows or low flows that might occur as a result of forest harvest in the Elliott State Forest are likely to be sufficiently small that changes in flows or channel morphology are virtually non-detectable. Accurate measures of peak flows are expensive, and long monitoring periods are required to accurately assess the effects of management. Alternatives include measures of road connectivity to streams and percent of watersheds in given stand structures.

The greatest risks for increased drainage network are associated with the existing road system. Older roads are more likely to have greater connectivity with streams than newly constructed roads, a characteristic believed to increase the drainage network. The vast majority of the Elliott State Forest road system is (and will continue to be) composed of old roads.

8.6.1.2. Minimization and Mitigation Programs

The HCP describes upland forest management strategies that minimize the percent of the landscape in an early forest structure. No more than 5 to15 percent of the Elliott State Forest will be in an early forest structure—the stand age most likely to result in increased runoff.

An increase in drainage network can occur with poorly managed or constructed roads, which in turn can cause increases in peak flows. The Forest Roads Manual (Oregon Department of Forestry 2000) describes practices to minimize and mitigate this potential effect. This includes road restoration activities designed to minimize connectivity of existing roads to streams. Information on the effectiveness of road restoration suggests that practices as described in the HCP are effective at reducing hydrologic connectivity to streams. This decreases the drainage network and reduces the risk of increased peak flows (see Section 8.3.2 for detail on road strategies).

8.7. SUMMARY

Table 8-1 provides a qualitative summary of aquatic indicators, potential effect to those indicators from forest management, and the rationale for effect findings. In general, practices described in the HCP are expected to result in either a reduced effect, no effect, or a low effect. The rational for these conclusions is that management activities described as part of the HCP will:

- Improve functions over time, improve conditions, and result in "reduced effect over time"
- Prevent effects to aquatic and riparian areas through restrictive BMPs, resulting in "no effect"
- Result in sufficiently small effects (e.g., likely to be immeasurable or short-lived), resulting in a "minor effect"

Aquatic and riparian conditions are linked with landscape processes such as landslides and hydrologic regimes and near stream conditions such as riparian forest structure and shade. Therefore, the HCP approach integrates landscape and site-specific management strategies. The HCP describes a number of integrated habitat conservation strategies for managing at the landscape level to achieve desired riparian and aquatic conditions. These include, but are not limited to, landscape design, watershed analysis, slope stability, and road management strategies. The HCP also describes a detailed set of site-specific approaches to management around fish-bearing streams and non-fish-bearing streams, as well as riparian and aquatic restoration.

Although this assessment described effects in terms of individual indicators, it is important to recognize that a single forest management activity can influence multiple indicators. Likewise, a single indicator can be influenced by multiple forest management activities, and indicators are often interrelated. A conceptual model of this interrelatedness is presented in Figure 8-1. Understanding the connections between management activities, the desired effect on watershed processes, influences on riparian and aquatic habitats, and associated indicators will lead to more effective detection of changes and improvements in forest management over time.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Stream Temperature		X	X	*No effect* because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection including debris flow-prone channels. These measures will maintain shade and in turn stream temperature along F streams and some N streams. *Minor effect* is possible on small N streams with narrower RMAs and fewer leave tree requirements.
Suspended Sediment			X	*Minor effect* from forest roads from fine sediment delivery to streams. The effect is expected to be minor due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels *may* increase large wood recruitment potential during landslides, reduce runout distances associated with debris flows, and in turn decrease sediment delivery to downstream reaches.
Intergravel DO Turbidity		X	X	*No effect* because of *minimization* programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These measures will protect large wood recruitment potential, improve condition of channel substrates, and in turn prevent decreases in intergravel DO. *Minor effects* are unlikely, but may occur if sediment delivery from roads is higher than expected.
Nutrients		X		*No effect* because of *minimization* programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to prevent management impacts on nutrient cycling.
Habitat Access	X	X		*Reduced over time* because existing roads will be brought up to current standards through restoration activities, which will reduce impacts of current conditions over time. *No effects* because all new roads require fish passage for all life stages.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Substrate/ Embedded	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. *No effect* due to minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection including debris flow-prone channels. These additional restrictions are likely to maintain large wood recruitment potential, and in turn maintain or improve condition of channel substrates. *Minor effect* because forest roads can contribute fine sediment to streams. The effect is expected to be low due to BMPs that prevent construction in critical locations, reduce connectivity to streams, prevent erosion of the road surface, and control traffic during wet weather. Additional restrictions around debris flow-prone channels *may* increase large wood recruitment potential during landslides and reduce run out distances associated with debris flows, thus decreasing sediment delivery to downstream reaches. Landslide frequency can be increased due to harvesting, but BMPs to minimize this impact are described.
Large Wood	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. *No effect* due to minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. Removal of trees from some high landslide hazard locations initiation sites may also reduce large wood recruitment to some F streams.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Pool Frequency and Quality	X	X	X	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, large wood begins to fall into streams, and pool frequency and quality improve. Will also improve with large wood placement mitigation projects. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, these practices may increase the pools' frequency and quality. *No effect* because of minimization programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential and, to the extent that this indicator is influenced by large wood recruitment, prevent impacts on pool frequency and quality. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could decrease pool frequency and quality. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. To the extent this indicator is influenced by wood recruitment from near stream, upstream, and upslope sources, this practice may result in delayed improvement in pool frequency and quality.
Large Pools	X	X		*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, and large wood begins to fall into streams. Will also improve with large wood placement mitigation projects. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, these practices may increase the numbers of large pools over time. *No effect* because of mitigation programs, which include: wide RMAs; managing for mature forest condition within 100 feet of F streams and some N streams; and more types of streams receiving protection, including debris flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. To the extent that this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, such practices will maintain current frequencies of large pools. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could decrease pool size.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Off-Channel Habitat and Refugia (*see large wood for wood-related rationale*)	**X**	**X**	**X**	*Reduced over time* because the HCP describes forest road mitigation projects that will reduce the miles of existing roads near streams where off-channel habitat might develop. *No road-related effects* because the HCP describes forest road construction, management, and policies that prevent road construction near streams preventing potential impacts on off-channel habitat. *Minor effect* from existing roads that may constrain development of off-channel habitat.
Width:Depth Ratio in Scour Pools	**X**	**X**	**X**	*Reduced effect over time* as riparian and aquatic strategies return riparian areas to desired function, including recruitment of large diameter wood to streams. Will also improve with large wood placement mitigation projects. To the extent this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, this improved function may decrease width:depth ratios over time. *Minor effect* from the removal of trees in the inner zones of RMAs that do not meet mature forest condition. This will result in a short-term loss of wood recruitment (not necessarily large) on some streams. To the extent this indicator is influenced by wood recruitment from near stream, upstream, and upslope sources, this practice may result in short-term increases in width:depth ratios. *No effect* because of minimization programs, which include wide RMAs; managing for mature forest condition within 100 feet of F and some N streams; and more types of streams receiving protection, including debris-flow-prone channels. These restrictions are likely to maintain large wood recruitment potential. To the extent this indicator is influenced by large wood recruitment from near stream, upstream, and upslope sources, such practices will maintain current width:depth ratios. The HCP describes forest road construction, management, and policies designed to reduce sediment delivery to streams and reduce road-related landslides. Such processes otherwise could increase width:depth ratios.
Streambank Condition		**X**		*No effect* because of minimization programs, which include 25-foot no-cut equipment exclusion and full suspension; wide RMAs; and more types of streams receiving protection, including debris flow-prone channels. The HCP describes forest road construction, management, and policies that avoid road construction near streams and aim to minimize stream crossings.

Table 8-5
Aquatic Indicators, Potential Effect to Indicators from Forest Management, and Rationale for Findings

Indicator	Estimate of Effect from HCP			Rationale
	Reduce over Time	None	Minor	
Floodplain Connectivity	X	X	X	*Reduced over time* when roads parallel to streams in floodplains are decommissioned. *No effect* because the HCP describes forest road construction, management, and policies that avoid road construction along floodplains. *Minor effect* from existing road due to the low percentage of roads in floodplains.
Change in Peak Flows & Base Flows	X		X	*Reduced over time:* The Forest Roads Manual describes practices to reduce potential increase in drainage network that may occur on existing roads that otherwise would contribute to increases in small peak flows. *Minor effect* on peak flows is possible from harvesting and existing roads that were not constructed to current standards. If impact occurs, it is likely to be on very small peak flows (one-half-year return interval) when 25 percent or more of very small basins is in a young stand condition. Such changes have only been observed on very small basins (0.1 to 1 square kilometers). Channel changes associated with increases of these small peak flows are unexpected because of their low stream power. An increase in drainage network can occur with poorly managed or constructed roads. The Forest Roads Manual describes practices to minimize this potential effect.
Increasing Drainage Network	X		X	*Reduced over time:* The Forest Roads Manual describes practices to reduce potential increase in drainage network that occur on existing roads that otherwise would contribute to increases in small peak flows. *Minor effect* because Some roads are not fully disconnected from the drainage network. Over time these will be corrected.

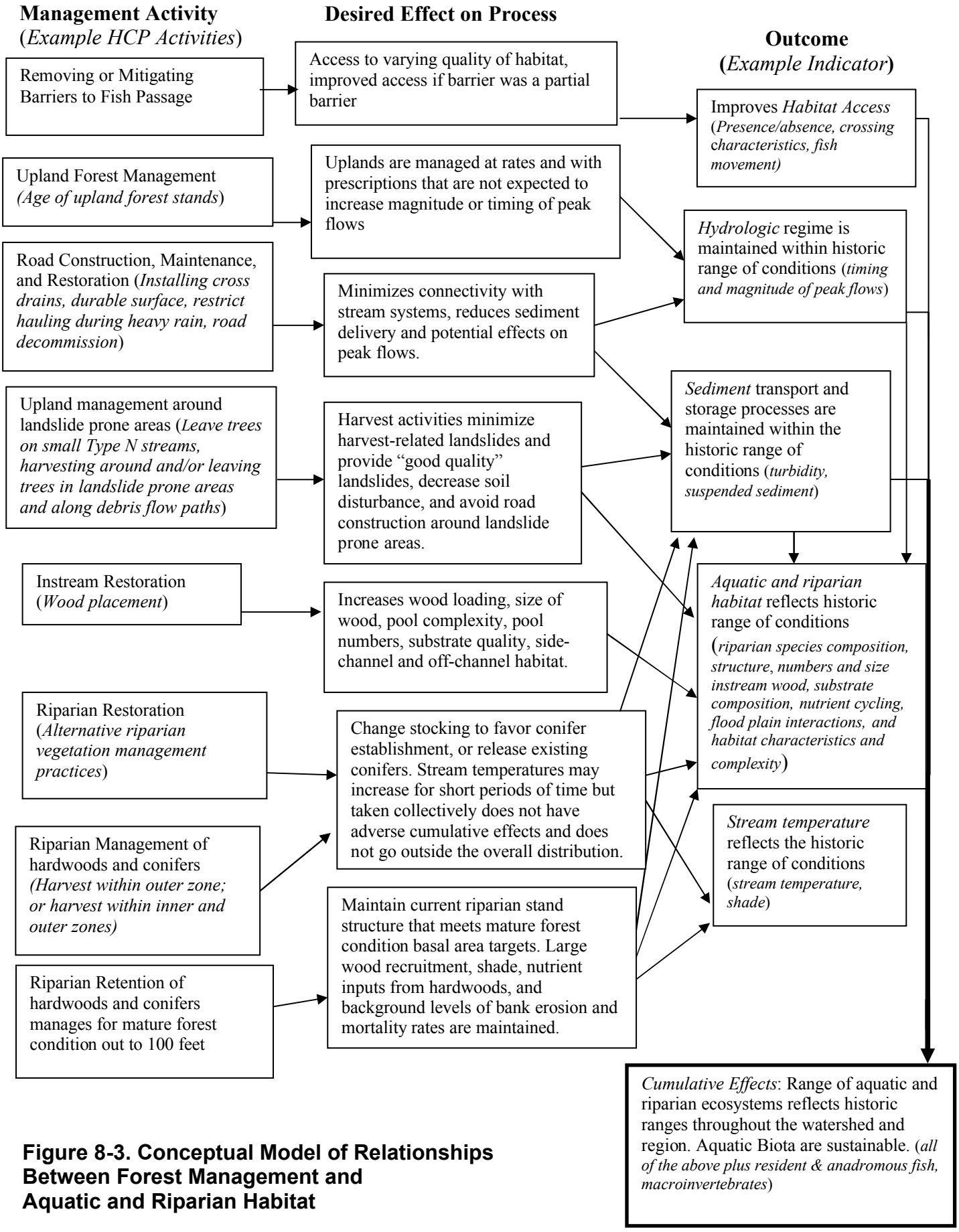

Figure 8-3. Conceptual Model of Relationships Between Forest Management and Aquatic and Riparian Habitat

Chapter 9
Conservation Strategies for Other Species

The Habitat Conservation Plan (HCP) conservation strategies discussed in Chapters 5 through 7 are expected to provide many of the habitats and conditions necessary to support numerous species, in addition to northern spotted owls, marbled murrelets, and fish. However, some species—especially those that are listed or proposed for listing, whose populations are restricted in distribution or habitat requirements, or whose populations seem to be declining at a regional scale—may require additional, very specific conservation and protection measures to supplement the underlying strategies. The additional vertebrate species being considered for coverage under an Incidental Take Permit (ITP) were selected from species known to inhabit, or whose ranges include, Elliott State Forest lands. The selection process included a review of published and unpublished literature and personal contact with local state, Federal, and private biologists, birders, and other knowledgeable individuals. Table 9-1 contains the full list of bird, mammal, and amphibian species developed through this process. Chapter 4 contains more information on the status of these species on the Elliott State Forest, and Chapter 11 presents a framework for adaptive management. It is necessary to read all chapters to understand completely the Oregon Department of Forestry's (ODF's) habitat conservation strategies.

Table 9-1
Other Species Covered by the Habitat Conservation Plan[1]

Birds	Mammals
Bald eagle	Fisher
Northern goshawk	**Amphibians**
Olive-sided flycatcher	Red-legged frog
Western bluebird	Southern torrent salamander
	Tailed frog

[1] For a complete list of species covered by the HCP, see Table 1-1 or 4-1.

9.1. BACKGROUND

9.1.1. Management Status for Other Species

The bald eagle first gained federal protection in 1940 when Congress passed the Bald Eagle Protection Act, later amended to include golden eagles and renamed the Bald and Golden Eagle Protection Act (BGEPA). Bald eagles were listed as an endangered species in 1967 under the Endangered Species Preservation Act and later transferred to the list of threatened and endangered species under the 1973 Endangered Species Act (ESA). In 1978, this action was clarified to list the bald eagle as an endangered species in most of the lower 48 states, with the exception of five states, including Oregon, where it was listed as threatened. In 1975, it was listed by the state of Oregon as a state threatened species. The USFWS appointed a recovery team in 1979, and a *Pacific Bald Eagle Recovery Plan* for seven western states was approved in 1986 (USDI Fish and Wildlife Service 1986). The *Pacific Bald Eagle Recovery Plan* (USDI Fish and Wildlife Service 1986) lists criteria that must be met before bald eagles can be considered recovered and then delisted as a federal threatened species.

In 1995, the USFWS downgraded the species to threatened status in the remaining lower 48 states. In 2007, the USFWS determined that the bald eagle was no longer in danger of extinction, or likely to become endangered within the foreseeable future because the threats that led to its listing have been reduced or eliminated. As a result, on August 8, 2007, the bald eagle was removed from the list of threatened and endangered species. The bald eagle has not yet been removed from the state list of threatened species. Protections for the bald eagle remain under the BGEPA as well as the Migratory Bird Treaty Act of 1972 (MBTA). In addition, the USFWS has proposed a post-delisting monitoring plan (USDI Fish and Wildlife Service 2007).

The fisher is currently considered to be a candidate species for listing by the USFWS. Previous petitions to list this species were denied for various reasons. The latest petition for the West Coast population of the fisher was recorded in 2003. The finding of the USFWS to this petition was that listing of this population was warranted but precluded because of higher priority actions.

At one time, the northern goshawk was considered a candidate for listing under the federal ESA. In response to a series of petitions to list the species, the USFWS initiated a status review in 1997 throughout all western states. In June 1998, the USFWS determined that federal listing was not warranted at that time (USDI Fish and Wildlife Service 1998b). A lawsuit was filed in the District Court of Oregon to contest that determination, and the decision not to list the species was upheld in July 2003. This species remains on ODFW's list of sensitive species (critical status) (Oregon Department of Fish and Wildlife 1997).

Other species on ODFW's list of sensitive species include the olive-sided flycatcher, western bluebird, southern torrent salamander, and tailed frog (all vulnerable status); and red-legged frogs (undetermined status). The olive-sided flycatcher is also considered by the USFWS to be a Bird of Conservation Concern in the Northern Pacific Forest region. The southern torrent salamander and tailed frog are also considered to be Species of Concern by the

USFWS. Species of concern is an informal term referring to species that are considered to be in need of concentrated conservation actions. Species of concern receive no legal protection, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species.

9.1.2. Other Species on the Elliott State Forest

Surveys have been conducted on the Elliott State Forest for bald eagles. These surveys have located four bald eagle nest sites that are currently active. Some limited surveys have been conducted for olive-sided flycatchers and western bluebirds. These surveys have located individuals of these species on the Elliott State Forest, but no nest sites have been located. Surveys have also been conducted for red-legged frogs, tailed frogs, and southern torrent salamanders. There are six ponds where red-legged frogs have been found. Tailed frogs and southern torrent salamanders also have been located in some appropriate habitats on the forest. However, the surveys for these species were limited in scope. It is known that they occur on appropriate habitat on the Elliott State Forest, but it is not known whether they are present in all streams.

No surveys have been conducted for northern goshawks or fisher. Northern goshawks are believed to be relatively rare in the Coast Range, but they could occur on the Elliott State Forest. Fisher is not currently known to inhabit the Elliott State Forest. However, if fisher populations expand in the future, the Elliott State Forest may provide habitats suitable for dispersal, foraging, and (potentially) denning.

9.1. CONSERVATION GOALS

The conservation goals for other species of concern on the Elliott State Forest are as follows:

- Maintain and enhance the ability of Elliott State Forest lands to support nesting, roosting, foraging, and wintering by bald eagles through applying protective measures that minimize the likelihood of disturbance and habitat degradation, and developing additional habitats for those functions.
- Maintain and enhance the ability of the Elliott State Forest to support nesting and foraging habitats for northern goshawks through applying protective measures that minimize the likelihood of disturbance and habitat degradation.
- Maintain and enhance the ability of the Elliott State Forest to support nesting and foraging by olive-sided flycatchers and western bluebirds through the development of habitats suitable for these species.
- Improve the quantity, quality, and distribution of mature forest habitats on the Elliott State Forest, to contribute to fisher conservation in areas with the greatest potential for future habitation.
- Maintain and enhance the ability of the Elliott State Forest to support reproduction and population maintenance of red-legged frogs through the application of forest management practices that minimize the likelihood of habitat degradation.
- Maintain habitats for southern torrent salamanders and tailed frogs across the landscape over time by maintaining: cool water temperatures; stream substrates low in fine sediments; large gravel and cobble in the stream substrates; intact and functioning riparian areas; a cool, moist microclimate; and connectivity to other small, non-fish-bearing streams.

9.2. CONSERVATION STRATEGIES

The habitat conservation strategies described in Chapter 5 provide the basis for the protection of all species in this HCP. Specifically, the following habitat conservation strategies contribute to the maintenance and enhancement of habitat for other species of concern on the Elliott State Forest:

- Strategy 5.2: Manage for a Range of Stand Structures Across the Landscape
- Strategy 5.3: Establish Conservation Areas to Protect Special Resources
- Strategy 5.4: Develop Implementation Plans to Achieve a Landscape Design that Provides Functional Habitat for Native Species
- Strategy 5.5. Maintain or Incorporate Habitat Components into the Forest at a Landscape Level
- Strategy 5.6 Aquatic and Riparian Strategies

These conservation strategies are designed to protect existing habitat, develop additional habitat, provide landscape connectivity, and sustain natural processes to benefit species of concern.

The Elliott State Forest is managed to produce a range of early, intermediate, and advanced stand structures across the landscape. By providing a range of stand structures on the landscape, habitat may be provided for a variety of species with different habitat requirements.

Conservation areas have been established to protect special resources, including threatened and endangered cores (T&E cores); steep, unique, or visual areas (SUVs); and riparian management areas (RMAs). In addition to providing habitats for northern spotted owls and marbled murrelets, T&E cores will provide habitats for other species associated with advanced structure, as well as provide connectivity across the landscape for late-successional forest associates. RMAs will protect habitat for fish species by maintaining the integrity and functions of stream channels. These areas also will provide valuable habitat for other species of concern that are associated with streams and streamside habitats, such as amphibian species. Finally, SUVs protect certain habitats that are rare in the Elliott State Forest, as well as areas where management is logistically difficult. In addition to maintaining some unique habitats, many of these areas contain advanced structure habitats. Thus, additional habitats for late-successional associated species will be provided in these conservation areas as well.

The distribution of stand structures across the landscape will achieve the variety of patch types, sizes, and arrangements necessary to provide functional habitat for native species. Forestwide and basin-specific targets for advanced structure stands, coupled with a logical landscape design developed during implementation planning, will provide habitat connectivity across the Elliott State Forest for species associated with advanced structure. In management basins with more advanced structure, connectivity is likely to be provided for many species by the greater amount of this habitat type. However, where advanced structure stand targets are relatively low, the arrangement of advanced structure patches becomes more important.

Snags and logs are stand structural components that are critical to the life cycle of many species of concern. These habitat components are maintained in all stand types, including early structure, and additional snags and logs are provided where needed, contributing landscape connectivity for species associated with these structures. In addition, live trees are retained in regeneration harvests, providing a valuable habitat component in early structure that will continue to provide valuable structure as the stand develops into other structural stages.

The aquatic and riparian conservation strategies protect existing aquatic habitats and their functions, and contribute additional advanced stand structures adjacent to waterways and aquatic habitats (Chapter 5). These strategies will benefit a number of aquatic species of concern, as well as provide complex habitats for other species that use riparian areas.

The following sections describe the habitats with which other species of concern are closely associated, the potential effects of the proposed action on these habitats, and the minimization and/or mitigation expected from the habitat conservation strategies relative to each species. In addition, other fine filter strategies to minimize effects to species of concern are identified as additional conservation measures. Monitoring is a key component of these strategies and monitoring actions associated with each species are described in this chapter as well as in Chapter 11.

9.3. KEY INDICATORS

Key indicators for the success of the habitat conservation strategies for other species of concern include:

- Maintaining known nest and winter roost sites for bald eagles;
- Minimizing disturbance to nesting goshawks and fisher should they be found on the Elliott State Forest;
- Providing habitat for bald eagles, northern goshawks, and fishers through the maintenance and development of advanced structure habitat on the Elliott State Forest through time;
- Providing habitat for olive-sided flycatchers and western bluebirds through retention of live trees and snags in early structure stands on the forest through time;
- Maintaining habitat for red-legged frogs through protection of ponds with known populations of red-legged frogs; and
- Maintaining habitat for tailed frogs and southern torrent salamanders through protection of perennial, non-fish-bearing streams.

The following sections describe each indicator and the potential effects of activities covered under this HCP on the indicator, followed by the minimization and mitigation provided by the conservation strategies.

9.4. POTENTIAL EFFECTS AND MINIMIZATION AND MITIGATION BY SPECIES

9.4.1. All Species

The following conservation measure applies to all species included in this chapter.

Conservation Measure 9.1
Information for Identifying Other Species

- To facilitate identification of other species on the forest, ODF will provide information on how to recognize adults and young animals and their nesting structures. This information will be used for informal training of foresters and others involved in activities on the forest, including monitoring and timber sale activities.
- This information also will be shared with the USFWS, and will be available within one year of plan implementation.

9.4.2. Site Plans

For several species, site plans will be developed in the event that any nesting sites, breeding areas, or other significant habitat locations are discovered on state forest lands. ODF will develop these plans in collaboration with ODFW and USFWS. Site plans will specify any actions necessary to address the most important potential threats to the species and to protect the site from deleterious changes to key habitat characteristics while the site is being actively used. Site plans will be completed within one year of the discovery of important nesting, breeding, or other significant habitat locations, or at the time an operation is planned within the established distance from a site—whichever comes first. Site plans will be reviewed on an annual basis to determine if continuing implementation is warranted. These plans are a conservation strategy for three species: bald eagle, northern goshawk, and fisher.

9.4.3. Bald Eagle

Surveys have been conducted on the Elliott State Forest for bald eagles. These surveys have located four bald eagle nest sites that are currently active.

In the Pacific Northwest, bald eagles nest primarily in multi-layered conifer stands with dominant old-growth trees within the forest canopy. Their nests are built in very large, older trees. Nest sites are closely associated with aquatic foraging areas such as estuaries, lakes, and rivers. Throughout the year, bald eagles spend much of their time perching. Perch trees are often prominent snags and live conifer trees with dead tops, or exposed lateral limbs that are usually associated with the nest site and primary foraging areas.

In the Elliott State Forest area, bald eagles are most often found near large inland lakes and marshes, along the Umpqua, Coos, and Coquille Rivers, and along the coast. The portion of the Elliott State Forest to the north and east that borders the Umpqua River, Mill Creek, and Loon Lake has excellent nesting and roosting habitat for bald eagles. The steep ridges overlook a foraging area and the abundant large, residual Douglas-fir trees provide nesting opportunities for additional eagle pairs.

Bald eagles in the Elliott State Forest are likely limited by the amount of water sources for foraging and territoriality by neighboring eagles. Fortunately, significant amounts of habitat for bald eagles exist near these large waterbodies. A scarcity of large, dominant trees on ridgetops near the lower West Fork and East Fork Millicoma Rivers and east of Tenmile Lakes are likely limiting factors for bald eagles becoming established in these locations. See Chapter 4, Section 4.3 for additional information about bald eagles.

For the purposes of this plan, bald eagle habitat is assumed to be advanced structure with large trees (at least eight trees per acre at least 32 inches diameter breast height (DBH)) within 1 mile of lakes and rivers (Table 9-2).

9.4.3.1. Summary of Potential Effects

Known Sites

Forest management activities have the potential to affect known sites and sites discovered in the future. The most likely potential effects are associated with mechanized timber management and road and landing construction and include:

- Removal or modification of habitat in nesting areas that affects occupancy or reproductive success; and
- Disturbance to nesting birds.

To date, ODF has not inadvertently harvested trees in a bald eagle nest site. During the 50-year length of the permit term inadvertent removal of habitat or activities with the potential to disturb nesting eagles could occur near an unknown and well concealed active eagle nest.

Advanced Structure

Habitat for bald eagles is found primarily in Basins 1, 2, 9, 12, 13, and a small portion of Basin 3, basins which are adjacent to the Umpqua River, Mill Creek, the lower portion of the

West Fork Millicoma River, and Loon Lake. Forest management activities have the potential to negatively affect habitat for bald eagles through final harvest of advanced structure with eight trees per acre greater than or equal to 32 inches DBH within one mile of rivers and lakes. Habitat development is expected to occur as a result of thinning and partial harvest treatments of other advanced and intermediate structure stands that develop, maintain, and enhance the characteristics of advanced structure over the term of the ITP.

9.4.3.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

The four known bald eagle nesting sites are located in conservation areas. By minimizing management activities in these areas and maintaining advanced structure, the nesting sites are expected to be protected throughout the term of the ITP.

There are over 6,200 acres within conservation areas that are within one mile of the Umpqua River, Mill Creek, the West Fork Millicoma River, and Loon Lake. These conservation areas have the potential to provide nesting areas for bald eagles, throughout the term of this ITP. Advanced structure is the primary habitat type within these areas, and over the ITP, further advanced structure will be developed in these areas. If bald eagles establish nest sites in these T&E Cores and SUVs in the future, these nest sites also will be expected to be protected throughout the term of the ITP.

In addition, site plans will be developed for known nesting sites and winter roosting sites as described in the following conservation measure. Eagles and their nests are very visible and eagle nesting behavior predictable enough to allow for a high level of determination of nest locations and implementation of site management plans. Implementation of the site management plans would greatly reduce or potentially eliminate effects from forest management activities.

Conservation Measure 9.2
Develop Site Plans for Bald Eagles

Site plans will be developed for nesting territories or winter roost sites that are on or affect state forestlands within one year of discovery, or any time an operation is planned within one-half mile of these areas, whichever comes first. These territory plans will specify actions that address the most important potential threats to the species and protect the site from deleterious changes to key habitat characteristics. Examples of management actions include:

- Retaining current and historic nesting and perching trees (usually taller and larger diameter trees that may extend above the canopy and that are snags or alive with broken, forked, or irregular tops);
- Providing a forested buffer around known nest tree(s) or roosting areas.;
- Maintaining territory or roost site integrity through buffers and other appropriate tools;
- Prohibiting felling, yarding, road construction, or other habitat alteration within one-quarter (1/4) mile of the active nest tree or perch trees or within one-half (½) mile if the eagles have line-of-sight vision to the disturbance area during the nesting season (January 1 to August 31). These restrictions would be waived if that year's nesting attempt has failed or the nesting territory is unoccupied;
- Managing stands to maintain nesting habitat or develop additional nesting habitat over time;
- Utilizing landscape strategies to maintain and enhance habitat on state forest lands adjacent to nest site(s) located on other ownerships; and
- Annual monitoring of occupancy and reproductive success.

Other formally adopted guidelines from the USFWS may replace these management actions at the discretion of the ODF.

Advanced Structure

Implementation of the conservation strategies over time will maintain both the distribution and the quantity and quality of habitat for bald eagles.

Conservation Areas

Approximately 6,200 acres of advanced structure are present in conservation areas (including T&E cores areas, SUV lands, and RMAs) within one mile of a water body (lakes or large rivers; Table 9-3). Through the limitation on management in conservation areas, and management for mature forest condition in RMAs, these acres will be maintained over the term of the ITP. Approximately 2,500 additional acres of advanced structure is expected to be developed in these areas over the term of the ITP.

Maintenance and Development of Advanced Structure

Figure 9-1 shows the amount of advanced structure projected to be on the forest over time by decade. At least 50 percent of the advanced structure will have at least eight trees per acre of 32 inches DBH or larger. Basin targets (see Table 5-1) guarantee that distribution of advanced structure habitat occurs across the forest in all basins and is not concentrated in one area. The basin targets for advanced structure in Basins 1, 2, and 13 are 50 percent, 40 percent, and 50 percent, respectively. Most of the advanced structure in these basins will be located in the conservation areas. However, some additional advanced structure outside of conservation areas will be located within 1 mile of rivers or lakes in these basins. Advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH will provide potential nesting areas for bald eagles, particularly in parts of the forest near the Umpqua River and Loon Lake.

9.4.3.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of bald eagles in the Elliott State Forest.
    - The maintenance and development of advanced structure within one mile of lakes and rivers will provide habitat for bald eagles throughout the forest.
    - Management for mature forest condition within the RMAs within one mile of lakes and rivers will create and maintain stand conditions with a high likelihood of providing large trees for bald eagles through time and space.
    - Site management plans for bald eagles will protect the site from deleterious changes to key habitat characteristics, and maintain occupancy and productivity of the site through time.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for bald eagles as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Annually monitor known nest sites and roosting areas to determine occupancy and productivity as part of site management plans for bald eagles.

Eagles have very high site fidelity to previous nests and territories. Revisiting these existing territories to assess occupancy and nest success early in the nesting season is a very effective and inexpensive way to monitor eagle occupation and locate alternate nest sites to avoid affecting this species as a result of forest management activities.

9.4.4. Northern Goshawk

Goshawks typically build their nests in dense patches of large, old conifer trees, with and without understories. Nest trees are frequently the largest in a stand, and are located near small breaks in the canopy. Goshawk nesting territories are large, and their foraging areas extend to 4,900-5,900 acres. Because goshawks need sizable territories with large trees for

nesting, they prefer expansive patches of late-successional forests with considerable canopy closure.

While northern goshawks are present in Coast Range forests, they are believed to be relatively rare in this region. No surveys have been conducted for northern goshawks on the Elliott State Forest, and it is unknown if there are any current territories on the forest. See Chapter 4, Section 4.4 for additional information about northern goshawks.

Although northern goshawks may use a variety of closed canopy stands to meet their habitat needs, for the purposes of this plan, habitat for northern goshawks is assumed to be advanced structure stands (Table 9-2).

9.4.4.1. Summary of Potential Effects

Known Sites

Forest management activities have the potential to affect nest sites discovered in the future through:

- Removal or modification of habitat in nesting areas that affects occupancy or reproductive success
- Removal or modification of habitat in proximity to nesting areas that affects the suitability of the nest site or increases the susceptibility of nests to predation
- Disturbance to nesting birds

The potential for forest management activities to take an otherwise unknown goshawk nest is low. Given the relative lack of goshawk occupation on the Oregon Coast and the conservation strategies in the HCP, it is unlikely more than a few goshawks would be taken this way in the 50-year permit term.

Advanced Structure

Figure 9-1 shows the amount of advanced structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP.

Final harvest of advanced structure stands has the potential to negatively affect habitat for northern goshawks. Approximately 20,000 acres of advanced structure outside of conservation areas will be harvested during the term of the ITP (Figure 9-2).

During the term of the ITP, approximately 26,000 acres of current advanced structure will be maintained on the forest, both within and outside of conservation areas (Figure 9-2). In addition, approximately 21,000 acres of ingrowth advanced structure will be developed during this period. The maintenance and development of advanced structure stands will positively affect habitat availability for the northern goshawk.

9.4.4.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

The 10,480 acres of advanced structure within T&E cores and SUVs have the potential to provide nesting areas for northern goshawks throughout the term of the ITP (Table 9-3). Advanced structure is the primary habitat type within these areas and, over the ITP term, further advanced structure will be developed in these areas. By the end of the permit term, T&E cores and SUVs will consist of over 14,000 acres of advanced structure. The limitation on management in conservation areas may promote the occupancy of northern goshawks if they move into these areas on the forest in the future.

If goshawks do move onto the Elliott in the future, nests may be discovered either through normal staff field work or through monitoring surveys. The following conservation measure will provide additional assurance that up to four nest sites at any given time that are discovered in the future are protected from the potential effects of habitat removal and disturbance. If more than four nest sites are located during any one breeding season, ODF will collaborate with ODFW and USFWS to determine which four sites will be subject to the following measure.

Conservation Measure 9.3
Develop Site Plans for Northern Goshawks

Site plans will be developed for nesting territories that are on or affect state forest lands within one year of discovery, or any time an operation is planned within one-half mile of these territories, whichever comes first. These territory plans will specify actions that address the most important potential threats to the species and protect the site from deleterious changes to key habitat characteristics. Examples of management actions include:

- Retaining nesting trees
- Providing a forested buffer around the nest tree(s)
- Maintaining territory integrity through buffers and other appropriate tools
- Managing stands to maintain and develop additional nesting habitat over time
- Using landscape strategies to maintain and enhance habitat on state forest lands adjacent to nest site(s) located on other ownerships.
- Periodically monitoring occupancy and reproductive success

A maximum of four goshawk territories will be protected by site management plans at any given time. No more than two of these will be located outside of T&E core areas. However, the following will apply to all actively nesting goshawks:

- Prohibiting felling, yarding, road construction, or other habitat alteration within 660 feet of any known active northern goshawk nest during the nesting season (February 15 through September 15). These seasonal restrictions would be lifted if the nest is abandoned.

Advanced Structure

Figure 9-1 shows the amount of advanced structure on the forest by decade. This advanced structure will be distributed in all basins to meet the basin targets for advanced structure. In some basins, additional advanced structure will be maintained and developed outside of the conservation areas in order to meet the basin target. In other basins, advanced structure within conservation areas will be adequate to meet basin targets.

The maintenance and development of advanced structure on the forest outside of conservation areas will provide habitat for northern goshawks that complements the advanced structure within conservation areas if northern goshawks move onto the forest in the future. The requirement for 500 acres of advanced structure in close proximity that incorporates a T&E core area in each basin (Conservation Measure 5.6) will provide additional assurance that large patches of interior habitat exist for northern goshawks.

9.4.4.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, and those that might be listed in the future, in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- The maintenance and development of advanced structure on the forest both within and outside of conservation areas will provide habitat for northern goshawks throughout the forest.
- Site management plans for northern goshawks will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for northern goshawks as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Approximately 11,600 acres of potential habitat will be surveyed for northern goshawks, beginning at year ten of the plan. A minimum of 20 percent of this acreage will be surveyed during any given year, so that surveys are completed in five years. A randomly selected subset of potential habitat will be identified for surveys, which will use established protocols. Surveys during the early breeding season for goshawks in courtship flights are a very effective way to identify territories and locate nest stands.
- Monitoring activities to determine occupancy and productivity will be established as part of site management plans for northern goshawks.

9.4.5. Olive-sided Flycatcher

Breeding habitat for olive-sided flycatchers is conifer forest, particularly forest burns where snags and scattered tall, live trees remain, in forested riparian areas adjacent to streams, rivers, and lakes, at the juxtaposition of late and early-successional forest, such as meadows

and harvest units, and in open or semi-open forest stands with a low percentage of canopy cover. Olive-sided flycatchers are associated with forest openings and forest edges, and are more abundant in landscapes that include high contrast edges between late seral and early seral forest. Altman (1999) describes optimal habitat as early-seral forest with retained live trees and snags over 40 feet tall. See Chapter 4, Section 4.5 for additional information about olive-sided flycatchers.

For the purposes of this plan, habitat for olive-sided flycatchers is assumed to be early structure stands with retained live trees and snags (Table 9-2).

9.4.5.1. Summary of Potential Effects

Nest Sites

ODFs Landscape Management strategies will result in the creation of olive-sided flycatcher habitat through forest management activities that create early seral forest adjacent to mature conifer forest habitats. However, once these habitats are created, there is some risk of the take of olive-sided flycatchers nesting in the adjacent mature forest. Forest management activities have the potential to affect these nest sites through:

- Removal or modification of habitat in nesting areas during the breeding season that affects occupancy or reproductive success
- Disturbance to nesting birds

The felling of trees in mature conifer forest adjacent to early seral forest during the nesting season of June, July, and August has the potential to take an otherwise unknown olive-sided flycatcher nest. Felling of timber may occur at any time of year, but more commonly takes place during the early spring rather than the summer, although some amount of felling may occur from June through August in any given year, and some percentage of this may take place in suitable olive-sided flycatcher habitat.

No potential take of olive-sided flycatchers is expected in riparian management areas adjacent to early seral stands.

It is not known whether or to what extent nesting olive-sided flycatchers may be sensitive to disturbance from nearby activities.

Forest management activities that create edge habitats will provide potential new nesting areas for olive-sided flycatchers.

Early Structure

Figure 9-1 shows the amount of early structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP. During the term of this permit, a range of 5 to 15 percent of the forest will be maintained in early structure. Much of this early structure will be adjacent to intermediate and advanced structure stands that provide potential nesting habitats for olive-sided flycatchers. In addition, virtually all early structure units will contain riparian management areas. Regeneration harvest activities that retain live trees and snags will effectively create additional olive-sided flycatcher habitats so that early structure habitats are present on the forest consistently

through time. Habitat will be lost as early structure stands develop into intermediate structure stands with closed canopies.

9.4.5.2. Summary of Minimization and Mitigation

The conservation strategies will create and maintain stand conditions that have a high likelihood of providing functional habitat elements for olive-sided flycatchers through time and space.

Nest Sites

The occurrence of inadvertent take of olive-sided flycatcher nest sites is expected to be low for the following reasons:

- Only a limited amount of felling will take place during the nesting season of June, July and August. Felling on the Elliott State Forest more commonly occurs prior to June.

- Early structure stands are typically allowed to grow for some time before adjacent mature stands are harvested. The Forest Practices Act prohibits clearcut harvest units within 300 feet of an adjacent clearcut if the combined area would exceed 120 acres until at least four years have passed since the stand was created and it is "free to grow" or the resultant stand of trees has attained an average height of at least four feet. This "green up requirement" ensures that mature forest adjacent to recent clearcuts is maintained for at least four years. Typically, adjacent mature forest is not harvested for ten years or more, delaying and potentially eliminating the chance of potential take of nesting olive-sided flycatchers in these situations.

- Riparian management areas are not subject to timber harvest. No potential take of olive-sided flycatchers is expected in riparian management areas adjacent to early seral stands.

Management for Early Structure

Early structure will be maintained on 5 to 15 percent of the forest through time. Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers through the term of the permit..

Habitat Components

Within regeneration harvest units, an average of three trees per acre will be retained. In addition, all existing snags of all decay classes will be retained where operationally feasible, including at least three hard snags per acre, 15 inches DBH or larger, and at least 20 feet tall. This retention level is expected to provide suitable habitat for olive-sided flycatchers.

Aquatic and Riparian Strategies

The landscape management strategies require retention of trees adjacent to streams. RMAs provide additional retained trees and snags within and adjacent to early structure stands, and also provide areas of high contrast edge adjacent to early structure. The presence of RMAs within and adjacent to early structure stands will contribute to the suitability of these early structure stands for olive-sided flycatchers. Once these riparian management areas are

created through harvest of the adjoining stands, they are not subject to timber harvest activities.

9.4.5.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, and those that might be listed in the future, in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for olive-sided flycatchers within and adjacent to early structure stands.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for olive-sided flycatchers as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Using accepted protocols, periodically sample early structure stands to determine the presence of olive-sided flycatchers. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.

9.4.6. Western Bluebird

Western bluebirds nest in cavities created by other woodpeckers, natural cavities, or artificial nest boxes. They breed in open habitats with low overstory tree densities, including grass-forb, shrub, and early successional forest stands that have suitable nest cavities and structures. This species is often found nesting in cavities along the edges of open fields (Eltzroth 2003). See Chapter 4, Section 4.6 for additional information about western bluebirds.

For the purposes of this plan, habitat for western bluebirds is considered to be early structure stands under ten years of age with retained or created snags (Table 9-2).

9.4.6.1. Summary of Potential Effects

Nest Sites

ODFs Landscape Management strategies will result in the creation of western bluebird habitat through forest management activities that create early seral forest with snags. Forest management activities have the potential to affect these nest sites through:

- Site preparation activities, especially slash burning that disturb breeding birds during the nesting season.
- Removal of nesting snags during the breeding season

Burning slash in recent clearcut units from late March through August has the potential to create atmospheric conditions that western bluebirds might find disturbing. Burning of slash typically occurs during the wet months of the year, but may occur in some units as late as April. Therefore, there is some limited possibility that bluebirds nesting within a unit where slash is being burned may be disturbed by the smoke. This disturbance is unlikely to last for more than one day.

The felling of snags adjacent to early seral forest during the nesting season from late March through August has the potential to take an otherwise unknown western bluebird nest. The landscape strategies (Conservation Measure 5.8) require ODF to retain snags in all decay classes within harvest units. Snags will only be removed when there are safety or operational issues that require a snag to be felled.

Forest management activities that create early structure with snags will provide potential new nesting areas for western bluebirds.

Early Structure

Figure 9-1 shows the amount of early structure on the Elliott State Forest at the initiation of this HCP (see also Table 3-4), and as projected by decade for the 50-year term of the ITP. During the term of this permit, a range of 5 to 15 percent of the forest will be maintained in early structure. Habitat will be lost as early structure stands develop into intermediate structure stands, and will be recreated through regeneration harvest activities that retain live trees and snags, so that early structure is present on the forest consistently through time. However, harvest activities may occasionally result in the loss of individual snags in proximity to early seral stands when safety or operational reasons require them to be felled.

9.4.6.2. Summary of Minimization and Mitigation

The conservation strategies will create and maintain stand conditions that have a high likelihood of providing functional habitat elements for western bluebirds through time and space.

Nest Sites

Conservation Measure 5.8 requires the retention of existing snags of all decay classes where operationally feasible during harvest activities, with a target of at least three hard snags per acre (decay class 1 or 2), 15 inches DBH or larger and at least 20 feet tall. If fewer than three hard snags per acre exist after harvest, one snag per two acres will be created, using live trees greater than 20 inches DBH and a minimum of 20 feet tall. This conservation measure will result in retention and creation of structures potentially suitable for western bluebirds within early structure stands.

The occurrence of inadvertent take of western bluebird nest sites is expected to be low for the following reasons:

- Western bluebirds will most commonly be found using snags within early structure stands or adjacent riparian management areas. These snags are not subject to forest management activities.
- In adjacent stands, only snags that are on the edge of harvest units adjacent to early structure provide potential habitat for western bluebirds. There are seldom operational

issues associated with snags on the edge of units. There may infrequently be safety reasons requiring removal of snags on the edge of units adjacent to early structure during the bluebird breeding season.

- Rarely, slash burning may occur within a unit being used by a nesting western bluebird. This disturbance is unlikely to last for more than one day.

Management for Early Structure

Early structure will be maintained on 5 to 15 percent of the forest through time. Early structure with snag retention will provide potential nesting and roosting habitats for the western bluebird.

Aquatic and Riparian Strategies

The aquatic and riparian strategies, including management of streamside and inner zones as well as special emphasis areas, require retention of trees, snags, and downed wood within and adjacent to regeneration harvests. The retention of snags along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.

9.4.6.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of western bluebirds in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- Early structure with snag retention will provide potential nesting and roosting habitats for the western bluebird.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for western bluebirds as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Periodically sample early structure stands to determine the presence of western bluebirds. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.

9.4.7. Fisher

The fisher is associated with expansive mature to late-successional conifer-dominated stands with a high canopy closure, large amounts of logs, and sizeable snags and trees with cavities. Although fishers have been seen in younger forests on a seasonal basis, even these stands have remnants of older forests present in the form of snags and logs.

Fishers were probably present on the Elliott State Forest at one time. However, fishers are not believed to currently be present on the Elliott State Forest because of their limited distribution in the state. The closest known documented recent observation is over 75 miles from the Elliott State Forest. However, the Elliott State Forest does contain potential habitat for this species. If fisher populations expand in the future, there is the possibility that they will utilize habitat on the Elliott State Forest. See Chapter 4, Section 4.8 for additional information about the fisher.

For the purposes of this plan, potential fisher habitat is considered to be advanced structure with at least eight trees per acre equal to or greater than 32 inches DBH (Table 9-2).

9.4.7.1. Summary of Potential Effects

Known Sites

Because there are currently no known sites, and it will likely be many years before fisher populations expand to the Elliott State Forest, the likelihood of take of this species is very low. However, forest management activities have the potential to affect fisher activity areas if they expand to the Elliott State Forest in the future. The most likely potential effects are associated with mechanized timber management and road and landing construction and include:

- Removal or modification of habitat in areas of concentrated fisher use that affects occupancy or use of these areas
- Disturbance to animals from forest management activities

Although the likelihood of take is low, during the 50-year length of the permit term, inadvertent removal of habitat or activities with the potential to disturb fishers could occur near an undiscovered activity area.

Advanced Structure

Advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH is the habitat most likely to be used by fishers. Figure 9-1 shows the projected acres of advanced structure with at least eight trees per acre greater than or equal to 32 inches DBH for each decade of this plan. At plan initiation, there were approximately 25,700 acres of advanced structure with large trees throughout the forest. Approximately 34 percent was in conservation areas at the beginning of the ITP term (Table 9-3). By the end of the permit term, approximately 52 percent of the advanced structure with large trees will be located within conservation areas (over 14,000 acres; Figure 9-2). The amount of advanced structure with large trees will remain relatively stable throughout the term of the ITP.

Forest management activities have the potential to negatively affect habitat for fishers through final harvest of advanced structure with eight trees per acre greater than 32 inches DBH. Approximately 12,500 acres of advanced structure with large trees outside of conservation areas will be harvested during the term of the ITP (Figure 9-2). Approximately 11,300 acres of advanced structure with large trees will be developed through the permit term, while approximately 26,000 acres of advanced structure will be maintained, both within and outside of conservation areas (Figure 9-2).

Forest management activities that result in the loss of important structures, including large trees, snags, and downed wood, also could negatively affect potential habitat for fishers.

9.4.7.2. Summary of Minimization and Mitigation

Known Sites

Conservation Areas

There are currently no known sites, and it will likely be many years before fisher populations expand to the Elliott State Forest. If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional research or survey efforts that include the Elliott State Forest, or conduct its own activities, as described under Monitoring below.

T&E core areas and SUVs have the potential to provide habitats for fisher throughout the term of this ITP. The limitation on management in these areas will promote habitat suitability for fishers should they move onto the forest.

If fisher is found to be using habitats on the Elliott State Forest, ODF will collaborate with USFWS to determine the need to develop a site plan, as described in the conservation measure below.

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Conservation Measure 9.6
Develop Site Plans for Fisher

Site plans will be developed when ODF and USFWS determine that fishers are exhibiting concentrated use of forested habitats on the Elliott State Forest and measures to avoid disturbing fishers during the breeding season are needed to minimize the potential for incidental take. These site plans will be developed within one year of discovery, or any time an operation is planned within one-half (1/2) mile of these areas, whichever comes first. These plans will specify actions to address potential disturbance to fishers during the times of concentrated use. Examples of actions to be implemented include:

- Seasonal restrictions on mechanized timber harvest activities and road and landing construction within one-half (1/2) mile of active areas of concentrated use
- Seasonal restrictions as needed for other forest management activities with the potential to affect areas of concentrated use.
- Using landscape strategies to maintain and enhance habitat on state forest lands adjacent to areas of concentrated use

A maximum of four fisher site plans will be implemented at any given time.

Advanced Structure

The overall landscape strategy of maintaining and developing advanced structure within and outside T & E cores will provide opportunities for fisher to use the Elliott State Forest. Potential fisher habitat also will be provided through the strategy to maintain 40 to 60 percent

of the forest in advanced structure stands over time, with at least 50 percent of the advanced structure having at least eight trees per acre of 32 inches DBH or larger. Figure 9-1 shows the amount of advanced structure with large trees on the forest by decade.

Approximately 11,300 acres of advanced structure with large trees will be developed during the term of the ITP, including approximately 5,900 acres within conservation areas and an estimated 5,400 acres outside of conservation areas. Approximately 16,000 acres of advanced structure with large trees will be maintained, including 7,500 acres outside of conservation areas in addition to the 8,500 acres within conservation areas (Figure 9-2).

The nearly 16,000 acres of conservation areas that are T&E cores and SUVs have the potential to provide habitat for fisher for the next 50 years. Initially, these areas primarily consist of advanced structure, but as further structure develops over time, they move from consisting of 65 percent advanced structure to over 90 percent advanced structure, with only small amounts of intermediate structure and nonforest. The proportion of T&E cores and SUVs consisting of advanced structure with larger trees changes from 43 percent to 70 percent over the 50-year term of the ITP. By the end of the permit term, T&E cores and SUVs will consist of over 11,000 acres of advanced structure with larger trees.

Although T&E core areas and SUVs have the best potential for providing future habitats for the fisher, development of additional advanced structure habitat on the landscape outside of these areas may provide important foraging and dispersal habitats for fishers. To the extent that basin targets for advanced structure are not met within conservation areas, additional advanced structure will be maintained and/or developed within that basin over time (Table 5-1). These basin targets guarantee that distribution of advanced structure habitat occurs across the forest and is not concentrated in one area. The requirement for 500 acres of advanced structure in close proximity that incorporates a T&E core area in each basin provides some assurance that larger patches of advanced structure will be present across the forest (Conservation Measure 5.6). In addition, mapped murrelet habitats retained for marbled murrelets (see Strategy 7.4) will provide additional habitat for the fisher.

Fishers are associated with legacy structures such as snags and logs. These structures are expected to occur as part of natural processes within conservation areas. Outside of conservation areas, stands being developed into advanced structure will be managed for these structures, including at least six snags per acre, two of which must be at least 24 inches in diameter; a total of 3,000 to 4,500 cubic feet of downed logs in all decay classes, or 600 to 900 cubic feet per acre of sound downed logs in decay classes 1 or 2; and multiple tree species, including shade-tolerant species, some trees with defects or decadence, and diverse understory vegetation. These large snags and logs will provide potential future denning and resting sites for fishers.

Finally, retention of snags and logs in RMAs, and management for mature forest condition within the RMAs for fish-bearing streams will create and maintain stand conditions with a high likelihood of providing functional habitat elements for fishers.

9.4.7.3. Monitoring

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of fishers in the Elliott State Forest, and will provide habitat sufficient to accommodate movement and interaction of fishers across the regional landscape.
- T&E core areas and SUVs would provide the best potential habitats for this species if individuals use the Elliott State Forest in the future.
- Site management plans will function to protect fishers from disturbance due to forest management activities during the breeding season .
- Outside of conservation areas, the maintenance and development of advanced structure with numerous snags and logs will provide habitat for fishers throughout the forest.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for fishers as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional fisher research or survey efforts that include the Elliott State Forest, or conduct its own fisher research or survey activities.

9.4.8. Red-legged Frog

Red-legged frogs breed in ponds, marshes, and slow-moving streams, and favor riparian areas with dense undergrowth. Not strictly aquatic, they can wander as far as 300 yards from water. Red-legged frogs were found at 6 of 13 ponds surveyed on the Elliott State Forest in 2001. See Chapter 4, Section 4.9 for additional information about the red-legged frog.

For the purposes of this plan, potential habitat for this species includes all ponds on the Elliott State Forest (Figure 9-2).

9.4.8.1. Summary of Potential Effects

Management activities have the potential to affect habitat for red-legged frogs through:

- Removal of water from occupied sites during the breeding season; and/or
- Degradation of water quality through removal of vegetation near occupied sites and through the use of ground-based equipment near breeding habitats.

Although the occurrence of forest fires on the Elliott State Forest is rare, there are occasions when water is drawn from ponds for firefighting purposes, primarily in the later summer months, July through September. By this time of year, few tadpoles remain in ponds, as most have metamorphosed into froglets. Nevertheless, water removal from red-legged frog breeding ponds may occasionally result in death or injury to red-legged frogs or tadpoles. It is expected that this occurrence will be infrequent over the term of the ITP due to the

infrequent nature of fires on the Elliott, the time of year when firefighting activities are most likely to occur, and the small number of occupied ponds.

9.4.8.2. Summary of Minimization and Mitigation

Riparian Management Areas

The six ponds on the Elliott State Forest where red-legged frogs were found are all less than one-quarter acre in size. The Aquatic and Riparian strategies protect ponds less than one-quarter acre through the following standards (see Table 5-8):

- A 25-foot RMA will be established, within which hardwood trees and brush will be retained in the RMA to protect hydrologic functions.
- Occupied ponds will be identified as important areas for temperature-sensitive amphibians, and will have at least 80 percent shade maintained over the aquatic area.
- Harvest activities or ground-based equipment use will not be allowed within 25 feet of all stream-associated wetlands.

The retention of trees near pond areas will contribute to cover and shade for this species. Limiting the exposure of aquatic and riparian habitats to ground-disturbing activities and removal of vegetative cover will minimize sedimentation and water quality degradation.

Some of the breeding ponds are used by the ODF for fire suppression activities. However, because red-legged frogs breed early in the year, it is highly unlikely that water removal would occur during the breeding season.

9.4.8.3. Monitoring

Assumptions

- RMAs for ponds will protect the functions of these habitats for red-legged frogs.

Activities

- Periodic surveys of all suitable ponds will be conducted at approximately six-year intervals to determine occupancy by red-legged frogs.

9.4.9. Headwater Amphibians

Torrent salamanders are encountered in seeps, springs, small streams, and the margins of large streams with cold water temperatures, and are associated with high gradient streams.

Tailed frogs are highly specialized for life in cold, clear, swift, perennially-flowing mountain streams. Tailed frog larvae show a strong association with coarse substrates, such as cobble, and both adults and larvae are generally negatively associated with fine substrates, such as sand and silt. See Chapter 4, Section 4.11 and 4.12 for additional information about torrent salamanders and tailed frogs.

Although they may be found in a wider range of stream types, for the purposes of this plan, habitat for these headwater amphibian species will be assumed to be small, perennial non-fish-bearing streams. Figure 8.1 (page 8-7) shows the miles of different stream types on the

Elliott State Forest. There are approximately 348 miles of small perennial non-fish-bearing streams on the Elliott State Forest (Table 9-2).

Surveys have located these two species in the Umpqua, Tenmile, and Coos Watersheds, but it is not known if they occur in all small perennial streams in these watersheds.

9.4.9.1. Summary of Potential Effects

Forest management activities have the potential to affect southern torrent salamanders and tailed frogs when they occur in proximity to small perennial non-fish-bearing streams and if they result in increased water temperatures, or in water quality degradation, specifically increasing siltation of rocky substrate. As well, alterations to riparian areas that contribute to lowered humidity, decreased shade, ground disturbance, and lack of large wood are also factors likely to negatively affect these species. Mechanized timber harvest in proximity to small perennial non-fish-bearing streams may result in these effects. In addition, spur road construction to access and harvest timber will involve stream crossings of these non-fish perennial streams in headwater areas that may affect headwater amphibians.

9.4.9.2. Summary of Minimization and Mitigation

Conservation Areas

An estimated eight percent of all small, perennial non-fish-bearing streams on the forest occur in T&E cores and SUVs. Because harvest activities are restricted in these areas, these streams are likely to retain suitable habitat for headwater amphibians throughout the term of the ITP.

Stand Structure Targets

Habitat for headwater amphibians will be maintained in perennial non-fish-bearing streams located within stands managed for advanced structure characteristics. Additionally, intermediate structure stands may support connectivity between and among aquatic habitats over time and space. Thirty to 60 percent of each management basin will be managed for advanced structure, including the conservation areas (Table 5-1) and ten of the 13 management basins will have advanced structure requirements that are in addition to what exists within conservation areas. Between 85 and 95 percent of the forest will be in intermediate and advanced structures at any point in time. Only 5 to 15 percent of the forest will be managed for early structure habitats.

Riparian Management Areas

Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs. RMAs standards for small, perennial non-fish-bearing streams are described in Chapter 5 and include:

- No harvest activities or ground-based equipment use within 25 feet of all perennial streams, and some seasonal streams
- An additional 15 to 25 conifer trees and snags per acre from 25 to 100 feet from the stream

- Retention of all hardwoods, non-merchantable trees, and other conifers as necessary to achieve 80 percent shade over the aquatic zone within 500 feet of a confluence with a Type F stream
- Extension of the 25-foot no harvest buffer on perennial Type N streams to protect the functions and processes for seeps and springs, source areas of perennial streams, stream-associated wetlands, stream junctions, and the splash zone of waterfalls.

These standards will contribute to cover and shade and water quality, as well as microclimates supportive of headwater amphibians. The retention and development of snags, dead, and downed material in the RMA will provide cover and shade for animals dispersing from the stream. Limiting the exposure of aquatic and riparian habitats to ground-disturbing activities and removal of vegetative cover will minimize sedimentation and water quality degradation.

In addition, best management practices described in the Oregon Forest Practices Act include the following to minimize negative effects to these streams:
All permanent crossings must be constructed to:

- Minimize excavation
- Restrict width and height of fill (less than 15 feet deep)
- Prevent erosion of the fill and channel (e.g. durable surfacing, draining road runnoff away from the crossing, etc.)
- Pass a peak flow that corresponds to at least a 50-year return interval

For temporary crossings;

- Operations will limit the number of crossings.
- Structures must be adequate to pass flows that occur during the operation.
- Structures will be located to minimize cut and fill depths (less than eight feet).
- All temporary crossings will be removed immediately after completion of the operation or prior to a runoff that exceeds the flow capacity of the structure, which ever comes first.
- Crossing material will be placed in a location where it will not enter waters of the state.

Additionally, the following conservation measure will further ensure protection of habitats for headwater amphibians during harvest activities:

Conservation Measure 9.8
Retention of Trees in the Inner Zone on Small Perennial Type N Streams

- The aquatic and riparian strategies target the retention of at least 15 to 25 conifer trees and snags per acre in the area located 25 to 100 feet from a small perennial Type N stream (Table 5-6). Unless there are operational or safety constraints, efforts will focus on retaining the trees closest to the stream. In most stands, this would result in retention of all trees within 50 feet of these streams.

9.4.9.3. Monitoring

Assumptions

- T&E core areas and other conservation areas may provide important source habitats for headwater amphibians throughout the forest.
- Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for headwater amphibians as an objective of activities described in Section 11.3.3.5 at ten-year intervals.
- Within the first five years of plan implementation, conduct a study to determine the effectiveness of RMA standards to protect the functions of small perennial Type N streams. Parameters to be measured include shade, water quality (e.g., stream temperature, macroinvertebrates, or sediment), and presence of headwater amphibians. The study will include surveys before and after management activities in a selection of perennial Type N streams, as well as surveys of small perennial Type N streams within a selection T&E core areas or SUVs. Follow-up surveys will be conducted in five and ten years.

Table 9-2.
Assumptions for Potential Habitat by Species

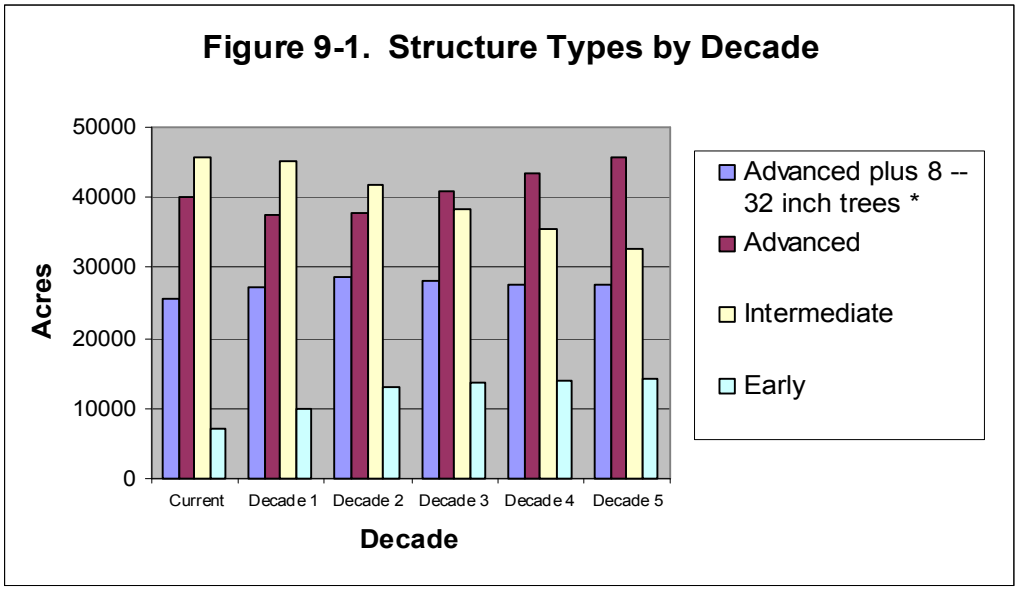
Species	Potential Habitat	Approximate amount of habitat at plan initiation
Bald Eagle	Advanced structure with at least 8 trees/acre at least 32 inches DBH within 1 mile of lakes and rivers[1]	10,800 acres
Northern Goshawk	Advanced structure	41,700 acres
Olive-sided flycatcher	Early structure with retained trees and snags	7,000 acres
Western Bluebird	Early structure with snags	7,000 acres
Fisher	Advanced structure with at least 8 trees/acre at least 32 inches DBH[2]	25,700 acres
Red-legged frog	Ponds	13 ponds
Tailed frog	Small, perennial Type N streams	350 miles
Southern torrent salamander	Small, perennial Type N streams	350 miles

[1] Subset of All Advanced Structure
[2] DBH = diameter breast height

Table 9-3
Current Condition [1]

Structure Type	Total Habitat in Plan Area at Start of Plan	Habitat Within Conservation Areas				Outside Conservation Areas
		Total	T&E Core	SUV	Riparian	
Advanced structure with eight trees per acre at least 32 inches DBH[2]	25,700	8,524	5,859	976	1,789	17,076
Advanced structure with large trees within one mile of rivers and lakes[3]	10,826	6,206	4,033	1,508	664	4,620
All advanced structure	41,716	13,159	8,410	2,070	2,679	28,557
Intermediate structure	44,090	8,723	3,219	1,851	3,653	35,367
Early structure	6,898	396	38	18	340	6,502

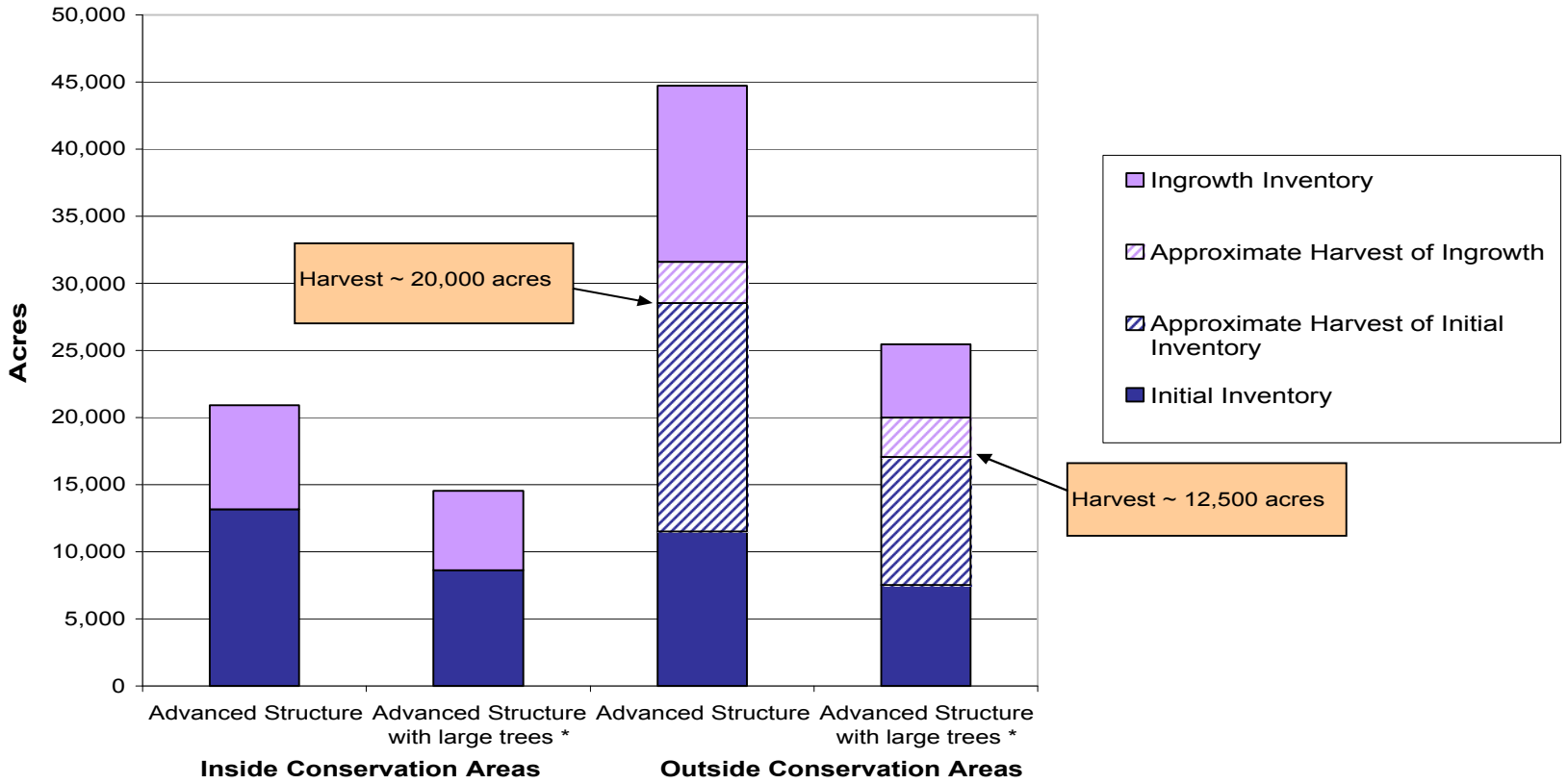
[1] In acres.
[2] DBH = diameter breast height
[3] Subset of Advanced Structure



* Advanced plus 8 – 32 inch DBH trees is a subset of Advanced Structure

Figure 9-2

Inventory of Advanced Structure Within and Outside Conservation Areas [1]



[1] Source for these numbers is output from Model 9u2.

* Advanced Structure with large trees is a subset of Advanced Structure

Ingrowth = acres developed into advanced structure during the 50-year period.

Harvest = total acres of advanced structure regeneration harvested for 50 years

Chapter 10
Conservation Alternatives Considered

The Habitat Conservation Plan (HCP) team evaluated current and desired forest conditions and developed a range of alternative conservation strategies. Each alternative is a strategy for managing northern spotted owls, marbled murrelets, and other vertebrate species, and their habitats on the Elliott State Forest, while maintaining the ability to manage the forest for other resources, including timber and revenue production to meet legal mandates (Alternative 7, which would produce no timber harvest or revenue, is an exception). The Elliott State Forest contains approximately 93,000 acres in Coos and Douglas Counties. Approximately 90 percent of this land consists of Common School Forest Lands (CSFLs), and the remainder is Board of Forestry Lands (BOFLs). The alternatives presented herein are designed to illustrate the range of reasonable responses to the issues. The alternatives are presented in more detail in the Environmental Impact Statement (EIS) for the HCP.

In meeting the requirements for an HCP, this subsection summarizes the alternative descriptions and discussion from the EIS. Alternative 1 is the no action alternative, involving the continued use of the existing (1995) HCP to manage for northern spotted owls and avoiding any incidental take of marbled murrelets. Alternative 2 is the preferred alternative, and the basis for the conservation strategy. Alternatives 3 through 7 present different management strategies. Alternatives 1, 2, and 3 were developed and analyzed fully. Alternatives 4 through 7 were considered, but eliminated from detailed analysis. This chapter also includes some discussion on the choice of Alternative 2 as the preferred alternative, the basis for the conservation strategy, and why the other alternatives were not selected. The EIS contains detailed information on the effects of each alternative, including the amount of potential incidental take of northern spotted owls and marbled murrelets.

The aquatic and riparian strategies are not the same for all alternatives. Alternative 1 uses the aquatic and riparian strategies in the 1995 Elliott State Forest HCP. Alternatives 2 and 4 use the aquatic and riparian strategies described in Chapter 5. Alternative 3 uses a modified version of the strategies used in the Northwest Forest Plan (USDA Forest Service, et al. 1994a). Alternative 5 describes other riparian management variations that were considered in developing Alternative 3. Alternative 6 uses Forest Practices Act (FPA) standards. Under the Memorandum of Agreement between the State of Oregon and the National Marine Fisheries Service, the Oregon Department of Forestry (ODF) is committed to aquatic conservation strategies that have a high likelihood of maintaining and restoring properly functioning aquatic habitat for salmonids on state forestlands. All alternatives will follow all FPA rules, the policies of the State Land Board and the Board of Forestry, and applicable laws, such as the state and federal Endangered Species Acts (ESAs).

Resource specialists from the ODF developed the alternatives in cooperation with the federal agencies. In addition, the ODF worked closely with the Department of State Lands (DSL) and the Oregon Department of Fish and Wildlife and their resource specialists. The public also contributed to alternative development through the public involvement process described in Appendix G of the Elliott State Forest Management Plan and Appendix D of the EIS, "Consultation with Others."

10.1. CURRENT MANAGEMENT (ALTERNATIVE 1: NO ACTION)

10.1.1. Description of Alternative

The ODF could continue to manage Elliott State Forest lands under the 1995 HCP for northern spotted owls and avoid incidental take of other threatened and endangered species. Under this alternative, the ODF would not apply for a new Section 10(a)(1)(B) incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS). The ODF would avoid the take of marbled murrelets by using the *Marbled Murrelet Operational Policy for State Forest Lands* (Oregon Department of Forestry 2004). Aquatic and riparian areas would be protected by applying aquatic and riparian management strategy 2 in the 1995 Elliott State Forest HCP.

Under this alternative, some northern spotted owls would be incidentally taken through habitat modification, but this would be mitigated by reserve areas and through nine long rotation basins that encompass about half the forest. Each long rotation basin would maintain 50 to 66 percent of its area in nesting, roosting, and foraging habitat for the northern spotted owl. At least half of the forest would be maintained in dispersal habitat. An ITP associated with the HCP is in effect through 2056.

Marbled murrelets would be protected in accordance with the provisions of the federal ESA under the Marbled Murrelet Operational Policy for State Forest Lands (Oregon Department of Forestry 2004). Occupied stands would be protected from harvest indefinitely, and in effect would become reserves for marbled murrelets. However, if ongoing surveys indicate that a marbled murrelet-occupied stand is vacant for a period of five consecutive years, the stand could become available for harvest. RMAs and non-production lands could provide some habitat for northern spotted owls and marbled murrelets, but would not be specifically managed for that purpose. Production lands would be managed with timber production as the primary use.

Under this alternative, management activities in the Elliott State Forest would be inherently unpredictable because of the mobility of the marbled murrelet. There would be permitted incidental take of northern spotted owls under this alternative, but no incidental take of marbled murrelets. Existing and planned habitat in the Elliott State Forest should provide for 26 northern spotted owls as predicted in the 1995 HCP. Some marbled murrelet habitat will also be protected through the northern spotted owl HCP. In the first few decades, timber harvest opportunities would become increasingly more constrained because of the obligations in the 1995 HCP, coupled with the identification of new marbled murrelet-occupied sites.

10.1.2. Why Alternative was Not Selected

The ODF chose not to pursue this alternative because it does not take advantage of recent advances in the management of riparian and upland habitats. This alternative does not include the concept that forest structural conditions are key to habitat use by wildlife, and does not

integrate the landscape strategies for multiple wildlife species. This alternative does not take advantage of the latest research and information for both northern spotted owls and marbled murrelets. It would not provide the same level of certainty, stability, and flexibility as the proposed HCP.

In addition, this alternative would limit timber harvest unnecessarily. The continued addition of new marbled murrelet-occupied sites would steadily reduce the land base where timber harvesting could occur. Revenue production would be significantly below the potential of the forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent. This alternative would not achieve that goal.

10.2. PROPOSED ACTION ALTERNATIVE (ALTERNATIVE 2)

10.2.1. Description of Alternative

The proposed HCP would manage the Elliott State Forest using principles of sustainable forest ecosystem management. These lands would be viewed as a landscape containing different habitat types within the context of the larger regional landscape. Over time, through forest management and natural processes, patches would develop into other habitat types. High-quality habitat areas called threatened and endangered cores (T&E cores) that are used by northern spotted owls and marbled murrelets would be maintained for these species for the length of the permit period. Outside the T&E cores, habitats of specific types, such as advanced structure, would change in location on the landscape over time and provide additional habitat areas for northern spotted owls and marbled murrelets. Most habitat patches would be forest stands of various ages with various structures. Other types of habitat patches would be a small percentage of the landscape, and might include meadows, wetlands, rock outcroppings, and other habitats. All currently occupied northern spotted owl sites and many occupied marbled murrelet sites would be protected in T&E core areas. Other than for monitoring, there would be no additional surveys for northern spotted owl and marbled murrelet sites, and no new protection sites would be designated.

The application of the landscape strategies would be intended to create forest conditions that would emulate historical conditions and processes relative to aquatic systems. The approach would also incorporate a set of variable, site-specific riparian strategies to address the range of desired conditions along the stream network. Desired conditions would vary depending on the functions provided by streams in different portions of the landscape, and are described in Appendix D of the HCP. All streams would have a 160-foot riparian management area with varying levels of tree retention depending upon stream type. The goal along fish-bearing streams would be to develop habitat conditions similar to mature timber stands. The goal along non-fish-bearing streams would be to develop habitat conditions sufficient to support important stream functions and processes, and to achieve properly functioning conditions in downstream fish-bearing waters.

The Elliott State Forest is part of a regional landscape with diverse forests that have varying characteristics, ownerships, histories, and management. Through landscape management of state forestlands in a regional context, the proposed HCP would contribute to the conservation of northern spotted owls, marbled murrelets, coho salmon and many unlisted vertebrate species throughout their range. While providing this contribution, the proposed HCP would manage the forest in a manner that meets legal mandates and trust obligations.

In the Coos District, most forestland is in federal or private ownership. The federal forests are usually in large blocks managed to provide large areas of northern spotted owl habitat and marbled murrelet nesting habitat within the marbled murrelet range.

The benefits and effects of the proposed HCP strategies for northern spotted owls, marbled murrelets, coho salmon, and other species are described in Chapters 6 through 9.

Adaptive management, a cornerstone of state forest management plans, would allow the ODF to use new knowledge to improve state forest management.

10.3. INCREASED STREAM BUFFERS AND INTENSIVE MANAGEMENT (ALTERNATIVE 3)

10.3.1. Description of Alternative

Approximately 50 percent of the Elliott State Forest would be managed as reserves through establishment of T&E core areas, steep, unique or visual areas (SUVs), and riparian reserve areas. Buffer widths within the riparian reserve areas were modeled after Forest Ecosystem Management Assessment Team stream buffers derived from the Northwest Forest Plan (USDA Forest Service, et al. 1994b), and are larger than stream buffer widths associated with the other alternatives. The remainder of the lands would be managed intensively for timber on a short rotation (40 to 50 years).

T&E core areas would be selected based on known northern spotted owl and marbled murrelet use. All fish-bearing streams would have a 160-foot riparian reserve along each side. All non-fish streams would have a 100-foot riparian reserve along each side. Some thinning could occur within these riparian reserves on a site-specific basis where it would benefit coho salmon and other aquatic species. The site-specific thinnings that may occur would be developed in collaboration with the Services and ODFW. SUVs would be primarily composed of steep areas deferred because of public safety issues.

Within the reserve areas, stands would eventually mature and grow into advanced forest structure. Stands would not gain structural diversity as fast as would occur with active management. Trees in these areas that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in conservation areas through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl and marbled murrelet habitat with minimal fragmentation.

10.3.2. Why Alternative was Not Selected

This alternative was not selected because the ODF considered it a less efficient way to meet the multiple resource demands of the Elliott State Forest. The landscape would not be managed under an integrated set of strategies that consider the long-term structural characteristics of the forest. The extensive reserve areas in this alternative would receive no management, and would take longer to develop suitable northern spotted owl and marbled murrelet habitat than if actively managed. Because of the extensive nature of the reserves, in large part as a result of the riparian areas, timber harvesting would be inefficient and operationally difficult.

10.4. COMBINED RESERVES AND INTENSIVE FORESTRY (ALTERNATIVE 4)

10.4.1. Description of Alternative

This alternative would rely on a combination of reserves and intensive timber management. Approximately half the land in the Elliott State Forest would be managed intensively for commercial timber production on short-rotations of 40 to 50 years or less. The remainder of the lands would be designated as reserves, including riparian management areas (RMAs). The location of reserve areas would be chosen based on information about current northern spotted owl and marbled murrelet use, but a long-term approach to designating these areas would be taken, with the goal of creating large blocks of connected reserve areas. The site-specific aquatic and riparian strategies in this alternative would be the same as those used in Alternative 2 – 160 foot RMAs on all streams with varying levels of tree retention depending upon stream type. The desired condition along fish-bearing streams would be mature forest habitat conditions and the desired condition along non-fish-bearing streams would be habitat conditions sufficient to support important stream functions and processes.

This alternative would contribute to the survival and recovery of northern spotted owls, marbled murrelets and coho salmon by protecting some existing habitat in a managed landscape, and providing RMAs and other lands classified as non-production. The arrangement of reserve areas on the landscape would be partially controlled by the location of northern spotted owl circles and known marbled murrelet nesting areas. RMAs in any location would also count as part of the reserves. The current distribution of stands in the Elliott State Forest is the result of past timber harvests, and is not necessarily a desirable or optimal arrangement for wildlife needs. Many occupied northern spotted owl and marbled murrelet sites would be protected in the reserve areas, but not all. There would be no additional surveys for northern spotted owl and marbled murrelet sites, and no new protection sites would be designated.

Under this alternative, one goal would be to arrange much of the reserve areas in large connected blocks to reduce the fragmentation that currently exists. However, this would mean that not all currently occupied northern spotted owl and marbled murrelet sites would be protected. In the long term, large blocks of older habitat would develop in reserve areas. Outside the reserves, short rotations of 40 to 50 years would be used so that most, if not all, existing northern spotted owl or marbled murrelet habitat would eventually be eliminated in these areas.

10.4.2. Why Alternative was Not Selected

This alternative was not selected because the ODF considered it a less efficient way to meet the multiple resource demands of the Elliott State Forest. The ODF believes this alternative may eliminate some known occupied northern spotted owl or marbled murrelet sites in the first decade, and have more intensive negative effects on watershed processes in the more

heavily harvested basins. The extensive reserve areas in this alternative would receive no management, and would take longer to develop suitable northern spotted owl and marbled murrelet habitat than if actively managed.

10.5. ALTERNATE BUFFER WIDTH EVALUATIONS (ALTERNATIVE 5)

10.5.1. Description of Alternative

In developing Alternative 3 (Section 10.3), the federal lead agencies and ODF reviewed a number of different applications of the Forest Ecosystem Management Assessment Team (USDA Forest Service, et. al. 1993) stream buffer widths for establishing riparian reserves. It was determined the increased stream buffer widths incorporated into Alternative 3 best met both the project purpose and need and the project applicant's stated objectives. The following summarizes the evaluations that were completed for alternatives incorporating alternative buffer widths into designated riparian reserve areas.

10.5.1.1. Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths

This alternative would use the landscape concepts and the conservation areas of the proposed HCP, but increase the stream buffers to match those used in the Northwest Forest Plan (USDA Forest Service, et al. 1994a). For fish-bearing streams, the width of a stream buffer area would typically be equivalent to the height of two-site potential trees, while the width of the stream buffer area for non-fish bearing and intermittent streams would be one-site potential tree. Largely because of these buffers, approximately three-quarters of the forest would be designated as conservation areas and would receive little or no active management. Regeneration and thinning harvests would be limited to the remainder of the forest.

Within the conservation areas, stands would eventually mature and grow into advanced forest structure. Stands would not gain structural diversity as fast as would occur with active management. Trees in these areas that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in conservation areas through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl and marbled murrelet habitat with minimal fragmentation.

10.5.2. Why Alternative was Not Selected

This alternative was not considered because it would not meet the constitutional and statutory obligations to produce revenue for the Common School Fund from CSFLs and to produce revenue for counties and local governments from BOFLs. Revenue production would be significantly below the potential of the forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent. This alternative would not achieve that goal. The large reserves would severely limit the number of acres available for timber harvest, and the placement of the reserves across the landscape would make it difficult and costly to perform management activities on those areas

that were not reserves. The ODF believes that the Aquatic and Riparian Strategies in Alternative 2 (Section 10.2) are a more efficient and effective way to achieve the habitat benefits and produce revenue from timber harvests.

10.6. WOOD EMPHASIS (ALTERNATIVE 6)

10.6.1. Description of Alternative

This alternative would be implemented to maximize timber harvest revenue in the Elliott State Forest consistent with the Oregon Forest Practices Act. Stands would be managed on short rotations, such as 40 to 50 years. This alternative would assume that federal lands would provide sufficient habitat for the survival and recovery of northern spotted owls and marbled murrelets. Surveys for northern spotted owls would continue, and occupied sites would be protected in accordance with the Forest Practices Act until they became vacant. Surveys for marbled murrelets would continue and occupied sites would be protected consistent with ODF policy unless they are shown to be vacant. Vacant northern spotted owl and marbled murrelet sites would become available for harvest. The only areas that would be certain to develop and remain as mature and advanced structure stands over the long-term would be RMAs and non-production areas, where timber harvest is not permitted because of scenic values, resource protection needs, public safety, or special uses. These areas might provide limited amounts of northern spotted owl and marbled murrelet habitat. RMA's would use buffers as prescribed in the administrative rules of the Forest Practices Act.

In the short term, state forestlands would provide habitat for northern spotted owls and marbled murrelets at occupied sites until those sites became vacant. In the long term, the lands would provide some nesting and dispersal habitat for northern spotted owls; northern spotted owls could use the state forest lands to move to federal lands where late successional reserves provide habitat. Northern spotted owl nesting sites would gradually decline over time. Marbled murrelets would be managed under the *Marbled Murrelet Operational Policy for State Forest Lands* (Oregon Department of Forestry 2004). Some marbled murrelet sites may be lost in the first few decades if they are shown to be vacant, but there would be a net gain of occupied sites until a finite amount of marbled murrelet-occupied sites are identified. In the long term, some of this pool of finite sites would be determined vacant and available for harvest.

10.6.2. Why Alternative was Not Selected

This alternative would contribute less to the survival and recovery of northern spotted owls and marbled murrelets than other alternatives. The USFWS likely would not authorize an ITP for this level of take, and implementation of the strategy would take on significantly higher legal risk to compliance with the ESA. This alternative would provide only minimal amounts of mature forest and advanced structure for other species of concern over the long term.

Additionally, this alternative was not selected because of the uncertainty that would be involved in planning forest operations, particularly the potential effects of newly discovered sites occupied by northern spotted owls and marbled murrelets. Because of the uncertainty involved with listed species sites, it is unknown whether this alternative would produce a

sustainable, even-flow harvest of timber, consistent with the Asset Management Plan of the DSL.

10.7. CONSERVATION EMPHASIS (ALTERNATIVE 7)

10.7.1. Description of Alternative

This alternative would require the ODF to manage the Elliott State Forest primarily as habitat reserves for northern spotted owls, marbled murrelets and coho salmon, and no harvesting of timber would occur. Stands would mature and grow into advanced forest structure. Trees that died from natural tree mortality, windstorms, insects and diseases, and forest fires would be left in the forest as snags and downed wood. Some openings, usually small, would occur in the forest through tree mortality. The Elliott State Forest would eventually provide large areas of northern spotted owl, marbled murrelet and coho salmon habitat with minimal fragmentation.

This alternative would not manage the thousands of acres of maturing, even-aged stands in the Elliott State Forest. These stands would undergo some thinning from natural tree mortality, but in denser stands, trees would increase diameter slowly. Stands would not gain structural diversity as fast as would occur with active management. Because there would be no harvested areas, this alternative likely would provide the most acreage of northern spotted owl and marbled murrelet habitat over time. However, because fire protection would suppress the natural creation of larger openings in the forests, this alternative would not provide the mix of habitats needed by many species, a mix that includes younger stands with grasses, forbs, and shrubs.

10.7.2. Why Alternative was Not Selected

This alternative was not considered because it would prevent the ODF from meeting its trust obligations for the Elliott State Forest and would not meet the fiduciary responsibility of the State Land Board to maximize revenue to the Common School Fund. The revenue goal for Common School Forest Land is to produce a return on asset value of three to five percent.. Not only would this alternative fail to produce an economic return from the forest, but it would result in net operating costs associated with implementation. Additionally, it would not provide quality diverse habitats for Oregon's fish and wildlife native species.

Chapter 11
Plan Implementation

11.1. IMPLEMENTING AGREEMENT

Implementation of this Habitat Conservation Plan (HCP) will be governed by an agreement between the State of Oregon and the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), collectively referred to as "the Services". The HCP will be funded by the Oregon Department of Forestry (ODF) as a part of ongoing operations. The Implementing Agreement is supplementary to the HCP; together, they fulfill the requirements outlined in the Endangered Species Act (ESA) for issuance of an Incidental Take Permit (ITP). The Implementing Agreement defines the roles and responsibilities of the parties and processes for addressing other issues, some of which are discussed below. The Implementing Agreement is included as Appendix K.

11.1.1. Plan Duration

The *Elliott State Forest Habitat Conservation Plan* will be in effect until it is replaced by a new HCP, or until it is terminated in accordance with the provisions of the Implementing Agreement. It is intended that this HCP be flexible enough to endure significant changes in legal requirements and knowledge base. It is expected that this HCP will be in effect for 50 years, the length of the ITP.

11.1.2. Unforeseen Circumstances

Under the ESA, an HCP is intended to provide property owners with economic and regulatory certainty. This certainty is realized through the establishment of management strategies that minimize and mitigate the likelihood of harm or harassment to listed and unlisted species. In exchange, the ODF will have the opportunity to practice responsible, adaptive, active forest management throughout the time frame of the HCP.

Under the ESA, the Services would not unilaterally impose additional mitigation for a species on a permittee in compliance with the terms and conditions of the Implementing Agreement, ITP, and HCP because of events outside the control of a permittee, referred to as "unforeseen circumstances." Unforeseen circumstances are changes in circumstances that were not or could not reasonably have been anticipated by the permittee and the Services at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of a covered species.

The Services refers to this as the "no surprises" rule (50 Code of Federal Regulations [CFR] Part 17 and Part 22). If unforeseen circumstances were to arise, the Services would seek to negotiate with the ODF on modifications that would, "to the maximum extent practicable, be consistent with the original terms of the HCP." Changes to HCP conservation strategies as a result of unforeseen circumstances would occur only as provided for in the HCP Implementing Agreement. Further mitigation requirements shall not involve additional financial, land, or water commitments, or additional restrictions on the use of land, water, or other natural resources on state forest lands without express, written consent from the ODF.

Any determination by the Services that unforeseen circumstances exist must be clearly documented in writing, and must be based on reliable, current, peer-reviewed technical information regarding the status and habitat requirements of the affected species. The Implementing Agreement further discusses the process for addressing unforeseen circumstances in Section 4.0 of the agreement.

11.1.3. Changed Circumstances

"Changed circumstances" are changes affecting the covered lands or covered species during the term of the HCP that can reasonably be anticipated by the state, and that can be reasonably planned for. Changed circumstances include events that significantly alter or impair the ability of the covered lands to provide the intended conservation benefits, and changes in the status of the covered species that alter the Services' ability to allow the authorized incidental take. While changed circumstances are not certain to occur during the term of the HCP, they have a reasonable potential to occur based on historic occurrences (e.g., wildfire) or credible scientific models. Changed circumstances are not unforeseen circumstances.

The ODF and the Services foresee that certain circumstances could change during the term of the HCP that would warrant adjustments to the conservation measures. Such "changed circumstances" are described in subsection 11.1.3.2, along with the responses that would be made by the ODF and the Services. This treatment of changed circumstances is based on and consistent with 50 CFR 17.22 (b) 5 &17.32 (b) 5.

The Elliott State Forest ITPs will authorize the incidental take of covered species under ordinary circumstances, for adaptive management described in the Implementing Agreement and for the responses to changed circumstances described in the Implementing Agreement (Section 9). (Changes affecting the covered species and/or implementation of the conservation measures beyond those described as changed circumstances would be considered unforeseen circumstances.)

11.1.3.1. Implications to ITP Coverage and HCP Implementation

The Elliott Forest ITPs will authorize the incidental take of covered species under ordinary circumstances and changed circumstances. Changes affecting the covered species and/or implementation of the conservation measures beyond those described as changed circumstances would be considered unforeseen circumstances. If additional mitigation measures or costs beyond those provided in the HCP are deemed necessary to respond to an unforeseen circumstance, the Services will not require additional measures or expenditures without the ODF's prior consent, unless the Services reach a conclusion that a species is at risk of extinction.

11.1.3.2. Treatment of Changed Circumstances

For purposes of the Elliott State Forest HCP, changed circumstances are distinguished from causal factors. Changed circumstances are physical or biological changes in the habitat of the

covered lands or status of the covered species that warrant modification of the conservation measures. Causal factors are the mechanisms or incidents that bring about the changed circumstances. An individual changed circumstance can be the result of a number of different causal factors. For example, significant loss of forest cover on the Elliott State Forest (changed circumstance) could occur from an outbreak of forest insects, drought, wildfire, wind, or a combination of two or more causal factors. This distinction is made because causal factors are largely irrelevant to the discussion of HCP responses to changed circumstances, and preoccupation with causal factors can interfere with the development of effective responses and recognition of actual changes.

11.1.3.3. Changes to the Covered Lands

Temporary Loss of Forest Cover

A temporary loss of forest cover is defined as any temporary reduction in stand density below 22 percent of the maximum stand density index (SDI) that occurs other than through intentional forest management. For the purposes of this HCP, stand density will be determined for stands greater than 20 acres in size as identified in the Elliott State Forest Stand Level Inventory (SLI). Temporary loss of forest cover can result from a number of causes, including wildfire, wind, forest pests, and pathogens.

SDI describes the density of the stand at a reference size, 10-inch-diameter, and is usually expressed as a percentage of the maximum number of trees the site will support. Twenty-two percent was selected because any stand below this stocking would not meet the standards for advanced structure, and would likely take more than 20 years to naturally increase to full stocking.

Such a temporary loss of forest cover could occur over a relatively large contiguous area or in relatively small patches within the forest. A temporary loss of forest cover will be considered a changed circumstance if the loss occurs:

- In a single stand or a number of stands comprising a contiguous area of more than 240 acres within a management basin within a ten-year period, or
- In more than one stand over more than 420 cumulative but non-contiguous acres, within a management basin, within a ten-year period.

Response: When a temporary loss of forest cover results in a changed circumstance:

- The harvest of merchantable dead and dying trees (subject to compliance with relevant provisions of the HCP) will occur, and necessary steps will be taken to re-establish the forest in the affected management basin(s) within a reasonable period of time.
- An update of all forest structure forecasts for the affected management basin(s) will be conducted, and a determination will be made as to whether the HCP forest structure targets can be met without a reduction in anticipated timber harvest volume (including volume from the harvest of the dead and dying trees).
    - If forest structure targets and timber volume objectives (40MMBF annual average over ten years) established by the State Land Board upon adoption of the HCP

and signing of the ITP can still be met for each subsequent ten-year period for the entire duration of the ITP, no changes will be made to the other provisions of the HCP.

- If forest structure targets can be met only through reductions in the timber harvest volume within the affected management basin(s), the state will make the necessary reductions and supplement the lost timber volume through increased harvesting in unaffected management basins, provided the increased harvesting will not result in an overall reduction in advanced structure below the basin target for advanced structure for an individual management basin, or take the forest outside of the forestwide structure ranges for advanced or early structure, in any decade subsequent to the temporary loss of forest cover.
- If a temporary loss of forest cover is of such magnitude that the timber harvest volume objectives (40MMBF annual average over ten years) established by the State Land Board cannot be met for each subsequent ten-year period for the entire duration of the ITP, without a reduction in advanced structure below the basin target for advanced structure for an individual management basin, or take the forest outside of the forestwide structure ranges for advanced or early structure, in any decade subsequent to the initial loss of forest cover, good faith discussions will be entered into for the purpose of adjusting the forest structure objectives of the HCP to be consistent with new forest conditions and the timber harvest objectives. During those discussions, the ITP will remain in effect.

Long-term Change in Forest Cover

A long-term change in forest cover is defined as any change in growing conditions on the Elliott State Forest that is sufficient in magnitude and duration to reduce the average Douglas-fir 50-year site index (King 1966) by more than 20 feet, or alter the overstory species composition of the climax community in favor of non-coniferous species. Such a change will be considered a changed circumstance for purposes of this Agreement. The causes of a long-term change in forest cover could include but are not limited to climate change, global warming, or introduction of forest pathogens that permanently alter the climax vegetation. The changes referred to in this section are broad changes that affect the character of the forest. They are not intended to apply to changes that may occur on small areas within the forest.

Response: In the event of a long-term change in forest cover, good faith discussions will be entered into for the purpose of adjusting the forest structure objectives of the Elliott Forest consistent with new growing conditions. While in those discussions, the ITP will remain in effect.

11.1.3.4. Changes to the Covered Species or Listing Status

Population Declines – Not Directly Related to Forest Management Activities

If predators, disease, competing species, or other agents not related to forest management activities cause or result in a decline in the regional population of a covered species that is likely to jeopardize its continued existence, such a circumstance will be considered a changed circumstance for purposes of this Agreement.

Response: Good faith discussions will be entered into for the purpose of determining whether actions can be taken on the Elliott State Forest to prevent further decline of, or to enhance the likelihood for increasing, the regional population. Such discussions might consider but are not limited to: adjusting threatened and endangered core (T&E core) area boundaries; changing core area locations; altering implementation plans; and modifying upland or riparian management approaches. The standards in the HCP will prevail until any changes are agreed upon. Any such changes will not require the commitment of land, water, or other natural resources beyond the level otherwise agreed to in the HCP, without ODF's consent.

New Listing of Covered Species

The HCP covers listed and unlisted species (i.e., species currently not listed as threatened or endangered under the federal ESA). The implementation of all conservation measures for listed and unlisted covered species, as well as the coverage for incidental take of listed species, will begin immediately upon issuance of the ITP by the Services.

Response: For species under the jurisdiction of the USFWS and NMFS, coverage for incidental take of an unlisted covered species for which conservation measures have been implemented will take effect immediately upon the listing of that species under the federal ESA.

De-listing of Covered species and Maintaining Coverage for De-listed Species

If a covered species is de-listed, coverage for the species may either be maintained or removed. If coverage for the species is maintained, the Services and the state will review the mitigation measures being implemented for that species to determine if they are still necessary to maintain coverage for the species. If it is mutually agreed that continued mitigation is necessary to maintain coverage for the species, mitigation will continue as specified in the HCP. If cessation or modification of the mitigation for that species would allow continued coverage, the HCP will be revised to eliminate or otherwise modify the mitigation measures in question. However, if elimination or modification of mitigation measures initially implemented for the de-listed species would materially reduce the mitigation for another covered species, the mitigation measures will not be eliminated.

De-listing of Covered Species and Removing Coverage

If a covered species is de-listed and coverage for this species is not to be continued, the HCP will be revised to eliminate or otherwise modify the mitigation measures being implemented for that species. However, if elimination or modification of mitigation measures initially implemented for the de-listed species would materially reduce the mitigation for another covered species, the mitigation measures will not be eliminated.

Extinction of Covered Species

In the event that a species covered by the HCP becomes extinct, the mitigation measures being implemented for that species will be reviewed to determine if they are still necessary to meet the requirements of the ESA for the remaining covered species. If it is mutually agreed that elimination or modification of mitigation measures initially implemented for the extinct species would not materially reduce the mitigation for another covered species, the mitigation measures will be eliminated or modified.

New Listings of Species Not Covered by the ITP

If a non-covered species that is present or potentially present on covered lands becomes listed, the Services will determine whether there is a potential for incidental take of the species while covered activities are being conducted. If the potential for take is determined, the ODF may choose to avoid incidental take of the species or to pursue incidental take coverage for the newly-listed species by amending the HCP and the ITP or by submitting a new ITP application for the species to the Services. For either approach, the Services will work with the ODF to identify the measures necessary to avoid take of, jeopardy to, or adverse modification of the critical habitat of the species as a result of covered activities.

If incidental take coverage for the species will be pursued by amending the HCP and the ITP or by preparing a separate HCP, discussions to develop necessary and appropriate mitigation measures to meet ESA Section 10(a) requirements for incidental take coverage will be entered into for the purposes of developing mutually acceptable mitigation measures and securing incidental take coverage prior to final listing of the species. In determining adequate mitigation for the species, the Services will fully consider conservation benefits to the species that have accrued from the time the existing ITP was signed and the HCP was first implemented, although it is recognized that additional mitigation measures may be necessary to satisfy the requirements of the ESA. The mutually-acceptable mitigation measures will be implemented until the permit is amended to include such species, the application is rescinded, or the Services give notification that the measures are no longer needed to avoid jeopardy to, take of, or adverse modification of the critical habitat of the newly-listed species.

If avoidance of take of a newly listed species interferes with full implementation of all the provisions of the HCP, the ODF will consult with the Services to determine how the HCP should be implemented until incidental take coverage is secured for the new species. During such time, the state will be considered in compliance with the HCP and the take prohibitions of the ESA as long as the HCP is implemented to the extent practicable consistent with the consultation or take avoidance of the newly listed species.

11.1.4. Amendments and Flexibility

State forest management is carried out under an approved Forest Management Plan (FMP) developed in accordance with the Oregon Constitution, and the State of Oregon statutes and the accompanying administrative rules. The FMP provides for the maximization of revenue to the Common School Fund (CSF) over the long term, consistent with sound techniques of land management. The ODF anticipates that adjustments to the FMP may be required as social, environmental, and economic factors and information affect forest policy and management. As well, the ODF will continually improve its knowledge through experience and experimentation during the performance of its management responsibilities, and through research and monitoring activities. The level of change to ODF management approaches will determine whether a modification or amendment would be appropriate. Modifications and amendments to the ITP are addressed in the Implementing Agreement, which outlines the process to be used.

11.1.5. Funding

The FMP is financially self-supporting from revenues generated by its management activities (no general fund dollars), including the sales of timber and special forest products; user fees; and gas, oil, and mineral leases. Funding is ensured and adequate to fulfill the obligations set forth by the HCP, ITP, and Implementing Agreement, provided that the ODF's obligation to fund implementation of the HCP is subject to the restrictions of Article XI, Section 7 of the Oregon Constitution. Once the Services and the State of Oregon sign the Implementing Agreement, the HCP becomes a legally required activity (see Section 11.2.2).

11.1.6. Land Transactions

Consistent with and in order to implement the Oregon Constitution and Oregon Revised Statutes, the ODF has a program of land acquisition and disposition, including but not limited to transfers, sales, exchanges, and purchases. Nothing in the HCP, ITP, or Implementing Agreement limits the state's right to acquire additional lands.

Land acquired by the state that is contiguous with the Elliott State Forest may be incorporated into the HCP and ITP as minor amendments in accordance with Sections 11 and 12 of the Implementing Agreement. A major amendment may be necessary should acreages exceed that amount.

Up to 640 acres of covered lands in state ownership may be disposed of or traded as minor amendments in accordance with Sections 11 and 12 of the Implementing Agreement. During the initial implementation period, lands to be disposed of will not include T&E core areas. Section 12 of the Implementing Agreement describes the processes required should the state choose to dispose of additional acreages of covered lands.

Sections 11 and 12 of the Implementing Agreement provide further discussion of the processes related to land transactions.

11.1.7. Transition Activities

Timber sale preparation by the ODF requires approximately 24 months between planning of the sale and its eventual auction. In addition, another two years or more could be required to complete harvest activities. Considering this planning and harvest process, the transition from sales planned under the 1995 HCP and the revised HCP will be handled as follows: Timber sales that have been identified, planned, or prepared under the 1995 HCP and ODF take avoidance policies for the marbled murrelet will continue through completion and harvest. These sales will be conducted and accounted for under the 1995 HCP. Sale planning and preparation under the revised HCP may begin upon HCP approval and issuance of the ITP. These sales will be conducted and accounted for under the revised HCP.

11.1.8. Reporting

The ODF will submit periodic reports to the Services describing actions taken to implement the HCP. Biennially, the ODF will provide an accounting of forest structure and mapped marbled murrelet habitat substantially in the form described in Appendix J and an accounting of the harvest and in-growth for advanced structure and mapped marbled murrelet habitat. Periodically (approximately four years), the ODF will also report on further actions related to the covered activities that have occurred to implement the HCP. These periodic reports would discuss such items as structure development, road-related and restoration activities, stream classification updates, and results of the monitoring program provided for in the HCP. At eight-year intervals, these reports will be presented in a combined format, and be used by the ODF, Services to determine the status of State's compliance with the terms of the HCP and establish a mitigation balance.

11.2. ODF IMPLEMENTATION

11.2.1. Roles and Responsibilities

The State Land Board and the Board of Forestry (BOF) are responsible for reviewing and approving the HCP and any needed changes in strategies. The State Land Board and the BOF are also responsible for entering into an Implementing Agreement with the USFWS, and making amendments if needed. The State Forester delegates to the Southern Oregon Area Director the overall responsibility for implementing the HCP. Implementation of the HCP consists of complying with the terms and conditions of the HCP and Implementing Agreement, determining when changes in strategies are needed, and proposing HCP amendments as needed.

The Coos District Forester is responsible for implementing all aspects of the HCP within the district. Key tasks include implementing the management strategies, district monitoring projects, and public involvement processes. The Assistant District Forester is responsible for coordination within the district. Key tasks include coordinating the development of Implementation Plans (IPs) and Annual Operations Plans (AOPs), monitoring priorities and projects, conducting periodic operational reviews, and managing information exchange.

The geotechnical specialist, wildlife biologists, and silviculturalist are responsible for providing technical assistance to district personnel as they develop IPs, AOPs, and monitoring plans. These specialists are also responsible for providing technical assistance for field reviews and landscape-level and site-specific recommendations for particular management activities. Specialists may also have specific responsibilities in monitoring and research projects.

Salem Forest Management Program staff, including administrators and technical specialists, is responsible for providing guidance and direction on statewide program issues.

The Research and Monitoring Coordinator will coordinate HCP monitoring under the State Forests Monitoring Program on all ODF-managed lands.

11.2.2. Implementation Levels

Many of the habitat conservation strategies require investments of capital. Examples include reforestation, precommercial thinning, habitat enhancement activities, and some monitoring activities. Priorities for resource investments are generally as follows:

- Activities necessary to maximize revenue to the CSF over the long term, consistent with sound techniques of land management
- Legally or contractually required activities
- Full implementation of all strategies and monitoring plans

IPs and AOPs identify the planned activities that will be pursued within given time periods based on the anticipated funding levels.

11.2.2.1. Habitat Conservation Plan and Forest Management Plan

Planning for the HCP, as well as ODF FMPs, is typically at broad spatial and long temporal scales, and identifies general goals and strategies. Information, decisions, and management incorporated into the HCP and the FMPs encompass landscape scales, policy concepts, and social, cultural, and environmental influences that may extend even beyond the ownership boundaries of state forest lands. On the temporal scale, the HCP as well as the FMPs provide a forecast of greater than ten years (generally 30 to 100 years or more).

These plans are reviewed periodically, a minimum of at least every ten years. Because of the nature of the information requirements in these plans, development of adequate monitoring information to indicate the need for change often requires more than ten years. Research efforts that are initiated at the beginning of the planning period may take even longer to produce results; however, ongoing research could produce information that would demand reconsideration of the strategies in these plans at any time.

11.2.2.2. Implementation Plans

The FMP requires the development of an IP that describes the management approaches and activities the district will pursue in carrying out the goals, objectives, and strategies within the FMP. An IP is intended to describe the activities, projects, and efforts for a ten-year period—beginning July 1, 2009 and extending through June 30, 2019. These IP activities reflect the harvest level set for CSFL's by the State Land Board, and those established for BOFL's by the State Forester. The FMP requires that the State Forester approve, modify, or deny the recommended IP. An IP undergoes a public comment period.

The IP is one step in a much larger planning process for state forestlands. The scale of the planning ranges from very broad policy documents such as the BOF's Forestry Program for Oregon (FPFO), to strategic plans such as the FMP and the HCP, to very specific plans such as an AOP. An IP provides a link between broad (strategic policy and the plans) and specific (AOPs). The other policies and planning activities are listed below, in order from the broadest policies and plans to those progressively more focused in strategies, location, and timeframe:

- The Constitutional Mandate for Common School Forest Lands describes the long-term purpose and goal for management of those lands.
- The FPFO is a long-term policy document that addresses all forestry issues in Oregon.
- The Greatest Permanent Value Rule describes the long-term purpose and goal for management of Board of Forestry Lands.
- The FMP and the proposed HCP are long-term strategic plans that are applied to the district IP.
- The Oregon Plan for Salmon and Watersheds is a long-term cooperative effort involving state and federal agencies, private landowners, and volunteers. This plan applies to the entire state, but focuses on managing resources by specific watershed basins, with the objective of restoring salmon populations and watershed health.

- An IP is a ten-year plan describing the activities, projects, and efforts that will be carried out to achieve the FMP goals, objectives, and strategies.
- The AOPs describe state forest management activities that will occur in a given fiscal year.
- The forest land management classification system, though not technically a plan, is developed in close association with the IP.
- Budgets occur in two forms, biennial and fiscal year. They provide the financial framework for accomplishing described tasks in the various plans. They include the costs for personnel, equipment, offices, contracts, and the other financial resources needed to manage the state forests.
- Plans for specific resources or activities also exist or are under development—e.g., the SLI.

11.2.2.3. Annual Operations Plans

The AOPs must achieve the goals set forth in the FMPs and be prepared within the constraints of the fiscal budget guidance. AOPs are developed by the district and describe the actual projects that will be pursued to achieve FMP and HCP goals and strategies during a fiscal year. These plans are consistent with the longer-term IP. Resource specialists from both the ODF and the Oregon Department of Fish and Wildlife (ODFW) have the opportunity to review and provide input on AOPs. Proposed AOPs are available for public review at district headquarters for 45 days prior to being approved or denied by the District Forester. The District Forester must consider any written comments from resource specialists and the public before approving or denying an AOP. Once approved, the AOP may be implemented.

11.3. ADAPTIVE MANAGEMENT

A significant body of scientific information and expertise was used to develop this HCP. However, the long-term effects of HCP implementation on the habitat needs of the covered species cannot be answered with total certainty at this time. Long-term, landscape-scale forest management is challenged by the dynamic, natural system within which it is conducted (the forest) and the limited scientific knowledge and modeling capabilities available to inform decision-making. These uncertainties can be addressed through the ongoing application of adaptive management.

Adaptive management is the process by which management practices are incrementally improved through the implementation of plans that provide opportunities to learn from experience, both successes and failures (Holling 1978; Walters 1986, Walters and Holling 1990). It is a formalized approach that integrates research, monitoring, and management designed to test and improve the effectiveness of management prescriptions. Adaptive management is based on clear "experimental" hypotheses developed from real policy options informed by previous experience and understanding. In recognition of the uncertainties inherent in the proposed management strategies, the HCP will be implemented using an adaptive management approach; thereby allowing the ODF to evaluate and modify strategies to ensure the continued achievement of the HCP's conservation objectives.

A detailed discussion of the adaptive management process can be found in Chapter 6 of the FMP. The following subsections discuss adaptive management and the role of research and monitoring under this HCP, and also identify where adaptive management may be applied. Adaptive management is linked to the ongoing State Forest Program research and monitoring activities that will provide the data and information needed to identify if, or when, adjustments to the conservation strategies may be required.

11.3.1. Effecting Change through Adaptive Management

Timely changes in strategies, approaches, and prescriptions in accordance with new knowledge provide the cornerstone for a successful HCP. As new information from monitoring, research, field trials, or day-to-day management becomes available, the information must be evaluated in the context of the HCP's guiding principles, goals, and strategies, as well as the relevant FMPs. The information must be evaluated in terms of its scientific, biological, or technical implications to the affected resources, and upon the operational feasibility and implications of implementing the change.

Final decisions on implementing change may be made by various people or institutional bodies, depending on the implications of the change. Where change significantly alters the fundamental strategies that determine the management of the forest, the State Land Board and State Forester will weigh the scientific and operational information in a formal public process and in consultation with appropriate other federal or state agencies. Where change does not significantly alter the fundamental strategies, such as in a practice or silvicultural technique, field personnel may institute changes without a formal approval process.

Adaptive management decisions will occur at four planning levels within the ODF:

- FMP or HCP
- IP
- AOPs
- Management activities

The range of decisions that will be made, how they will be made, and who will make them are described in more detail in Table 11-1. At all four planning levels, various sources of information can trigger change: public input, monitoring information, research information, and operational input. When ODF managers and staff receive new information, they recommend changes to the appropriate decision-making official, as shown below, and the appropriate official makes the final decision.

Planning Level		Who Decides
Forest Management Plan and Habitat Conservation Plan	→	State Land Board/BOF, in consultation with appropriate other agencies (e.g., USFWS, NMFS, ODFW)
Implementation Plans	→	Director of Department of State Lands, State Forester
Annual Operations Plans	→	District Forester
Management Activities	→	Management Unit Forester

The State Land Board, BOF, Director of the Department of State Lands, and State Forester will weigh the scientific, operational, and public information in a formal process to determine changes to the HCP. The ODF will collaborate with the Services and other state agencies as necessary to obtain the best available information to evaluate the necessity for modifications to the HCP.

11.3.2. Evaluation of Technical Information

In accordance with the *State Forests Monitoring Program Strategic Plan* (Oregon Department of Forestry, 2002a), a team with the necessary technical and operational expertise will be assembled as needed to evaluate the body of information from research, monitoring, operational input, and other appropriate current sources. This group will also make recommendations for change based on its review of the information. Proposed changes may involve minor adjustments in management practices or may require significant changes at policy and planning levels, depending on the purpose and implications of the gathered information. This team also may provide guidance in identifying specific research and monitoring projects critical to evaluating the success of the HCP's conservation objectives.

Table 11-1
Effecting Change

Forest Management Plan & Habitat Conservation Plan (Long Term—10 Years or More)	Implementation Plans (Periodic—Maximum 10-Year Interval)	Annual Operations Plans (Annual)	Management Activities (As Appropriate)
EXAMPLES OF WHAT MIGHT CHANGE			
Forest Management Plan Stand type percents Arrangement **Habitat Conservation Plan** Northern spotted owl strategies Marbled murrelet strategies	Landscape design Silvicultural approaches, i.e., sequence of treatments, etc. Management opportunities & objectives	Approaches to meeting objectives, e.g., silvicultural prescriptions Monitoring projects	Techniques for culvert installation, snag creation, etc.
EXAMPLES OF MONITORING			
Framework	**Identify and Implement Projects**		
Implementation	What is the condition of State Forests based on stand type percentages and habitat availability?		
Are we doing what we said we would?	Is active management promoting habitat development by moving stands toward advanced structure?		
Effectiveness	Are the silvicultural practices used to achieve forest structures sufficient to maintain a full array of forest products?		
Are the management practices producing the desired results?	Is sustainable forest ecosystem management helping to improve forest health on State Forests?		
Validation	Protocol development and implementation		
Are the planning assumptions valid, or are there better ways to meet goals and objectives?	Data gathering and analysis Evaluation Communication		

Table 11-1 (continued)

Forest Management Plan & Habitat Conservation Plan (Long Term—10 Years or More)	Implementation Plans (Periodic—Maximum 10-Year Interval)	Annual Operations Plans (Annual)	Management Activities (As Appropriate)
EXAMPLES OF PUBLIC INVOLVEMENT			
Formal Board of Forestry Meetings Oregon Administrative Rules Process Public Meetings Federal Processes for HCP Technical Specialist or Citizen Input Committees **Informal** Voluntary Participation in Monitoring Program Regular Reporting Processes, including Monitoring Reports Public Submittal of Information	**Formal** Public review and comment processes Public meetings Technical specialist or citizen input committees **Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information	**Formal** Review and comment period **Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information	**Informal** Voluntary participation in monitoring program Regular reporting processes, including monitoring reports Public submittal of information

The goal for evaluation and analysis of technical information is to offer explanation of the data, their weaknesses and strengths, identification of triggers and thresholds that apply to the data set and resource, conclusions, and the management recommendations that emerge from those conclusions. Analysts will be responsible for identifying triggers and thresholds for effecting change related to the specific monitoring or research question, resource, or species, if these have not already been identified during the project development phase or the information gathering phase.

Triggers and thresholds are critical to helping resource managers determine if information indicates a need for change. In a complex ecosystem, triggers or thresholds are rarely achieved with unequivocal certainty. More often, some degree of a threshold is reached, and the analysis will be required to determine if the information indicates a sufficient risk to the system, given normal variability and error in data collection. To add to the complexity, biological triggers may differ from social or political triggers and thresholds.

In some instances, determining if a trigger or threshold has been reached or exceeded will be relatively easy. In these cases, the direction and/or need for change is more clearly identified. However, when monitoring and research information is considerably confounded by the natural variability of the system due either to insufficient replication or natural conditions, triggers and thresholds can be difficult to determine. Recommendations for change become less clear and risk assessment becomes a significant component of the adaptive process.

Risk evaluation is a critical concept linking monitoring and research information to effective and efficient adaptive management decisions. In instances where the system or population is particularly sensitive or the degree of risk is determined to be high, thresholds will be lower and triggers are set to be more sensitive to indicate the need for change. Where risk to the resource is not as great, the threshold may be higher and the triggers may be set to be more demanding to indicate the need for change. More data may be needed to justify a change.

Thresholds and triggers for change may be developed at any of various points:

- Prior to initiating management activities
- During development of the monitoring question(s) and/or project
- After monitoring has provided more information

In addition, reevaluation may be required at points in all of the above processes.

Even during technical analysis, situations may arise where people will not agree on the interpretation of the data, particularly when making management recommendations. A process for issue resolution will be developed, to help the team clearly articulate their concerns and differences and arrive at (as close as possible to) a consensus before offering their conclusions and recommendations. If technical issues cannot be resolved, the only option may be to include a set of technical information and recommendations, with accompanying identification of resource risks and the range of differing opinions that were expressed by the team.

11.3.3. Research and Monitoring

In adaptive management, research blends with monitoring to provide the data and information needed to evaluate and adjust management activities. Both rely on testable hypotheses implemented through experiments that address a range of variables. Scientists lead research, maintaining tight control of a study design that intensively measures several variables on a relatively small area or part of the system. Research on parts of a system can improve predictions about how the system might respond to management intervention. However, such response predictions can ultimately only be tested in an operational setting, leading to the design of monitoring projects to test research findings. Through monitoring, these management experiments measure a small set of carefully selected key variables to understand the effect of management on a system as a whole. Information gained through both research and monitoring is fed back into the adaptive management process to inform future decisions and effect changes in management.

The following subsections discuss the research and monitoring program, and its funding sources and reporting activities. As well, the subsections present some of the research areas and monitoring assumptions that will be used to frame the specific projects and associated questions to be developed under this HCP. Finally, some possible monitoring activities that will be considered for testing the identified assumptions regarding the HCP strategies are presented, as well as those activities that will be conducted.

11.3.3.1. Research and Monitoring Program

The State Forests Research and Monitoring Program will manage the research and monitoring projects associated with the HCP consistent with existing policy.

The current State Forests Research Policy, adopted by the State Forester in 1995, is "to acquire knowledge in a timely and cost-effective manner concerning questions of significant importance to achieving the Program's mission, and ensure that knowledge is effectively and efficiently transferred and applied." There is considerable overlap between the HCP research priorities and those envisioned for the FMP. However, it is important to note that the goals and strategies of the FMP set the context for much broader research objectives and different overall research priorities than those that are part of this HCP.

In keeping with the State Forests Program's research policy guidelines, it is not the intent of the ODF to develop an extensive research infrastructure to accomplish the needed investigations. Instead, the ODF, through the State Forests Program, will sponsor research, working with qualified research institutions through cooperative agreements and contracts. In some situations that require close coordination with State Forests Program field operations, ODF scientists and resource specialists may provide in-kind or cooperative participation in the research. Therefore, an important part of the State Forests Program research activities will be to stay in touch with other relevant research programs, and both exchange and assimilate information that can be used to meet information needs.

The ODF recognizes the substantial financial commitment required for research and monitoring. Policy states that approximately five percent of the State Forests Program's annual budget can be invested in research, monitoring, and technology transfer related to

program-wide commitments. The proposed biennial and annual budgets are based on projected revenues to the program fund, or the state's share of receipts generated from the sale of forest products and certain other fees collected. The State Forests Program receives no general fund support from the State Legislature.

As a result of the "dedicated" funding structure, biennial and annual expenditures are somewhat variable in response to shifting revenue levels that are largely beyond the agency's control. Because annual budget revenue estimates are generally more accurate, the funding and prioritization described in this subsection will be applied through the fiscal budget process, and in keeping with the State Forests Program's policy. The approximate intervals included in some of the possible HCP monitoring activities will provide the ODF flexibility in determining the most cost-effective, affordable schedule for conducting the monitoring activities.

11.3.3.2. Research and Monitoring Procedures and Reports

Research and Monitoring Procedures

To implement each aspect of HCP research and monitoring, projects will be developed and detailed questions and procedures will be prepared. Project questions and procedures that may be developed will build off the research areas and monitoring assumptions and the monitoring activities identified. The monitoring procedures to be used will align as much as possible with guidance established by the USFWS in its *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (USDI Fish and Wildlife Service and National Marine Fisheries Service 1996). The ODF Research and Monitoring Coordinator will work with a team of scientists, biologists, and field staff from ODF and other agencies to prepare the research and monitoring projects and the associated questions and procedures.

Monitoring Reports

Timely reporting of research and monitoring information will be of the utmost importance. Under the State Forests Monitoring Program, analyzed information, with recommendations for management action, will be presented in an annual report prepared in coordination with other reporting requirements (e.g., reports to the State Land Board) so that a single report can satisfy more than one requirement.

This report will form the basis for determining the possible need to adapt management policies, biological or habitat goals, or monitoring activities. This report will be available to the State Land Board, the public, and other state and federal agencies. Special project reports that stand alone as individual studies or technical papers may also be available, and monitoring program updates and project descriptions will be available on the ODF web site.

11.3.3.3. Management Activities in Progress

Management activities in progress or underway when the HCP is adopted that are exempt from compliance with the conservation strategies (see Section 11.1. and Section 8 of the

Implementing Agreement) will not be reported as part of implementation monitoring for the purposes of this HCP. Otherwise, such activities will not be monitored.

11.3.3.4. Research Priorities

Under this HCP, the ODF has identified three research priorities:

1. Research that is a necessary part of a conservation strategy
2. Research needed to:
    a. assess or improve conservation strategies that are in place, or
    b. increase management options and commodity production opportunities for lands managed pursuant to the HCP, including testing of new technologies and experimental application of silvicultural techniques
3. Research needed to improve general understanding of the wildlife, habitats, and ecosystems addressed by the HCP

The research areas that have been identified as supportive of the HCP will be considered and prioritized accordingly, and are presented below.

11.3.3.5. Priority Research Topics

Conservation Strategies

- Research that allows the ODF's State Forest Program to increase its ability to accelerate development of functional habitat in conjunction with active management (commercial silvicultural activities and timber harvest), and compares this active management to areas on the landscape managed through a more passive approach—*research priority 1*
- Research to determine how to design, create, and manage landscape-level habitat patterns for the benefit of the species covered by the HCP using various forest ages and structures in a geographic area, and to best move these patterns across the landscape to allow maximum timber harvest flexibility—*research priority 1*
- Research to evaluate riparian area management and instream large wood levels—*research priority 1*
- Research to identify large wood sources in streams and to assess the level to which large wood enters aquatic systems from upslope sources—*research priority 2*
- Research to determine the best management approach to ensure properly functioning landslide processes and minimize the incidence of management-induced landslides—*research priority 2*
- Research to determine background levels of sediment from natural sources in forest streams that will provide a benchmark for evaluating the effects of human activities on sediment contribution—*research priority 2*

Species-Specific Strategies

- Research to determine the effectiveness of managed stands to provide productive habitats for covered species—*research priority 1*
- Research to determine the effects of forest management activities on prey of covered species—*research priority 2*
- Research to improve general understanding of the biology and ecology of species covered by this HCP—*research priority 3*
- Research to determine how to manage and harvest timber at or near breeding sites to minimize effects on covered species—*research priority 1*

11.3.3.6. Monitoring Objectives

The ESA, under Section 10 regulations, requires that an HCP specify measures that will be taken to monitor the impacts of take resulting from project actions (50 CFR 17.22(b)(1)(iii)(B) and 50 CFR 222.22(b)(5)(iii)). Monitoring for the HCP will focus primarily on the following three monitoring objectives:

- Determine whether the conservation strategies are implemented as written.
- Determine whether anticipated habitat conditions have resulted from implementation of the conservation strategies.
- Evaluate cause-and-effect relationships between habitat conditions resulting from implementation of the conservation strategies and the animal populations that these strategies are intended to benefit.

These three objectives are referred to as implementation monitoring, effectiveness monitoring, and validation monitoring, respectively:

- **Implementation Monitoring**—Used to determine if objectives, standards, and management practices specified in the HCP conservation strategies are being accomplished. Implementation monitoring is used to determine whether specified actions or criteria are being met.
- **Effectiveness Monitoring**—Used to determine if the design and execution of the prescribed management practices are achieving the HCP conservation objectives. Every management decision is intended to achieve a given set of future conditions. Effectiveness monitoring can be used to compare existing conditions to both past and desired future conditions to describe the overall progress or success of the management activities.
- **Validation Monitoring**—Used to determine whether data and assumptions for predicting outcomes and effects are correct. Validation monitoring seeks to verify the assumed linkages between cause and effect. Validation monitoring is long term, and will be accomplished through formal research and effectiveness monitoring projects.

11.3.3.7. Management Strategy Assumptions and Priority Research and Monitoring Activities

Due to potential fluctuations in budgets (Section 11.3.3.1.), postponement of some projects may be required until sufficient funding is available. However, the ODF will conduct at least the following monitoring activities under this HCP: implementation monitoring; effectiveness and validation monitoring; and conservation strategies.

Implementation Monitoring

Implementation monitoring will document the types, amounts, and locations of forest management activities carried out on ODF-managed land on a representative subset of operations, both inside and outside areas addressed by the conservation strategies. Activities in areas addressed by the HCP will be sufficiently described to document compliance with the requirements of the conservation strategies. Implementation monitoring will be used to document trends in landscape-level habitat conditions. Implementation monitoring will be conducted according to the sampling protocols developed by the State Forests Research and Monitoring Program.

Effectiveness and Validation Monitoring

Under this HCP, effectiveness monitoring will be carried out on a representative subset of stands to document changes in habitat conditions (e.g., in-stream large wood, marbled murrelet nesting platforms) that result from timber harvest and other forest management activities. Effectiveness monitoring will be prioritized according to the amount of risk presented by a management activity. Specifically, the ODF will establish a project in a subset of stands to test an underlying assumption of the Marbled Murrelet Conservation Strategies that stands will develop characteristics suitable for marbled murrelet nesting (see Section 7.5)

Effectiveness of management activities will be evaluated both in the short term (five to ten years after harvest) and over the life of the HCP. Over the long term, aggregated information from research and monitoring projects will help validate a number of important assumptions that form the basis for the development of the conservation strategies.

Conservation Strategies

The following subsections discuss assumptions for each conservation strategy and activities that will be considered for use or that are used in testing these assumptions. The assumptions form the basis from which research and monitoring projects are already being conducted or will be developed. Estimates for the timing, frequency, and costs of monitoring activities are summarized in Table 11-2.

The ODF expects that the HCP landscape management strategies, aquatic and riparian management strategies, and upland management strategies (the integrated habitat conservation strategies) will provide needed habitat and maintain and restore properly functioning aquatic systems on state forest lands. The species-specific strategies will also contribute to ensuring habitat needs for the species covered by this HCP in the short term. These hypotheses are supported by assumptions made regarding each of the short- and long-term strategies that provide the framework of this HCP.

When large-scale disturbance events such as severe fire or insect and disease outbreaks occur, conservation areas will be evaluated through an adaptive management process to determine if they can still function for their intended purpose. Active management, including salvage, may be applied if the evaluation indicates that it would help restore the conservation area's function faster. Salvage of downed wood in T&E cores would occur only to facilitate the maintenance or development of advanced structure, one of the conservation measures for these areas.

Through time, monitoring information from throughout the forest and research information from a variety of sources will be evaluated. If the Services and ODF agree that such information indicates silvicultural treatments or other management activities would benefit the covered species and be cost effective, such management activities may be conducted in conservation areas. However, at the time of the preparation of this HCP, the only anticipated management activities are those discussed in this subsection or in Section 5.3.

Northern Spotted Owl Habitat Conservation Strategies

Assumptions

The landscape management strategies will provide habitat sufficient for the persistence of northern spotted owl sites in the Elliott State Forest, and provide habitat sufficient to accommodate movement and interaction of the northern spotted owl across the regional landscape.

- T&E core areas will maintain habitat sufficient to allow northern spotted owl pairs to persist.
- Advanced stand structure provides nesting, roosting, and foraging habitats for northern spotted owls.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow northern spotted owls to persist.
- Active silvicultural management can result in the development of habitat for northern spotted owls.
- Intermediate structure stands provide some foraging habitat and allow for movement and interaction of northern spotted owls across the regional landscape.
- Implementation of landscape design principles results in a landscape that provides connectivity for northern spotted owls.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and northern spotted owl habitat suitability as an objective of activities described in Section 11.3.3.5 at ten-year intervals. This study would determine what proportion of advanced structure stands also have characteristics of northern spotted owl habitat. Northern spotted owl habitat suitability would be determined by similarity to inventoried stands occupied by northern spotted owls (see Table 6-1).

- Conduct periodic density studies to assess the population and locations of northern spotted owls on the Elliott State Forest. Studies would use established density protocols for one year and survey all suitable habitat. Studies would occur at approximately eight-year intervals. These studies would address the questions of whether northern spotted owls are persisting on the Elliott State Forest; whether they are continuing to use T&E cores; and whether or not northern spotted owls are using developed habitat.

Marbled Murrelet Habitat Conservation Strategies

Assumptions

The landscape management strategies will maintain habitat sufficient for the persistence of marbled murrelet sites in the Elliott State Forest through time.

- T&E core areas provide sufficient protection to maintain occupied marbled murrelet sites.
- Advanced stand structure provides nesting habitats for marbled murrelets.
- Advanced structure stands are provided in a sufficient quantity and distribution in the Elliott State Forest to allow marbled murrelets to persist.
- Active silvicultural management can result in the development of habitat for marbled murrelets.

Activities

- Conduct periodic surveys of marbled murrelet T&E core areas to determine what proportion remain in occupied status. Surveys would be discontinued when marbled murrelet occupancy is confirmed, or after a period of five consecutive years of survey. Surveys would use established protocols and would occur at ten-year intervals.

Other Listed and Unlisted Species Habitat Conservation Strategies

Assumptions

- The landscape management strategies will provide habitat sufficient for the persistence of other covered species, in the Elliott State Forest, and those that might be listed in the future, and will provide habitat sufficient to accommodate movement and interaction of species across the regional landscape.
- The maintenance and development of advanced structure within one mile of lakes and rivers will provide habitat for bald eagles throughout the forest.
- Management for mature forest condition within the Riparian Management Areas (RMAs) within one mile of lakes and rivers will create and maintain stand conditions with a high likelihood of providing large trees for bald eagles through time and space.
- Site management plans for bald eagles will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.

- The maintenance and development of advanced structure on the forest both within and outside of conservation areas will provide habitat for northern goshawks throughout the forest.
- Site management plans for northern goshawks will protect the site from deleterious changes to key habitat characteristics and maintain occupancy and productivity of the site through time.
- Early structure habitats with snag and live tree retention will provide habitat for olive-sided flycatchers.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for olive-sided flycatchers within and adjacent to early structure stands.
- Early structure with snag retention will provide potential nesting and roosting habitats for western bluebirds.
- The retention of snags and additional trees along all perennial streams and a portion of seasonal non-fish-bearing streams will provide potential nesting structures for western bluebirds within and adjacent to early structure stands.
- T&E core areas and SUVs would provide the best potential habitats for the fisher if individuals use the Elliott State Forest in the future.
- Site management plans will function to protect fishers from disturbance due to forest management activities during the breeding season.
- Outside of conservation areas, the maintenance and development of advanced structure with numerous snags and logs will provide habitat for fishers throughout the forest.
- RMAs for ponds will protect the functions of these habitats for red-legged frogs.
- T&E core areas and other conservation areas may provide important source habitats for headwater amphibians throughout the forest.
- Management standards within RMAs should significantly minimize the likelihood of habitat loss or degradation for southern torrent salamanders and tailed frogs.

Activities

- Establish monitoring projects in a sub-sample of stands to determine and track development of stand structure and habitat suitability for other listed and unlisted species, as an objective of activities described in Section 11.3.3.5, at ten-year intervals.
- Annually monitor known nest sites and roosting areas to determine occupancy and productivity as part of site management plans for bald eagles.
- Establish monitoring activities to determine occupancy and productivity as part of site management plans for northern goshawks
- Approximately 11,600 acres of potential habitat will be surveyed for northern goshawks, beginning at year ten of the plan. A minimum of 20 percent of this acreage will be surveyed during any given year, so that surveys are completed in five years. A randomly selected subset of potential habitat will be identified for surveys, which will

use established protocols. Surveys during the early breeding season for goshawks in courtship flights are a very effective way to identify territories and locate nest stands.

- Periodically sample early structure stands to determine the presence of olive-sided flycatchers and western bluebirds. A representative sample of these habitats will be surveyed using established protocols. Surveys will occur at approximately ten-year intervals.
- If federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the Elliott State Forest, the ODF will participate in regional fisher research or survey efforts that include the Elliott State Forest, or conduct its own fisher research or survey activities.
- Periodic surveys of all suitable ponds will be conducted at approximately six-year intervals to determine occupancy by red-legged frogs.
- Within the first five years of plan implementation, conduct a study to determine the effectiveness of RMA standards to protect the functions of small perennial Type N streams. Parameters to be measured include shade, water quality (e.g. stream temperature, macroinvertebrates, or sediment), and presence of headwater amphibians. The study will include surveys before and after management activities in a selection of perennial Type N streams, as well as surveys of small perennial Type N streams within a selection T&E core areas or SUVs. Additionally, follow up surveys would be conducted in five and ten years.

Riparian Management Strategies

The combination of landscape and site-specific strategies will provide an array and frequency of riparian stand conditions across the landscape and through time that provides for desired future conditions of riparian areas, aquatic habitat, and watersheds. At the core of this broad assumption are multiple goals and assumptions regarding riparian and landscape strategies and the desired effects on riparian, aquatic, and watershed conditions. There is a general need to understand implementation of the aquatic and riparian strategies, including the amount of riparian areas with management in the inner zone.

Vegetation will be retained or managed within the stream bank and the inner zones of fish-bearing and large and medium non-fish-bearing streams, to achieve mature forest condition with the goal of protecting aquatic and riparian resources. Salvage of downed wood in these areas would occur only to facilitate the establishment of mature forest conditions, and only in consultation with the ODFW and the Services.

Assumptions

- Tree retention standards along 75 percent of small perennial non-fish-bearing stream reaches are sufficient to meet management goals related to properly functioning conditions, and to meet water quality standards established by the State of Oregon under the mandates of the federal Clean Water Act.

Activities

- Implementation Monitoring: Conduct comprehensive monitoring on a subset of harvest units to determine implementation of riparian and aquatic strategies. Utilize

methods to quantify proportion of harvest plans that manage in riparian inner zones or apply alternative vegetation treatments.

- Shade, Riparian Characteristics, and Water Quality on Small Perennial Type N Streams: On a subset of harvest units with small perennial Type N streams, monitor riparian and buffer characteristics, shade, and water quality parameters (e.g., stream temperature, macroinvertebrates, or sediment) before and after harvesting. This project will be coordinated with the amphibian-related monitoring described in Chapter 9 and above.

Table 11-2
Sample Monitoring and Surveying Matrix[a]

Species	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Northern Spotted Owls																				
Monitor to determine development of stand structure for northern spotted owl habitat suitability.[b]																				
Northern spotted owl density studies to determine presence.																				
Marbled Murrelet																				
Digitize habitat and measure vegetative characteristics.																				
Survey T&E core areas for marbled murrelet occupancy.																				
Other Species																				
Monitor to determine development of stand structure and habitat suitability for other listed and unlisted species.																				
Monitor a subset of harvest units with perennial Type N streams before/after management for riparian and buffer characteristics, shade, and water quality parameters.																				
Annual monitoring of known bald eagle nest sites.																				
Survey a subset of habitat for northern goshawks, beginning at year ten of the plan, and completing surveys in 5 years.																				
If fisher populations expand in the future, participate in or conduct research or survey efforts in the region.	To be determined																			

Table 11-2 - continued

Species	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Periodic surveys of early structure stands to determine presence of western bluebirds and olive-sided flycatchers.																				
Surveys before/after management activities in a selection of perennial Type N streams to determine presence of southern torrent salamanders and tailed frogs. Follow-up surveys in five and ten years.																				
Periodic surveys of ponds with red-legged frogs to determine continued presence.																				
Cost/Year	**150**	**150**	**150**	**150**	**50**	**100**	**180**	**210**	**150**	**100**	**80**	**80**	**80**	**180**	**100**	**80**	**180**	**80**	**60**	**40**

[a] This is an example timeline for how monitoring projects may be distributed through time.
[b] A project designed and conducted under the State Forests Monitoring Program Strategic Plan to address both FMP and HCP information needs.