

ELLIOTT STATE FOREST MANAGEMENT PLAN

State Forester Report for Board GPV and Planning Rule Determination

Introduction

This attachment has been prepared for the Chair and Members of the Board of Forestry to assist in their review of the draft Elliott State Forest Management Plan (FMP), and assist their determination of whether activities carried out or allowed by the State Forester on Board of Forestry (BOF) lands under the revised FMP meet the obligation to secure the greatest permanent value (GPV) to the state, as defined in OAR 629-035-0020, on Board of Forestry lands.

The Greatest Permanent Value (OAR 629-035-0020) and Forest Management Planning (OAR 629-035-0030) rules direct the State Forester to develop management plans that:

- Meet standards for management 629-035-0020 (2) and (3).
- Contain specific elements 629-035-0030 (2)
- Adhere to guidance from a set of stewardship principles 629-035-0030 (3).

The State Forester, through direction to staff, has followed these OARs and produced the Elliott FMP. The Elliott State Forest is managed under a single FMP to meet mandates for two landowners. Most of the Elliott is Common School Forest Lands (CSFL) (86,367 acres); the remaining are BOF Lands (8,906 acres). The GPV rule only applies to the BOF Lands. However, this assessment considers the achievement of GPV in the context of the FMP as it is applied to the entire Elliott State Forest. The information in this attachment demonstrates how the rule requirements are met.

OAR 629-035-0020 Greatest Permanent Value Definition

1. As provided in ORS 530.050, "greatest permanent value" means healthy, productive, and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic, and environmental benefits to the people of Oregon. These benefits include, but are not limited to:
 - a. Sustainable and predictable production of forest products that generate revenues for the benefit of the state, counties, and local taxing districts;
 - b. Properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;
 - c. Habitats for native wildlife;
 - d. Productive soil, and clean air and water;
 - e. Protection against floods and erosion; and
 - f. Recreation.

The State Forester is charged with a number of tasks to secure this GPV. These are outlined here with descriptions of how these tasks are met.

OAR 629-035-0020 (2) directs the State Forester to maintain these lands as forest lands and to actively manage these forest lands in a sound environmental manner, to provide sustainable timber harvest and revenue to the state, counties, and local taxing districts.

The Elliott FMP addresses this with strategies to maintain the lands as forest lands and by including specifications to ensure management is done in a sound environmental manner. Modeling analysis predicts this FMP will provide sustainable harvest and revenues to the state, counties and local taxing districts.

OAR 629-035-0020(2) further requires that the management focus described above not be exclusive of other forest resources, but must be pursued within a broader management context that meets certain standards. These are:

OAR 629-035-0020(2)(a): Results in a high probability to maintain and restore properly functioning aquatic habitats for salmonids, and other native fish and aquatic life.

In the opinion of the State Forester, the Elliott FMP has a high probability to maintain and restore properly functioning aquatic habitats for salmonids, and other native fish and aquatic life. The plan defines properly functioning aquatic habitats and establishes strategies to achieve those functions. Elliott FMP definitions and strategies are based on the best available science on aquatic and riparian functions. Where available, research and monitoring has shown these strategies to be effective.

The Elliott FMP defines properly functioning aquatic habitats within the context of the natural disturbance regimes that created habitat for aquatic species. The FMP combines concepts of landscape-scale management (managing for a diversity of stand structures) and site specific prescriptions (riparian strategies) to describe how these habitats will be maintained and restored. Landscape-scale approaches maintain and restore specific components such as sediment routing, nutrient cycling, and hydrologic regimes. At the site-specific level, riparian strategies maintain and restore functions to provide large wood recruitment from riparian areas, debris flows, and landslides. Riparian strategies provide high shade levels to maintain and restore cool stream temperatures.

The Elliott FMP includes references to scientific literature, the basis used to develop definitions and strategies for properly functioning habitats. In addition to the referenced body of science, new information is reviewed below to discuss the probability to maintain and restore properly functioning aquatic habitats for salmonids and other native fish and aquatic life.

Definition for Properly Functioning Aquatic Systems: In determining what constitutes a “properly functioning aquatic system” the overall approach in the Elliott FMP is based on the USDI Bureau of Land Management definition (1993- revised in 1995) in which the following key concepts are established:

- Native aquatic species have co-evolved with the forest ecosystems in western Oregon.
- High quality aquatic habitats result from the interaction of many processes, some of which have been greatly influenced by human activity

- Aquatic habitats are dynamic and variable in quality for specific species, through time and across the landscape.
- No single habitat condition constitutes a properly functioning condition. Rather providing diverse aquatic and riparian conditions over time and space would more closely emulate the natural disturbance regimes under which native species evolved.

The FMP states that the “biological and ecological objectives of the strategies in this plan are to maintain and restore the key ecological functions of aquatic, riparian, and upland areas that directly influence the freshwater habitat of aquatic species within the context of the natural disturbance regimes that created habitat for these species.” (Page 4-34). The Elliott FMP goes on to describe specific riparian and aquatic functions provided by each individual stream type (pages 4-34-37) (summarized in Table 1). Strategies are designed to achieve these functions in the context of the overarching definition of properly functioning aquatic habitat.

These riparian functions vary with distance from stream. The majority of functions are provided in the near stream zone (“Streambank Zone”). The number of aquatic functions provided by the riparian management area (RMA) decreases as the distance from the stream increases. This is reflected in Riparian Strategy 5b describing four zones: the Aquatic, Streambank, Inner, and Outer RMA Zone functions, with highest levels of tree retention closest to the stream.

Table 1. Summary of stream and riparian functions by stream Type as described in the Elliott FMP .

| Function or Desired Outcome | Stream Type | | | | |
|---|---|--------------|----------------------------|----------------------|--------------------------|
| | Fish and Large and Medium Type N* | Small Type N | | | |
| | | Perennial | Seasonal Debris Flow Prone | Seasonal High Energy | Seasonal |
| Shade/Stream Temperature | X | X | | | |
| Sediment Routing | X | X | X | | |
| Stream Banks | X | X | X | X | |
| Large Wood Recruitment: On-Site and Watershed Routing | X | X | X | X | X (on-site functions) |
| Floodplain Functions | X | | | | |
| Hydrologic Regime | Affects Entire Watershed- not explicitly listed as desired riparian function. | | | | |
| Leaf Litter Input/ Nutrient Cycling | X | X | X | X | X |

*Manage for mature forest condition within 100 feet of stream to achieve high proportion of the functions and processes associated with properly functioning aquatic habitats.

Specific riparian functions, a summary of FMP strategies that address these functions, and the scientific basis for the strategies are reviewed below. A portion of the scientific information is in the FMP. The following discussion expands on it to include more recent research and monitoring where available. For the complete text of the FMP strategies summarized below, see the FMP sections referenced in the discussions.

Dynamic and Variable Ecosystems- A Disturbance Based Approach

An important backdrop to an evaluation of individual functions is the overarching FMP statement that “aquatic habitats are dynamic and variable in quality... through time and across the landscape.” The FMP definition of properly functioning riparian and aquatic systems states there will be “diverse aquatic and riparian conditions over time and space” suggesting this will “more closely emulate the natural disturbance regimes under which native species evolved.” Reeves et al. (1995) confirm that “long-term and short-term ecological processes that create and maintain freshwater habitats must be restored and protected.” They go on to describe a disturbance-based approach for considering the variability of habitat conditions that would have resulted from natural disturbance events. Historically all watersheds were likely not in a high quality condition at all times. Reeves et al. (1995) emphasize the importance of watershed reserves within this dynamic perspective to protect and maintain the best existing habitats.

A dynamic ecosystems approach to aquatic, riparian, and watershed conditions is a core concept in the Elliott FMP. The best available science suggests a dynamic ecosystems approach combined with protection and maintenance of riparian and aquatic functions is a valid approach to achieve diverse aquatic and riparian conditions over time and space. Riparian measures as described below use a functional approach to establish protection measures around streams.

Shade over Streams

Strategy Reference: Strategies for Sustainable Forest Management- Strategy 5 (Aquatic and Riparian Systems) Tables 5-2 through 5-3

- No-touch harvest zones near streams (25 ft)
- Riparian Management Areas (RMAs) with variable tree retention standards out to 160 feet
- Within 100 feet of all Fish (Type F) and Large and Medium Non-Fish (L/M Type N) streams manage RMAs to achieve mature forest condition and once achieved- little to no management
- Maintain 80% shade on small perennial N streams that flow into Type F streams

Scientific Information: It is expected there has been and will be a range of shade conditions across the landscape. These conditions will change over time and include low, moderate, and high shade levels. Shade levels were reported in the Elliott Watershed analysis (ODF 2003). The Watershed analysis reported on shade as collected by ODFW and DEQ in separate efforts. A wide range of shade was observed from 47% on WF Millicoma River to 98% on Trout Creek. In general high shade levels were observed on narrower streams. For example the average shade as measured by ODFW on streams 0-30 feet wide ranged from 82-89%, on streams 31-60 feet it averaged 78-83%, and streams 6-120 feet wide it ranged from 65-68%. Shade along mainstem rivers tends to be lower in part because rivers are wider and tree canopies can only shade the edges of the river in comparison to tributaries where tree canopies can cover the narrow streams.

Recently available data from ODFW aquatic inventories has been summarized by ODFW for watersheds on the Elliott (Kavanagh et al. 2005) and confirm the summaries provided in the Elliott

Watershed Analysis. Kavanaugh et al. (2005) reported on stream and riparian conditions in the Coos, Tenmile, and Umpqua watersheds. They also summarize “reference conditions”. Reference conditions were derived from 124 streams with low impact from human activity and similar to the Elliott study area. Kavanaugh et al. reported that shade levels were in a moderate to high condition as compared to reference conditions for Coos (average = 83%), Tenmile (average = 80%), and Umpqua (average = 81%) watersheds.

Oregon natural resource management agencies completed a Coho Assessment in 2005 (ODFW 2005a) including a series of papers to evaluate aquatic habitat. In a contributing paper, Dent (2005) provides an evaluation of cover as a surrogate for shade. Shade on randomly selected sites across all ownerships was statistically less than shade on reference sites. However, riparian conditions along public (including State and Federal) forested streams had the highest levels of shade as compared to other land uses.

Recently ODF monitored shade on 10 small perennial non-fish streams within 500 feet of Type F streams (ODF 2010). Overall, 8 of the 10 streams sampled maintained $\geq 80\%$ cover. Furthermore, in 2002, the joint DEQ ODF sufficiency analysis concluded that shade levels appear adequate on large Type F Streams when managed using Forest Practices Act riparian standards (ODF and DEQ 2002).

These data and studies suggest that management under FMP strategies has a high probability to maintain and restore shade. Potential future shade as it relates to stream temperature is discussed under “Stream Temperature” below.

Stream Temperature

Strategy Reference: Same as shade over streams

Scientific Information: 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). More recently, under the Forest Practices Act and FMPs, riparian buffers have been established along streams to maintain shade and stream temperature with varying effectiveness reported in the literature.

Small and Medium Fish Streams: The most recently available information on the performance of FMP Aquatic and Riparian strategies suggests the Elliott FMP strategies are effective at meeting DEQ Water Quality stream temperature standards on small and medium fish bearing streams (Groom et al. 2011a) and preventing harvest-related increases in stream temperature (Groom et al 2011b).

Large Fish Streams: Research on the effects of forest management on stream temperature primarily evaluates standards that are not directly comparable to Elliott FMP (studies look at no buffers, narrower buffers, wider buffers, etc.). These studies have consistently demonstrated that buffers can prevent increases in stream temperature or decrease the magnitude of stream temperature changes. However, harvest effects have been highly variable thus limiting applicability to other situations (Moore et al. 2005). In 2002, the joint DEQ ODF sufficiency analysis concluded that it is likely that DEQ water quality standards are being met on Large Type F streams managed using the FPA. The Elliott FMP include riparian standards that exceed the FPA.

Non-fish Streams: Studies have produced a range of results. Some recent studies on small headwater streams have found that harvesting without buffers increases stream temperature while buffers ranging from 30-90 feet wide appear to prevent increases in stream temperature (Moore et al. 2005, Wilkerson et al. 2006). Conversely, a study of 15 small headwater streams reported no change in stream temperature even without buffers (Jackson et al. 2001). Moore et al. 2005 conclude that temperature changes in headwater streams are unlikely to produce substantial changes in temperature of larger streams unless they comprise a large proportion of the larger river. Research is underway in three Oregon watershed scale studies to evaluate effects of contemporary forest management on small headwater streams and potential transfer to downstream reaches (Watershed Research Cooperative 2010) one of which is being conducted in the Trask Watershed- with State Forest, Weyerhaeuser, and Bureau of Land Management ownership. Stream temperature is one component being researched.

The Elliott State Forests watershed analysis (ODF 2003) evaluated shade and stream temperature as it relates to achieving properly functioning conditions (meeting DEQ water quality standards) with data from the West Fork Millicoma and Ten Mile. Results indicated that meeting state water quality numeric criteria depended in part on distance from the watershed divide and shade for the Millicoma sites. In the Millicoma sites greater than 10 miles from the divide, no matter how high the shade, did not meet the numeric standard. Otherwise, shade levels of 80-100% shade were predicted to meet DEQ numeric standard. Lower shade levels could achieve the standard if the sites were higher up in the watershed. A predictive relationship for stream temperature was not found. Three sites exceeded the numeric standard and had shade levels of 51%, 74%, and 83%.

The available data suggest that management under FMP strategies has a high probability to maintain and restore desired stream temperature patterns by maintaining shade with no-cut buffers and managing riparian areas around Fish stream and Large and Medium Type N streams for mature forest conditions.

Sediment Routing

Strategy Reference:

Strategies for Sustainable Forest Management--Strategy 1 (Diversity of Stand Structures) and Strategy 5 (Aquatic and Riparian Systems) Table 5-2 through 5-3. Also Forest Roads Manual (Oregon Department of Forestry 2000), and Forest Practices Act Technical Notes 2 and 6

- 160-foot RMA established along 75 percent of the debris flow-prone channel.
- No harvest within 25 feet of all except other seasonal Type N streams.

- No ground-based equipment within 25 feet of all streams and 50 feet of Type F and Large and Medium Type N streams.
- Less than 10% ground disturbance within 100 feet of Type F and Large and Medium Type N Streams.
- Full suspension on all fish-bearing streams and large and medium non-fish-bearing streams.
- Use road design and construction best management practices (BMPs) that minimize the occurrence of road-related landslides
- Prevent net increases in road mileage next to streams
- Confine road construction to ridgetops and away from high landslide hazard locations to the maximum extent feasible
- 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 causing erosion and delivery of sediment to streams
- Require maintenance or proper vacating practices for roads not currently in use.
- Identify high landslide hazard locations as described in detail in Technical Notes Number 2 (Oregon Department of Forestry 2003a) and Number 6 (Oregon Department of Forestry 2003b).
- Consider adjusting unit boundaries to exclude high landslide hazard locations with highest down slope risk.

Scientific Information: Sediment in streams: The most recently available information on fine sediment in streams on State Forests comes from ODFW aquatic inventories (Kavanaugh et al 2005). These data indicate that fine sediment in spawning gravels is at moderate (Tenmile and Coos) to low levels (Umpqua) as compared to reference conditions. The report suggests all three regions have moderate levels of gravels in riffles, and a high level of bedrock. Strategies listed above are designed to prevent fine sediment delivery to streams as a result of forest management activities. The information below reflects on the effectiveness of those strategies.

Roads: Road strategies minimize negative effects of roads on water quality and fish habitat by reducing the amount of chronic and episodic sediment delivery to streams. Studies conducted to evaluate the effectiveness of road construction and maintenance practices demonstrate that such Best Management Practices (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).

Roads with greater connectivity to streams have a higher potential for sediment to be delivered to streams (Mills et al., 2007). In general the goal for State Forests roads is to reduce the amount of roads that hydrologically connected to streams (ODF Performance Measure 5 (ODF 2008). The Elliott Watershed analysis reported on connectivity in 3 categories: short (<100 feet), medium

(100-360 feet), and long (>360 feet). Only 9% were considered short, 32% were considered medium, and 31% were considered long. Delivering length could not be determined on 28% of streams. Maintaining and reducing occurrences of hydrologically connected roads (i.e. reducing the length of ditch that delivers to a stream) results in maintaining and restoring habitat by reducing sediment delivery to streams. Improving fish passage increases the amount and type of habitat available for fish at multiple life stages and therefore is an important component of restoring properly functioning aquatic habitat.

Landslides: Data from the 1996 landslide study (Robison et al. 1999) has helped shape ODFs guidelines for identifying landslide hazard. Important factors include stand age, slope steepness, and rainfall intensity. The probability that a debris flow will deliver to a Type F stream (Benda and Cundy 1990) was evaluated using the Robison data. Key drivers include channel steepness and junction angle. These factors are used today by ODF to identify landslide hazard locations and debris flow prone channels. Recent models have been proposed to predict debris-flow prone terrain and aggregate at watershed scales. Such models are valuable at large landscape scales to estimate the miles of debris flow prone streams. They can also be used to prioritize leave-tree locations along debris flow prone channels to contribute to large wood recruitment during debris flow events (Miller and Burnett 2008) and to maintain and restore positive benefits of debris flows.

Buffers to “Filter” Sediment: Studies have demonstrated that 30 foot buffers with minimal harvest and ground disturbance restrictions were effective at preventing chronic sediment delivery to streams and physical disturbance of stream channels (Rashin et al. 2005, NCASI 2000). In a Washington study, when sediment delivery to streams occurred, it was associated with stream crossings for the yarding system. Other factors included proximity of ground disturbance to the stream and the density of un-buffered non-fish streams. Findings suggest buffers are effective by keeping active erosion sites farther from the stream (Rashin et al. 2005).

These data suggest that management under the FMP strategies have a high probability to maintain and restore properly functioning sediment routing functions.

Stream Banks

Strategy Reference:

Strategies for Sustainable Forest Management--Strategy 5 (Aquatic and Riparian Systems), Table 5-2 through 5-3,

- 25 feet no harvest on all streams (except “other” small seasonal Type N streams)
- No ground-based equipment within 25 feet of all streams and 50 feet of Type F and Large and Medium Type N streams.
- Less than 10% ground disturbance
- Full suspension of logs during harvesting on Type F and Large and Medium Type N streams.

Scientific Information: Stream bank erosion can occur as a result of natural processes such as wind throw, landslides, and high-flow events creating a “background” rate of bank erosion (Rashin et al. 2006) regardless of harvest. The influence harvesting within RMAs on stream bank

stability is in part a function of root strength. Tree roots extend radially as far as the tree crown, so tree roots beyond the crown distance will have significantly diminished influence on stream bank stability. However, non-tree species (e.g. shrubs and herbaceous species) also provide stabilization as a function of root density (NCASI 2005). Bank stability can be influenced by wind throw. Predicting wind throw from buffers is challenging at best. It appears to be a function of vegetation, topographic and storm characteristics (Steinblums et al. 1984) and less so with buffer width (Ruel et al. 2001) Wind throw is episodic, with greatest wind throw occurring the first few years after harvest (Rashin et al. 2006) and with large wind storms. Rashin et al. (2006) observed harvest-related bank erosion associated with wind throw and yarding practices. The study concluded that the benefits of wood recruitment to streams outweighed the relatively minor contribution of wind throw to sediment delivery. Restrictions such as riparian leave trees, no ground-based equipment and full suspension through RMAs, omitting roads from riparian areas, and minimizing stream crossings decrease potential effects on stream bank erosion (Rashin et al. 2006).

FMP strategies have a high probability to maintain and restore properly functioning aquatic habitat with respect to stream banks.

Large Wood Recruitment: On-Site and Watershed Routing

Strategy References: Strategies for Sustainable Forest Management--Strategy 1 (Diversity of Stand Structures) and Strategy 5 (Aquatic and Riparian Systems) , Table 5-2 through 5-3

- 160-foot RMAs along streams, each with three zones: stream bank zone, Inner Zone, and Outer Zone.
- 25 ft. no-harvest zone on nearly all (everything except “other” small seasonal Type N) streams.
- Management within Inner Zone of Type F and Large and Medium Type N 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 will have minimal to no harvest.
- Leave trees in Outer Zones range from 10-25 trees/acre on Type N streams to 10-45 trees/acre on Type F streams.
- Active restoration activities including large wood placement

Scientific Information: Most recently available information on the amount of large wood in streams comes from ODFW summaries of aquatic inventories and ODF Watershed analysis. This information consistently reports low levels of complex habitat- typically formed by multiple pieces of wood jammed up with and around large pieces (key) of wood. Changing this condition is best achieved through recruitment over time from near-stream and upstream sources.

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 stream adjacent 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 the NW State Forests 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 (May and Gresswell 2003). In these cases, small stream channels can play a significant role in contributing key pieces of large wood to downstream aquatic functions. 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). Wood storage in small headwater streams also influences the storage and routing of nutrients and sediment throughout a watershed. (Gomi et al. 2002).

Management near potential landslide locations and debris flow-prone channels influences *upslope* sources of large wood recruitment. The retention of trees in high landslide hazard locations that are located in areas likely to deliver to a stream will maintain a portion of this source of large wood recruitment to streams (Burnett and Miller 2008). 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 1985; Bilby and Bisson 1998; Sedell et al. 1982).

There is a potential to decrease near-stream sources of wood by thinning riparian areas. This happens if trees are removed 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 [large woody debris] 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 wood 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 decision to thin riparian areas has to balance the potential for a short-term loss of suppression mortality against the long-term benefit of having mature forest conditions in riparian areas sooner than if left unmanaged.

In summary, we expect a range of effects on large wood recruitment and loading in streams from the application of the Elliott FMP. As riparian and aquatic strategies return or maintain riparian

areas in mature forest conditions, including the ability to recruit large-diameter wood to streams and large wood placement, there should be an improvement (restoration) of large wood recruitment and eventually wood loading in streams (which will take much longer). Where mature forest conditions exist, the aquatic and riparian strategies will likely maintain (no effect) current conditions. As outlined above, research indicates that FMP RMA strategies will provide 70 to 99 percent of streamside sources of wood. Removal of trees in the Inner Zones of RMAs that do not meet mature forest condition will improve diameter growth rates. However this could result in a short-term loss of wood recruitment (not necessarily large wood) on some streams. Elliott FMP strategies address landslide sources of large wood recruitment by leaving trees along debris flow-prone reaches, managing upslope areas for an array of forest structure types, and adjusting harvest boundaries, when operationally feasible, to avoid high landslide hazards.

Elliott FMP strategies have a high probability to maintain and restore wood recruitment functions over time as riparian areas develop.

Floodplain Functions

Strategy Reference:

Strategies for Sustainable Forest Management Strategy 5 (Aquatic and Riparian Systems), Table 5-2 through 5-3

- Riparian standards discussed above are measured from average annual high water, edge of stream associated wetland, side channel or channel migration zone whichever is greatest.

Scientific Information: Floodplain connectivity is primarily influenced by channel constraint, large wood recruitment from near-stream and upslope processes, large floods, and geomorphology. Of these processes, ElliottFMP strategies have the greatest potential to influence inputs of large wood (described under large wood) and channel constraint from roads. 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.

Elliott FMP road construction strategies maintain current conditions 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. FMP strategies as referenced above 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.

Landscape and site-specific aquatic and riparian strategies have a high probability of maintaining and restoring floodplain functions.

Hydrologic Regime

While hydrologic regime is not listed as a function for specific stream types, it is an important overarching watershed function. It relates to the overarching ecological objective of the ElliottFMP to “maintain or restore the key ecological functions of aquatic, riparian, and upland areas that directly influence the freshwater habitat of aquatic species within the context of the

natural disturbance regimes.” The following strategies have the potential to influence hydrologic regime.

Strategy References: Strategies for Sustainable Forest Management--Strategy 1 (Diversity of Stand Structures) and Strategy 5 (Aquatic and Riparian Systems) Table 5-2 and 5-3. Also Forest Roads Manual.

- Upland forest management strategies with an expected outcome of 10-20% of the landscape in an early forest structure minimize the percent of the landscape in an early forest structure.
- Disconnect roads from streams
- Minimize soil compaction

Scientific Information: Upland forest management has the potential to influence hydrologic processes. Forest management practices as described in the Elliot FMP that have the greatest potential to affect hydrologic processes include harvesting at landscape scales that result in a young stand condition and road management.

Several studies have been done to evaluate the effects of forest management on stream flows. 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 and Lisle 1998). Time frames vary by study and range from 9 to 33 years.

Research has evaluated regeneration harvest rates that range from 0 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 at a detectable level when regeneration harvest exceeds 29-40% in rain dominated watersheds (Grant et al. 2008). For watersheds in the Transient Snow Zone the detection is at lower harvest levels ranging from 15-25%. Increases in summer base flows may also occur, but are not as commonly researched and results are highly variable (Beschta et al. 2000, Moore et al. 2005). The magnitude of observed changes in peak and low flows are generally small because response flows have low return intervals (Beschta et al. 2000, Grant et al. 2008).

If a change in peak flow occurs, it is likely to be on small peak flows (half-year to five-year return intervals) and at small watershed scales (0.1 to 1 square kilometers). 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 not expected because of their low stream power (Grant et al. 2008). 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), Alesa 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 on the Elliott State Forest is likely to be sufficiently small that changes in flows or channel morphology would be virtually non-detectable.

The Elliott Watershed Analysis provides a synthesis of streamflow data from the West Fork Millicoma gauging station. Most of the land upstream from the gauge site is part of the Elliott State Forest. The peak flow associated with the 50-year recurrence interval was 9,800 cfs or a unit flow of 208 cfs per square mile of drainage area for the West Fork Millicoma River (Figure 1). This is typical for low elevation mountains of the central Coast Range (ODF 2003). The Elliott Watershed analysis concluded there was no evidence of an increase in peak flows due to forest management.

Figure 1

West For k Millicom a River

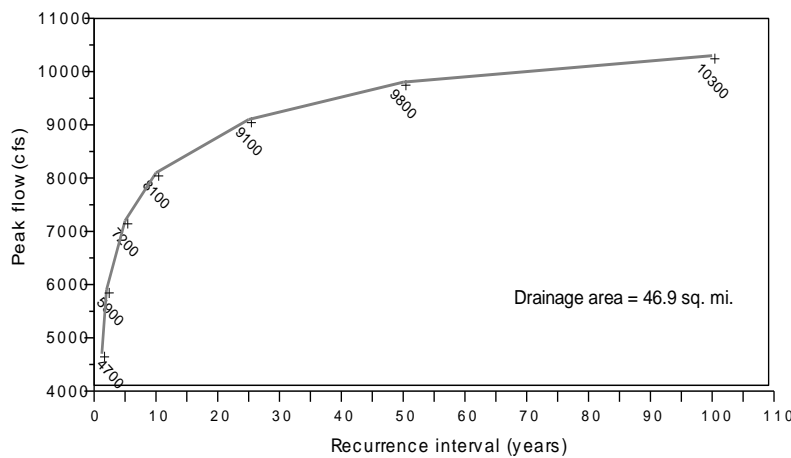


Figure 1. Relationship between peak flow and recurrence interval for the West Fork Millicoma River (From Elliott Watershed Analysis ODF 2003).

As described above, an assessment of recent literature supports the Elliott Watershed Analysis conclusion. An expected outcome of the Elliott FMP is that regeneration stands (young stands/early structure) are expected to range from 10-20%. This range falls below that which has been associated with changes in peak flows. There is potential for this threshold to be exceeded at very small scales. Even if there were a detectable effect, it would be on very small peak flows. In the unlikely event that a change in peak flows did occur, research indicates that it would not affect channel morphology.

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). 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. 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. State forests reports 9-20% of roads are connected to streams. Increases in the 25-year return interval were observed as a result of road construction (King and Tennyson 1984). Information on the effectiveness of road restoration suggests that practices as described in the Elliott FMP are effective at reducing hydrologic connectivity to streams. This decreases the drainage network and reduces the risk of increased peak flows.

Even if there is a change in small peak flows (which is a low probability) in a subset of watersheds, research suggests the Elliott FMP has a high probability to maintain and restore hydrologic function. Strategies to disconnect roads from streams will maintain and restore watershed function in relation to hydrologic regime.

Leaf Litter Inputs and Nutrient Cycling

Strategy References: Strategies for Sustainable Forest Management--Strategy 1 (Diversity of Stand Structures) and Strategy 5 (Aquatic and Riparian Systems) Tables –2 through 5-3

- No harvest within 25 feet of all but other small seasonal Type N streams
- No ground based equipment within 25 feet
- Retain 10-25 trees out to 100 feet
- Retain all dead and downed wood out to 100 feet
- Range of upland stand structure types provides large percent of landscape in complex structure. Streams that flow through these areas are afforded benefits of adjacent vegetation to provide the leaf litter and nutrient cycling functions.

Scientific Information: Retaining trees and shrubs along the entire channel network maintains sources of leaves to streams. Leaf litter inputs have an important influence on biological processes particularly on narrow headwater streams with closed riparian canopies. In small headwater streams leaf litter tends to be stored longer, transformed into smaller particles, which in turn become important food sources for macroinvertebrates (Richardson 1992, Gomi et al. 2002). Leaf litter plus terrestrial sources of macroinvertebrates are important sources of nutrients to downstream reaches (Wiplfi and Gregovich 2002). Studies have demonstrated the importance of both coniferous and deciduous vegetation and trees and shrubs to the nutrient regime of streams (Liquori and Jackson 2001; and Minore and Weatherly 1994).

Elliott FMP strategies maintain and restore riparian conditions over time. This has a high probability to maintain and restore properly functioning conditions with respect to leaf litter and nutrient cycling.

Additional Strategies

There are two more strategies that provide additional contributions towards maintaining and restoring aquatic habitats and are also designed to protect, maintain and enhance wildlife habitats. These strategies are not just associated with streams and riparian functions, and thus are separated from the other strategies.

Aquatic Amphibians and Additional Habitat for Terrestrial Wildlife

Riparian management strategies are intended to also provide benefits for wildlife habitat. Direct benefits and protection of habitat are provided to stream-associated amphibians through RMAs which help to maintain cool stream temperatures and reduce sedimentation. Riparian buffers are also expected to provide added habitat-value to many terrestrial wildlife species.

Strategy References: Strategies for Sustainable Forest Management--Strategy 1 (Diversity of Stand Structures) and Strategy 5 (Aquatic and Riparian Systems; 5a-5g, Tables 5-2 though 5-3)

- Produce a desired array of stand structure types across the landscape
- Watershed scale analyses and planning
- Apply management strategies (described above) which
 - Prescribe a graduated tree retention approach (decreasing as distance from stream increases).
 - Use a blended approach (diversity of stand structure types across the landscape and site-specific strategies)- acknowledging patterns created by interrelated upland and hydrologic disturbance patterns (fire, windstorms, floods)
- Manage and restore aquatic and riparian habitats to mimic natural dynamics, supplement legacy elements, and consider disturbance regime at watershed and site scales.
- Apply alternative vegetation treatments to better achieve the FMP aquatic and riparian habitat goals and to maintain diverse riparian plant communities at the landscape and basin scales.

Scientific Information: Several local and large scale processes interact so that riparian areas contribute to wildlife habitat. In terms of biodiversity, NCASI (2005) described four components: habitat heterogeneity, biological legacies (snags, logs, trees), physiological stress, and resource availability. Use of riparian buffers is widely regarded as a valuable approach for biodiversity protection. The effectiveness of buffers to provide for biodiversity depends on careful consideration of these four components at both local and broad scale goals (NCASI 2005).

The use of variable retention harvests, long rotation even-aged harvest and riparian buffers with greater stand densities closer to streams can be effective at preserving and creating legacies, heterogeneous physical and vegetation structure, and a full array of disturbance regimes. A tiered approach to riparian management might support wildlife goals better than a fixed-width buffer by providing greater heterogeneity. An example of a tiered approach is to apply full retention near the stream, variable thinning or patch cuts at greater distances, and even aged management beyond (NCASI 2005).

Effectiveness of various riparian buffer widths to meet wildlife goals will depend on the desired function for specific species. For maintaining shade, 56 – 82 ft buffer has been reported as effective, 98 ft for microclimate, and 197 – 328 ft to protect the most sensitive organisms. Location may also be a factor as species distribution along the stream gradient varies. Some riparian-associated species of wildlife occur mostly along larger streams whereas other species such as torrent salamanders are most abundant in small, high-gradient, headwater streams (NCASI 2005, Olson and Weaver 2007).

Studies on effects of logging and buffers on stream amphibians have been variable. Most studies have shown that parent geology and channel characteristics (substrate, gradient, basin drainage area, etc.) appear to have the strongest influence on abundance of stream amphibians (Russell et al. 2004, Stoddard and Hayes 2005, Kroll et al. 2008). Some studies have shown that clearcut logging of headwater streams with no buffers or small buffers can lead to reduced abundance of some stream amphibian species, but not for others (Dupuis and Steventon 1999, Vesely and McComb 2001, Jackson et al. 2007). Little research has been conducted to examine effects of buffer width. Large buffers (> 148 ft wide) within clearcut harvest units appear to be effective at maintaining diversity and abundance of stream amphibians when compared to unlogged forests (Stoddard and Hayes 2005), however this study only examined a single buffer width class. Vesely and McComb (2001) looked at a variety of buffer widths, but had small sample sizes. They indicated that odds of finding torrent salamanders increased with increasing buffer width. Small buffers (20 ft) appear to be effective for thinning operations (Olson and Rugger 2007).

Width is not the only parameter to consider. Just as important is the structure and composition of the riparian area and how that varies locally and at larger scales. NCASI (2005) proposed that “riparian forests with varied tree species and age classes, occasional shrub-dominated patches and woody legacies such as snags and downed logs, have high potential to maintain biodiversity whereas even-aged single species stands often lack the legacies and heterogeneity that underlie biodiversity.” More is needed to understand the level of heterogeneity needed to provide sufficiently for biodiversity.

While the GPV rule separates out aquatic habitat and wildlife habitat, it is important to note that they are intertwined in the forest and strategies that benefit aquatic habitat make wildlife contributions and vice versa.

Active Aquatic Restoration

Strategy References: Strategies for Sustainable Forest Management Strategy 5 (Aquatic and Riparian Systems)

- Implement watershed analysis
- Assess factors limiting recovery
- Identify design and implement project to remedy identified problems in a timely manner
- Stream restoration, to benefit fish and amphibian species of concern

Scientific Information:

Restoration on the Elliott (1995- 2010): Given the status of fish populations and habitat, the Elliott State Forest Management Plan includes an Aquatic and Riparian Strategy to implement

Stream Restoration Projects. Since 1995 ODF has invested \$2,224,686 in cash and in-kind funding to implement 239 projects. More detail on these projects is provided in Table 1.

Table 1. Restoration Projects for the Elliott State Forest. These projects are complete and have been reported to the OWRI. *Data source: Bobbi Riggors, OWEB, 05/16/2011*

| | |
|---|-------------|
| Total Number of Projects | 239 |
| Total Funds Spent (see break-out below) | \$5,801,341 |
| OWEB Funding | \$1,108,497 |
| ODF Cash Funding | \$1,296,222 |
| ODF Inkind Funding | \$928,646 |
| Other Funds Utilized | \$2,467,976 |
| Number of Crossings Improved for Fish Passage | 24 |
| Miles Made Accessible from Fish Passage Crossing Improvements | 17.52 |
| Number of Instream Large Wood Placement Projects | 46 |
| Miles of Stream Treated with Large Wood Placement | 35.35 |
| Number of Large Wood Structures Placed | 396 |
| Number of Logs (especially key pieces) Placed | 1454 |

The department’s commitment to future restoration projects is always reliant on available resources. Future projects will consider priorities established by the Oregon Coast Coho Conservation Plan and ODF Watershed Analysis findings. The watershed analyses provide recommendations for stream reaches that would benefit from restoration projects. Future restoration projects on State Forests will consult the Watershed Analyses, the Oregon Coast Coho Conservation Plan, and continue to work with local ODFW biologists to assure restoration priorities are being addressed whenever possible.

Scientific studies on the benefits of restoration provide a range of conclusions. Most studies demonstrate that restoration efforts result in desired outcomes for channel characteristics (Johnson et al. 2005; Roni and Quinn 2001). A range of fish responses is reported. For example, wood placement was not associated with significant changes in the abundance of coho salmon juveniles when considered at the habitat unit scale over a few days (9-11 days) (Bjornn et al. 1991). Longer-term studies did indicate positive responses of coho salmon to wood placement in terms of increased survival (Solazzi et al. 2000), abundance of summer juveniles (Roni and Quinn 2001; Solazzi et al. 2000; Giannico 2000), and smolt output (Roni and Quinn 2001; Solazzi et al. 2000).

Alternatively, it has been argued that instream restoration projects may be expensive experiments that have not demonstrated utility and cannot take the place of watersheds with properly functioning systems. Without treating the causes of degradation, restoration cannot succeed and without careful design, restoration projects have actually caused long-term shifts in channel morphology and losses of instream functions (Beschta et al. 1994). Kauffman et al. (1997) agree stating that “complex ecosystems and associated habitat features cannot be created via simple and artificial construction of selected components.”

The Institute for Natural Resources (INR) used a Systematic Evidence Review (SER) to evaluate the benefits of an SER approach. The focus of the pilot project was instream restoration. Findings from the final report mostly focused on the use of an SER approach in natural resources (INR 2008). However, there were some suggestions with regard to the literature on restoration. The overall body of evidence to support wood placement was somewhat unclear with significant information gaps. Evidence was stronger for direct effects on habitat components than for effects on salmon numbers or survival (Burnett et al. 2007; INR 2008).

Recent monitoring by the Tillamook Watershed Council on two streams in the Trask Watershed (Elkhorn and Cruiser Creeks) with restoration projects suggests that restoration was successful on both the habitat and fish response fronts. Preliminary data (unpublished) suggest that instream wood placement structures have succeeded in creating vast surface areas of highly complex, low velocity habitat that is stable and present at variable flow profiles. Large numbers of juvenile coho suggest habitat is productive. Furthermore, the decrease in juvenile coho from control reaches suggests observations in the treatment reaches are a result of the restoration.

Four restoration projects were monitored by ODFW on the Elliott State Forest. In each case large wood structure was added to the stream to improve streams structure and complexity, to allow the stream to better interact with the floodplain, and to improve overall stream habitat. Since these are fairly recent sites and winter flows have been relatively benign, substantial changes in pool area or gravel recruitment have not been observed (Kavenaugh 2005).

While the benefits of restoration on actual fish populations may be difficult to measure, indications are that carefully designed restoration in the context of entire watershed function will be beneficial. There is no doubt that streams in coastal forests lack complex pools with large wood and Elliott streams lack cobbles and gravels. Much of the original causes of this condition have been discontinued (wood removal, splash dams, not leaving trees near the stream when harvesting). Ideally, riparian and watershed functions will eventually take the place of the need to do restoration projects. However, even in the best case scenarios riparian area and watershed contributions will be cyclic. Given the fact that these streams are currently severely limited by complex pool habitat, thoughtful commitment to restoration remains an important tool for restoring watersheds on the Elliott State Forest.

The aquatic and riparian strategies including restoration have a high probability to maintain and restore properly functioning aquatic habitat for salmonids and other native fish and aquatic life.

Probability to Maintain and Restore Properly Functioning Aquatic Habitats

Summary of BOF land contribution to fish habitat: The largest contiguous acreage of BOF lands are along the West Fork Millicoma and Marlow Creek. There are also small blocks of BOF lands distributed along Palouse, Roberts, Benson, and Dean Creeks. Fish populations in the Elliott State Forest use stream, lake, and estuarine habitats that cross landownership boundaries on and off the forest. The connectivity and use of the array of habitats is important for the productivity of these populations. As a result, the populations and stream habitat on the Elliott State Forest

should be viewed in the larger context of the areas from the estuary to headwater, on and off the forest proper.

Winter habitat while present in Elliott streams, tends to be limiting (Kavanaugh et al. 2005). One measure of potential winter rearing coho habitat quality is called “Intrinsic Potential” (Burnett et al 2007). This model predicts relative potential over-winter habitat quality for coho. In general streams with lower gradients and higher flood prone areas tend to have higher intrinsic potential and these occur within and outside of the Elliott Forest. High intrinsic potential streams are expected to respond favorably to restoration and are good candidates for improving winter rearing habitat for coho salmon. Most streams on BOF lands in the Tenmile, Palouse and Larson in the Coos, West Fork Millicoma, Shofield and Dean in the Umpqua have high intrinsic potential into the upper reaches (Kavanaugh et al. 2005).

Actual coho distributions as well as distribution for steelhead, cutthroat, and Chinook salmon extend beyond the modeled intrinsic potential for all streams. In terms of the Board of Forestry lands, the West Fork Millicoma, Marlow Creek, and Dean Creek all support cutthroat, Coho, Chinook, and/or Steelhead. Chum are also present in the Millicoma.

The Elliott FMP has a high probability to maintain and restore properly functioning aquatic habitats for salmonids, other native fish, and aquatic life. The FMP contain a definition of properly functioning aquatic habitats that is based on the best available science and from that definition and the relevant scientific literature, the necessary components of properly functioning aquatic habitats have been identified. Strategies in the FMP address these components and are based on the best available science. Where available, monitoring has shown these strategies to be effective. Specific components of pertinent strategies are:

- A blended approach, consisting of landscape-scale approaches coupled with site-specific strategies, will create forest conditions that emulate historic conditions and processes relative to aquatic ecosystems.
- The mature riparian forest goal, commitment to maintain mature forests once achieved, and wide buffers are likely to capture 70-99% of the large wood recruitment on Type F and L/M Type N streams.
- Wide buffers and standard management targets designed to mimic mature forest conditions are highly likely to maintain shade and have been demonstrated to meet DEQ stream temperature standards (on small and medium Type F streams).
- The FMP allows for alternative approaches for managing riparian areas that don't meet mature forest condition in ways that will achieve that condition in a timelier manner.
- The FMP incorporate goals and options for aquatic habitat restoration projects.
- Upland strategies are designed to minimize impacts of roads on aquatic and riparian ecosystems and recognize the connectivity between aquatic habitat and upslope management practices. Road-related strategies have been demonstrated to be effective at minimizing sediment inputs to streams.
- The FMP incorporates landslide strategies designed to identify high hazard locations and manage these areas to mimic landslide processes of large wood recruitment and routing to streams.

This section has reviewed the FMP definitions of properly functioning aquatic conditions and the scientific basis for the landscape and site-specific strategies to achieve them. Although this summary described the science in terms of individual functions, clearly aquatic and riparian conditions are a function of multiple interrelated landscape processes. The integrated FMP strategies recognize this and collectively have a high probability of achieving desired riparian and aquatic conditions.

OAR 629-035-0020(2)(b): Protect, maintain, and enhance native wildlife habitat

In the opinion of the State Forester, this FMP protects, maintains, and enhances native wildlife habitat. The FMP contains a set of strategies that are based on scientific research in silviculture and biology. These strategies employ an integrated approach of active management which will result in an outcome of a diverse array of forest stand types across the landscape, protection of areas known to be used by T&E wildlife species, and active management to provide for key structural habitat components. Together, these strategies are designed to protect, maintain, and enhance wildlife habitat for the suite of native species that occur on the Elliott State Forest. Each strategy is addressed below.

Strategies for Sustainable Forest Ecosystem Management, Strategy 1: Actively Manage for a Diverse Array of Stand Types

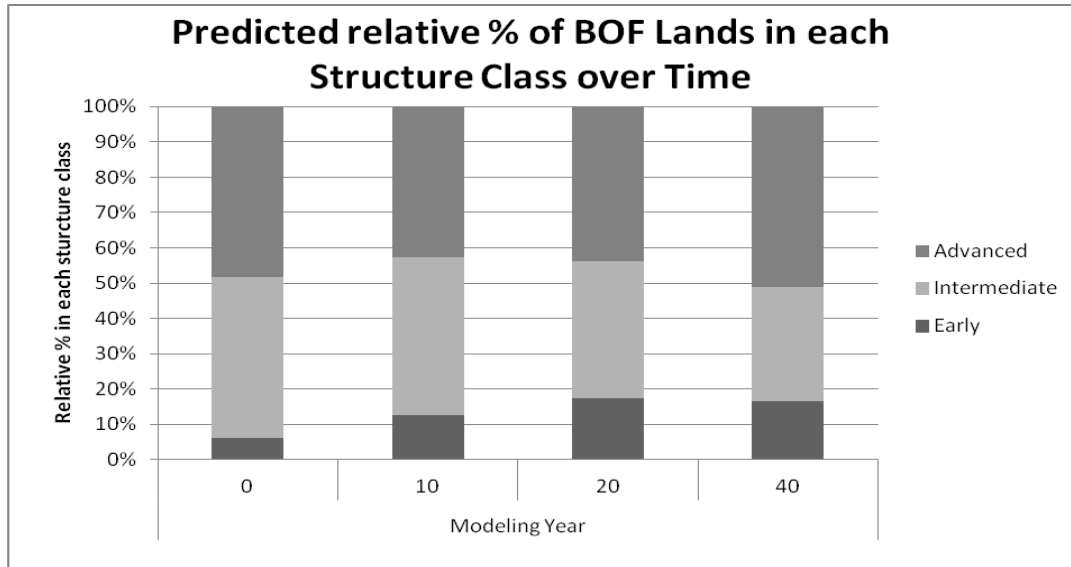
Strategy Reference: This strategy describes how the planning area will be managed to achieve a sustainable harvest level that will result in a landscape of three different stand types: early structure, intermediate structure, and advanced structure. This strategy will result in varying percentages and configuration of stand structures across the landscape over time. This strategy also describes the protection of existing old-growth stands, and promotion of a diverse tree species composition, multi-layered forests, a diverse shrub and herbaceous layer, and development of gaps in the canopy. This strategy is expected to result in conditions which emulate the diversity of stand types historically associated with conifer forests and adequate connectivity across the forest. It is assumed that since native species co-evolved with historical disturbance regimes and forest conditions which are being emulated, the full suite of forest stand types created under this strategy will provide a meaningful contribution to the habitat needs of native wildlife.

Scientific Information: Applicable science that underpins this strategy is described in Chapter 4, Sustainable Forestry Concept 1, which describes the science and background behind the use of a variety of stand types to emulate natural disturbance patterns of the Coast Range.

Also inherent in this strategy, along with the riparian management strategy and the strategy for protection of T&E Areas, is the assumption that the diversity of stand types and associated wildlife habitats will contribute to biological diversity at the landscape level and that connectivity of mature forest will occur across the landscape over time (Chapter 4, Sustainable Forestry Concept 2). This assumption can be tested through the adaptive management process. Science to further support these assumptions is described below.

Summary of existing contributions from BOF lands:

All three stand structure types are currently well represented on the BOF portion of the Elliott State Forest. Modeling predicts that stand structure types will continue to be well represented over time. Thus, it is likely that BOF lands will contribute to provide a diverse array of wildlife habitat types over time.



Strategies for Sustainable Forest Ecosystem Management, Strategy 2: Manage Conservation Areas to Protect Special Resources and Avoid Take of T&E Species.

Strategy Reference: This strategy describes the use of Conservation Areas to protect sensitive resources. Some conservation areas will be designated specifically to protect wildlife, particularly T&E areas. Other conservation areas will be designated to protect other resources but are expected to also provide wildlife habitat. Examples are riparian areas and steep, unique, and visual (SUV). Included in SUV areas are old growth stands and unique hardwood stands.

T&E areas will have a direct contribution to meeting GPV requirements to protect, maintain, and enhance wildlife habitat. Marbled Murrelet Management Areas are designated to protect areas known to be occupied by this species. These areas are typically mature or older forest and are expected to also provide habitat for other late-seral-associated species of wildlife. Spotted Owl activity centers are designated and protection measures are used to maintain habitat associated with these sites. Stand conditions vary, but most spotted owl habitat is typically mature forest or younger structurally complex forests. For both marbled murrelets and spotted owls, ODF State Forest Division policies are in place to direct management and protection of these sites (ODF 2011a & ODF 2011b). The policies include provisions for surveying to document occurrence, maintenance of habitat around known sites, and protection of sites from disturbance.

Scientific Information: ODF State Forest Division policies for management of spotted owls and marbled murrelets are based on guidance published by the USFWS (USFWS 1990, USFWS 2003, USFWS 2004), ODF research studies conducted on habitat use by spotted owls and marbled murrelets on State Forest Lands (Islam et al. 1997, Anthony et al. 1999, and Nelson and Wilson 2002, Glenn et al. 2004) and based on other best available science. The USFWS guidelines and Biological Opinions were themselves based on scientific information available at the time. Although the ITG Guidelines, which form the basis for habitat protection measures for spotted owls, were published 21 years ago, more recent research on ecology and habitat use of spotted owls has supported the guidelines for habitat retention (particularly Olson et al. 2004 & Dugger et al. 2005). Strategies for protecting areas occupied by marbled murrelets was based largely on ODF-sponsored research (Nelson and Wilson 2002) which was conducted in part on the Elliott State Forest.

Summary of existing T&E contributions from BOF lands:

BOF lands currently contribute to conservation of both spotted owls and marbled murrelets. There are portions of 8 Marbled Murrelet Management Areas, totaling 1.101 MMMA Acres currently designated on BOF lands. This represents approximately 12% of BOF acres that are contributing to conservation of marbled murrelets. There are two spotted owl activity centers currently on BOF lands. Portions of 19 different spotted owl circles (1.5 miles around each owl activity center) overlap BOF lands. A total of 6,546 or 73% of BOF lands currently occur in a spotted owl circle. Only a portion of each owl circle is required to be maintained under ODF's Take Avoidance Policy, thus not all of the BOF land in owl circles is necessarily currently contributing or will be required to be maintained as owl habitat.

Strategies for Sustainable Forest Ecosystem Management, Strategy 3: Actively Manage to Provide Key Legacy Structural Components.

Strategy Reference: This strategy describes management for within-stand habitat features to be retained in clearcut harvest units including live trees, snags, and downed wood. A summary of the strategies is below:

Live Trees: Retain 2 to 4 live trees per acre with at least 25% in upslope areas or in RMA's that extend well into upslope areas.

Snags: Retain at least three hard snags per acre at least 15" or greater in DBH.

Downed Wood: Retain an average of 300 to 600 cubic feet per acre of hard logs; each log should have a minimum volume of 20 ft³. When available, at least two logs per acre must meet or exceed 26" diameter at the large end. At least 50% of the downed log volume should be from conifer logs.

Scientific Information: The science used to develop this strategy is summarized in Appendix C of the FMP.

Combined Effect of Sustainable Forest Ecosystem Management Strategies on Wildlife Habitat.

The Strategies for Sustainable Forest Ecosystem Management work together to provide wildlife habitat across the Elliott State Forest. It is anticipated that habitat will be provided for species of wildlife native to the central Coast Range of Oregon. In addition, it is anticipated that connectivity will be adequate across the forest, particularly for species associated with closed-canopy conifer forests (connectivity is typically of concern for these types of species as opposed to open-canopy associated species). Although this is not a separate forest management strategy, the concept of connectivity is inherent in Strategy 1 which assumes that habitat will be maintained by managing for a diverse suite of forest structural types. Because it was not well described in the FMP, the science to support this assumption are described below.

Landscape connectivity may be thought of as the degree to which the landscape aids or hinders the movement of animals among resource patches (Taylor et al. 1993). Another useful definition of landscape connectivity is the outcome of species-specific dispersal behavior and movement patterns and how these interact with patterns of landscape cover (Lindenmayer and Franklin 2002). Movement of organisms through a landscape shapes the distribution and abundance of a species. Landscape connectivity can allow populations to maintain or increase their demographic and genetic size, enhancing chances for long-term persistence (Lindenmayer and Franklin 2002). Landscape connectivity also influences recovery of a species and recolonization of a landscape after disturbance; the exchange of genes and individuals in a population; as well as occupancy of habitat patches (Lindenmayer and Franklin 2002).

Strategies which support landscape connectivity

Strategies for Sustainable Forest Management Strategy 5-2—Manage Conservation Areas to Protect Special Resources and Avoid Take of T&E Species

T&E areas will be maintained on the landscape to protect known sites used by spotted owls and marbled murrelets. These areas are anticipated to remain fairly static unless it is documented that the protected species is no longer using the site or has moved to a new area. Thus, these areas are anticipated to contribute to connectivity by creating mid- to long-term patches of mature forest that will provide stepping stones across the landscape. Midspatial scale areas managed primarily for conservation goals (Lindenmayer and Franklin 2002) are one way to provide connectivity. These areas facilitate connectivity by acting as stepping stones between the larger reserves (e.g., adjacent USFS and BLM lands). In addition, midspatial scale areas contribute to biodiversity by providing important habitats for some species; protecting aquatic and semi-aquatic ecosystems; providing refugia for organisms that subsequently provide offspring for colonizing surrounding forest; maintaining landscape heterogeneity; providing nodes for restoration and expansion of key habitats; increasing protection for habitats, vegetation types or organisms poorly represented in large ecological reserves (Lindenmayer and Franklin 2002).

Strategies for Sustainable Forest Management Strategy 5—Aquatic and Riparian Systems. Riparian Management Areas will result in riparian corridors being present throughout the Elliott State Forest when harvesting occurs on both sides of a stream. Larger, less linear corridors will exist where harvest occurs on only one side of a stream and the habitat is contiguous with upslope areas. A corridor is a swath of habitat that permits movement of organisms between local populations or from one region to another (Noss 1991, Lidicker and Koenig 1996). Evidence for how and whether species use corridors or depend on them for their movement is limited (Wiens 1994), but evidence from well-designed studies generally supports utility of corridors as a conservation tool, though not essential for conservation strategies for all landscapes (Lindenmayer and Franklin 2002; Baier and Noss 1998). Some species, such as the northern spotted owl, are known to disperse randomly, so corridors are not an appropriate conservation tool for this species (Lindenmayer and Franklin 2002). Riparian Management Areas are anticipated to function as corridors for some species. Linear reserves along aquatic habitat features provide one form of connectivity on the landscape. These reserves are narrow corridors providing connectivity throughout the stream network of a watershed. Riparian reserves may be characterized by a high amount of edge, and will not, by themselves, provide adequate connectivity for all wildlife species, particularly those that are restricted to upland areas and those that are sensitive to edge. Riparian forests are habitats with unique microclimates and vegetation. A large proportion of biodiversity in forested landscapes is associated with aquatic ecosystems.

Strategies for Sustainable Forest Management Strategies 1 (Actively Manage for a Diversity of Stand Structures) and 3 (Actively Manage to Provide Key Legacy Structural Components). Conservation strategies applied throughout the matrix may provide better connectivity than corridors for species that disperse randomly (Lindenmayer and Franklin 2002). If the “matrix” between conservation areas is managed in a way that appropriate vegetation cover or key structures for species are provided for across the landscape, then the intervening landscape acts as a movement filter rather than a movement barrier (Lindenmayer and Franklin 2002). Rosenberg and Raphael noted that even small forest patches retaining down logs or large snags seemed to support forest-interior species associated with those elements (Rosenberg and Raphael 1993). Strategy 3 is anticipated to aid connectivity throughout the matrix as early seral stands transition into intermediate and advanced structure.

Stand structures that are important for wildlife include trees from multiple age cohorts; large living trees and snags; large diameter logs; vertical heterogeneity – canopy layers; canopy gaps or antigaps; thickets of understory vegetation (Lindenmayer and Franklin 2002; Carey and Wilson 2001; Bunnell et al. 1997). Providing these structural features in managed stands provides within stand heterogeneity that allows some animals to persist in the managed areas and others to disperse across the managed area that otherwise would be prevented from doing so. In addition, these structures provide structural enrichment that allows a harvested stand to return to habitat suitability sooner (Lindenmayer and Franklin 2002).

GPV Determination for BOF lands and requirement to “protect, maintain, and enhance” native wildlife habitat:

ODF believes that BOF lands currently contribute to protecting, maintaining, and enhancing wildlife habitat. A significant amount of acres of BOF lands is already designated for the purpose of protecting listed T&E species. It is expected that these areas will also provide habitat for many other species of wildlife that rely on older forest conditions. Areas on BOF lands that will be harvested will provide habitat for early seral species. Strategies to maintain or create legacies when clearcut harvesting will help to maintain important components of wildlife habitat on the landscape. These structures will enhance habitat conditions for a large suite of wildlife species. Many species identified by ODFW Conservation Strategy as being in need of conservation are expected to benefit from the strategies to be implemented on the Elliott State Forest. A few examples include:

| Strategy Species | Elliott Strategy that contributes to habitat |
|-----------------------------|---|
| Marbled Murrelet | T&E Strategy |
| Northern Spotted Owl | T&E Strategy |
| Western Bluebird | Strategy 3 (snag retention in clearcuts) |
| Red Tree Vole | Strategy 1 (specifically advanced structure stand types) and Strategy 2 (secondary beneficiary to SUV and T&E policies) |
| Clouded Salamander | Strategy 3 (downed wood retention) |
| Southern Torrent Salamander | Riparian Strategies |

OAR 629-035-0020(2)(c) Protect soil, air, and water

In the opinion of the State Forester, this FMP protects soil, air, and water. This is based on the integrated strategies, which provide the overall framework for protecting these resources, and on-site specific strategies designed to provide specific protections.

There is overlap between this section and the sections above, so strategies discussed earlier that address soil and water are not repeated here.

FMP Strategy Reference Summary: Soils

- Comply with forest practices requirements for soil protection
- Minimize management-induced slope movement by obtaining geotechnical assistance
- Maintain quantities of organic material in the soil with specific practices for prescribed burning and timber harvesting

The Department recently developed sustainable indicators for soil, air and water for all forestland ownerships in Oregon (ODF, 2007). For soil, the most comprehensive scientific document on soil productivity in the Pacific Northwest remains Perry et al. (1989). This proceedings of a major conference has several chapters that evaluate forest practices in general, including those practices used on state forests. Roads remain a major influence on soil and water, as discussed in

Mills et al. (2007), which describes the technical basis for the roads indicators and metrics used by the Department.

FMP Strategy Reference Summary: Air Quality

- Limit prescribed burning to specific areas to reduce risk of wildfire and debris flows and to remove barriers for stand establishment and wildlife forage
- Burn slash under conditions that will minimize the risk of significant fire escape
- Continue fire prevention and suppression activities
- Comply with the Oregon Smoke Management Plan
- Implement alternatives to burning, and use techniques that reduce smoke

Air resource protection is summarized in annual smoke management reports (ODF, 2010). This Smoke Management Report found emissions statewide in 2010 were the second least amount of emissions during the previous 11 year period and only two-thirds of average. It also found that State Forests represents only 2.8 percent of forest acreage burned statewide.

The FMP follows the Board of Forestry's 2003 Administrative Rules which revised practices for landslides, for both public safety and natural resource protection using continually developing science on landslides (rules adopted by the Board and promulgated in 2003). The science on other soil productivity and air quality relationships and associated forest practices has not changed significantly in recent years.

For these reasons, the FMP protects soil, air, and water.

OAR 629-035-0020 (2)(d) Provides for outdoor recreation opportunities

In the opinion of the State Forester, the FMP will provide for recreational opportunities. The integrated strategies will maintain a diverse array of stand types and properly functioning watersheds open to outdoor recreation. These recreational opportunities are anticipated to include fishing, hunting, trapping, off-road vehicle use, hiking, mountain biking, and camping.

OAR 629-035-0020(3)(a)-(f) Management Practices must: (a) pursue compatibility of forest uses over time; (b) integrate and achieve a variety of forest resource management goals; (c) achieve, over time, site-specific goals for forest resources using the process as set forth in OAR 629-035-0030 through 629-035-0070; (d) consider the landscape context; (e) be based on the best science available; and, (f) Incorporate an adaptive management approach that applies new management practices and techniques as new scientific information and results of monitoring become available.

The sustainable forest ecosystem management strategies (actively manage for a diversity of forest structures, manage conservation areas to protect special resources and avoid take of T&E species, actively manage to provide for key structural components, manage for a diverse and healthy ecosystem using integrated pest management, and manage aquatic and riparian systems) are designed to meet the goals of OAR 629-035-0020(3)(a) –(d). In addition to these landscape level strategies, the plan includes specific strategies to guide implementation and meet these standards.

The Elliott FMP is based on the best science available (OAR 629-035-0020(3)(e)). The FMP includes references to much of the science that underpins the strategies. Additional science is referenced above. This represents the body of work currently known by the Department of Forestry that has relevance to the strategies of the FMP. Staff continues to develop the body of work that makes up the best available science.

The Elliott FMP includes strategies to meet OAR 629-035-0020(3)(f). These strategies utilize the best scientific information available to guide forest resource management actions and decisions by using monitoring and research to generate and utilize new information as it becomes available. Concepts that shape adaptive management and how to implement adaptive management are described under Adaptive Forest Resource Management in Chapter 7.

Plan Elements OAR 629-035-0030 (2)

This FMP replaces the 1994 Elliott FMP and includes the elements required under 629-035-0030 (2).

These elements include:

- a. A set of guiding principles, including legal mandates and Board of Forestry policy that have provided appropriate guidance for the development of this FMP (Chapter 3, Appendix D).
- b. A description and assessment of the resources on state forest lands in these planning areas and consideration of the surrounding ownership in order to provide a landscape context (Chapter 2).
- c. Appropriate statements about what the State Forester intends to achieve for each forest resource, expressed as forest management goals (Chapter 3);
- d. Appropriate descriptions of management strategies which describe how the State Forester will manage the forest resources in the planning area to achieve the forest resource management goals (Chapter 4 and Chapter 5).
- e. General guidelines for asset management which provide overall direction on investments, marketing, and expenses (Chapter 6).
- f. General guidelines that provide adequate direction for implementing the Elliott FMP, and for monitoring, research, and adaptive management (Chapters 6 and 7).

Plan Stewardship Principles OAR 629-035-0030(3)

The proposed plan is consistent with stewardship principles outlined in OAR 629-035-0030 (3).

This portion of the planning rule contains some overlap with the section of the GPV rule giving direction to the State Forester on how to secure GPV found in OAR 629-035-0020 (2). Topics with overlap and with proposed revisions are handled in greater detail above.

The concepts and strategies of the proposed plan include strategies for actively managing forest land in the planning area. The strategies contribute to biological diversity of forest stand types and structures at the landscape level and over time by providing a variety of forest conditions and

resources (Chapter 5 Resource Management Strategies) and conserving and maintaining genetic diversity of forest tree species (Chapter 5 Resource Management Strategy 4).

Forest conditions and riparian areas are managed to result in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life (Chapter 5-Manage Aquatic and Riparian Systems).

Forests are managed to protect, maintain, and enhance native wildlife habitats (Chapter 4- Concepts for Sustainable Forest Ecosystem Management, and Chapter 5-Strategies for Sustainable Forest Ecosystem Management), recognizing that forests are dynamic and that the quantity and quality of habitats for species will change geographically and over time.

The Elliott FMP provides for healthy forests (Chapter 5- Actively Manage for a Diverse and Healthy Ecosystem Applying the Principles of Integrated Pest Management) by managing forest insects and diseases through an integrated pest management approach, and utilizing appropriate genetic sources of forest tree seed and tree species in regeneration programs.

The Elliott FMP has strategies for specific resources that maintain or enhance long-term forest soil productivity (Chapter 5-Soils).

The Elliott FMP has strategies to comply with all applicable provisions of ORS 496.171 to 496.192 and 16 USC § 1531 to 1543 (1982 & supp 1997) concerning state and federally listed threatened and endangered species. These strategies are addressed in Chapter 5-Strategies for Sustainable Forest Ecosystem Management.

Collectively the plan's strategies aim to produce sustainable levels of timber and direct management practices that protect, maintain, and enhance other forest resources. Management practices that enhance timber yield and value also contribute to the development of a diversity of habitats for maintaining salmonids and other native fish and wildlife species.

The Elliott FMP includes an adaptive management approach to use the best scientific information available to guide forest resource management actions and decisions by using monitoring and research to generate and make use of new information as it becomes available. Concepts that shape adaptive management and how to implement adaptive management are described under Adaptive Management (Chapter 7).

The Forest Management Plan for the Elliott State Forest emphasizes the need for adaptive approaches to management, in which the results of management actions are measured and compared to pre-determined objectives, and changes are made where necessary. This approach requires a commitment to long-term information gathering and the incorporation of that information into the decision-making process. Following adoption of the FMP, a 10-year research and monitoring plan will be developed as a separate document, linked to the FMP and Implementation Plan. The plan will describe the general monitoring issues that are anticipated to be addressed; provide a framework to aid prioritizing and developing specific monitoring projects to assess the effectiveness of the management strategies; guide development of annual

operations plans to support monitoring projects; and describe funding mechanisms and how available funding will be prioritized among projects.

Summary

The Elliott FMP addresses greatest permanent value by maintaining lands as forest lands, including specifications to ensure management is done in a sound environmental manner, and is predicted to provide sustainable harvest and revenues to the state, counties and local taxing districts. Management is not exclusive of other forest resources, but is pursued within a broad management context that meets several environmental standards. In the opinion of the State Forester, the Elliott FMP:

- Has a high probability to maintain and restore properly functioning aquatic habitats for salmonids and other native fish and aquatic life because sustainable forest ecosystem management strategies combined with site-specific strategies for other resources address the necessary components to maintain and restore properly functioning aquatic habitats.
- Protects, maintains, and enhances native wildlife habitats
- Protects soil, air, and water.
- Provides outdoor recreational opportunities.

The sustainable forest ecosystem management strategies actively manage for a diversity of stand structures, manage conservation areas to protect special resources and avoid take of T&E species, actively manage to provide key wildlife habitat structural components and manage for sustainable economic and social benefits. The Elliott FMP is based on the best science available and incorporates an adaptive management approach.

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