United States Department of the Interior

BUREAU OF LAND MANAGEMENT
COOS BAY DISTRICT OFFICE
1300 AIRPORT LANE, NORTH BEND, OR 97459
Home page: www.blm.gov/or E-mail: OR_CoosBay_Mail@blm.gov

1792/OR-120
128-EA-03-24

February 27, 2007

Dear Concerned Citizen:

The BLM has completed addenda to the Brummit Creek Density Management and Restoration Environment Assessment (EA Addendum 1 and EA Addendum 2). These addenda provide additional information to the Brummit Creek Density Management and Restoration Environmental Assessment (EA No. OR128-03-24). The addenda have been reviewed by the interdisciplinary planning team and myself and found to be consistent with the Finding of No Significant Impact (FONSI) that was completed with the EA.

The Brummit Creek Density Management and Restoration EA was previously made available for a thirty-day public review and comment period ending February 28, 2005. The EA addenda have been prepared to enhance and clarify information for red alder and associated hardwoods and to analyze an additional treatment area not discussed in the EA. The addenda are narrowly focused. Due to the previous extensive public review and the narrow focus, the public review and comment period for the EA addenda will be fifteen days. It will begin February 28, 2007 and end close of business March 15, 2007. Comments must be received during this period to be considered for subsequent decisions. Comments will be limited to the specific issues that are addressed in the EA addenda.

If you would like a copy of the addenda then please direct your requests or questions to Jeff Davis, Coos Bay BLM District, 1300 Airport Lane, North Bend, OR 97459, call (541) 756-0100, FAX: (541) 751-4303, or e-mail to or_coosbay_mail@blm.gov, ATTN: Jeff Davis.

Sincerely,

Paul T. Flanagan

Paul T. Flanagan
Myrtlewood Field Manager

Addendum #1 to the Brummit Creek Density Management and Restoration Environmental Assessment (EA No. OR128-03-24)

Chris Sheridan (MFO Forest Ecologist/ Team Lead)
Aimee Hoefs (MFO Fisheries Biologist)
Completion Date: 02/26/2007

1.0 Introduction

This addendum to the **Brummit Creek Density Management and Restoration Environmental Assessment, EA# OR128-03-24** ("EA", hereafter), has been produced to enhance and clarify information provided in the original EA specifically for red alder and associated hardwoods as part of the *Affected Environment* and related to the *Effects of the Action*. Key components of this addendum include:

1. Additional research and analysis on cover amount and arrangement of red alder, both current conditions and historic range of variability (HRV)
2. Discussion of the autecology of red alder, including its presence in plant associations and persistence as a patch and community type in different topographic, geomorphic, and landscape positions.
3. The functions of red alder patches and communities, including support of hardwood associated species, in terrestrial and riparian/ aquatic landscape positions.
4. Predicted direct, indirect and cumulative (including future) effects of removal of red alder patches from the action area on: a) forest structure, function, and support of species; b) aquatic function and species.
5. Review of mitigation proposed in the EA for changes in red alder cover and functions.

2.0 Hardwood cover and arrangement

Hardwood cover and arrangement was addressed in the original EA. This addendum enhances that analysis by: a) performing new analyses of hardwood cover and arrangement at two larger spatial scales (Subbasin and Province); b) contrasting these results with results from the EA (subwatershed-scale), as well as with primary literature; and c) describing the distribution of hardwoods in different topographic positions.

2.1. *Historic red alder hardwood patch cover and arrangement*

Historic hardwood cover conditions were analyzed using cover type maps of conditions in the 1930s (Harrington 2003) and historic (1800s) survey records for the Coquille Subbasin. 1930s cover type maps developed by (Harrington 2003) were converted to raster format and analyzed using FRAGSTATS. This 1930s image has a number of biases affecting its accuracy, interpretability, and relevance, including:

- Grain size. Based on distribution of patch sizes in this image, the "operational grain size" (the smallest patch differentiated) was probably on the order of 40 ac.
- Single, recent historic reference point. Forest conditions in the 1930s only roughly approximate conditions prior to European settlement, and represent only a single, discrete reference period. Use of this 1930s image as a surrogate for historic conditions assumes minimal European influence on the landscape at this period. This assumption is not true of hardwood-dominated bottomlands, which had been largely converted to agriculture, grazing or home sites by this time. Separate data from the 1800s is presented for the Coquille Subbasin to illustrate periods less influenced by European settlers.

- Subjectivity in determining "nonforest areas". For this analysis, "burned", "denuded", and "nonforest" types were lumped as nonforest. Based on observation of 1950s aerial photos, many nonforest patches (perhaps 30-50%) would have supported some hardwood component.
- Mixed hardwood patches. These types were not identified in 1930s surveys. Therefore, hardwoods occurring in small (< 40 ac.) patches were lumped with conifer or non-forested patches. To facilitate comparison with historic data, modern data grain size was increased.

Hardwood cover was analyzed at the spatial scales of the CR Province and the Coquille subbasin. Note that the Coquille subbasin contains areas outside of the CR Province. These areas do not support large cover by the tanoak series, and include the analysis area for the Brummit EA, and are therefore considered an appropriate second analysis scale. Results from analysis of this created historic imagery were compared to published studies for the CR Province and other analysis landscapes.

2.1.1. Coast Range Province

Analysis of the composite 1930s cover type map (Harrington 2003) suggests that the Coast Range (CR) Province of Oregon in the 1930s supported roughly **4%** cover by hardwood patches[1] (**Table 1A**). Hardwood patch size averaged > 1,000 ac.[2]. Historic hardwood patch distributions were dominated by moderately small patches (75th quartile (75% of patches) was 672 ac.); the largest of these patches covered only a small part of the landscape (LPI=0.5%) compared to conifer and non-forest patches. Theses small hardwood patches were somewhat clumped (Clumpiness 0.67) (**Table 1A**).

The 1930s image (**Figure 1**) appears to support the importance of two drivers in CR Province hardwood (and non-hardwood) distribution: 1) discrete disturbance events such as the Tillamook fires, producing large areas of nonforest cover in the CR foothills; and 2) a longitudinal gradient in hardwood cover, driven by some combination of land use (farming/grazing vs. forestry), geomorphology (valley bottoms vs. foot slopes), climate, and elevation. These drivers would be predicted to produce a historic distribution of hardwood patches that included relatively few patches of modest size, which were somewhat clumped in the western portions of the CR Province, at lower elevations within basins.

(Wimberly and Ohman 2004) estimated roughly 3.6% hardwood cover for the Oregon Coast Range in 1936, roughly comparable to these results. (Kennedy and Spies 2004) described historic cover and arrangement of hardwood and other cover types for the central Oregon Coast in the period 1939-1994, at a small scale (20 m) of spatial resolution. Results from this work suggest that historic (1939) cover by hardwood patches (> 0.1 ac.) in the central Oregon Coast Range may have been roughly 22%, far higher than CR Province estimates by either (Wimberly and Ohman 2004) or this analysis (using data summarized by (Harrington 2003)). This apparent discrepancy appears to be principally a function of analysis scale and disturbance history, and is discussed by (Wimberly and Ohman 2004)(pg. 644). The area analyzed by (Kennedy and Spies 2004) was dominated by the Alsea and Siletz basins, which had higher levels of hardwoods than the other basins in the CR Province during the 1930s, due to their particular disturbance history. This localized higher hardwood cover is evident in **Figure 1**. Smaller grain size (20m) in the (Kennedy and Spies 2004; Kennedy and Spies 2005) analyses may have allowed splitting of hardwood patches that were lumped in the analysis here described; analysis of 1994 data with a 25 m resolution led to more comparable results (see below). (Kennedy and Spies 2004) classified roughly 20% of their analysis area as nonforest (water, road, bare, herb, or shrub) vs. 30% for data from (Harrington 2003); the finer resolution used by (Kennedy and Spies 2004) may have allowed them to class more open areas as hardwood. (Ripple, Hershey et al. 2000) found roughly 11% cover by hardwood-dominated stands in a study of pre-logging landscapes in the north-central Oregon Coast Range (prior to 1949); roughly 40% of the cover included forest types with some (≥ 20%) red alder component.

[1] Hardwood patches < 40 ac. in size were not identified by this analysis. Smaller hardwood patches were probably lumped with conifer or non-forest patch types.
[2] 40 ac. was the grain size for this image. This would strongly influence the estimated mean patch size.

2.1.2. Coquille Subbasin

Estimated historic hardwood conditions in the Coquille subbasin included lower hardwood cover (**1.2%)** and slightly smaller mean patch size than the CR Province as a whole (**Table 2A**). Historic hardwood patches in the Coquille subbasin were dominated by moderately small patches (50% of the hardwood cover was $\leq$ 712 ac.). The historic Coquille subbasin landscape was slightly less diverse than the CR Province as a whole (diversity index (SHDI) of 0.65 vs. 0.78). (Wimberly and Ohman 2004) estimated cover by hardwood in the Coquille subbasin at 1.5%, similar to these estimates.

2.1.3. Variability in different topographic and landscape positions

Historic hardwood cover was variable by topographic position and broader landscape position within the CR Province (**Figure 1**), presumably due to variability in environmental and disturbance gradients described above. Strong variability was observed between bottomlands and upper watershed topographic positions, with little hardwood in upper watershed positions. Additionally, pre-European bottomland conditions may have been significantly different than conditions depicted in 1930s cover type maps (DEQ**; Table 3**). Cover types supporting hardwood communities or species may have covered roughly 4% of the Coquille River Subbasin in the 1800's (**Table 3**), in areas classed primarily as nonforest or conifer in 1930s cover type maps.

Historically, hardwood patches occurred both along ridges (Kennedy and Spies 2005) and in slide paths in the CR Province. Upper watershed areas, including the EA action area, were generally depicted as coniferous patch types in 1930s cover type map (**Figure 2**). Hardwood patches < 40 ac. in size are visible in 1959 aerial photographs of areas south of the EA units in the WF Brummit drainage (for example), but do not appear in the immediate vicinity of these EA units (**Figure 4**). Considering the disturbance regime, climatic conditions and higher elevations of the action area, hardwood cover in the action area prior to European settlement would be predicted to be low and confined to fluvially-disturbed areas, outside of major fire returns (see "**Red Alder Distribution on the Landscape**", below).

2.2. *Current cover and arrangement of hardwood patches; patch dynamics*

Current (modern) hardwood cover conditions were analyzed using a modified 1994 WODIP cover type map (Nighbert, O'Neil et al. 1997). Data transformations included reclassification and smoothing to depict three classes (hardwood, conifer, and nonforest), and aggregation to a 400 m grain size. Smoothed WODIP data with its original 25 m grain size and four cover types (including a "mixed" conifer/ hardwood class) was also analyzed for comparison. Current hardwood cover was analyzed at the spatial scales of the CR Province and the Coquille subbasin. Results from analysis of current cover maps were compared to historic and current hardwood cover and arrangement data analyzed by (Ripple, Hershey et al. 2000), (Wimberly and Ohman 2004), (Kennedy and Spies 2004), and (Kennedy and Spies 2005). Results from the original EA for the analysis area and action areas are also repeated here for context.

2.2.4. Coast Range Province

Analysis of the smoothed 1994 WODIP cover type map suggests that the Coast Range Province of Oregon in 1994 supported roughly **5%** cover by hardwood patches (**Table 1B**). Mean 1994 hardwood patch size was small; 75% of modern hardwood patches were < 79 ac. in size. Modern CR Province cover estimates are roughly comparable to data in (Wimberly and Ohman 2004), who estimated roughly 7% hardwood cover for the Oregon Coast Range in 1996. (Kennedy and Spies 2004) described much higher levels of hardwood cover in the modern period for the central CR (roughly 20%); reasons for this difference are probably similar to those described above for historic data (above). Similarly to the current analysis (**Table 1B**), (Kennedy and Spies 2005) observed that modern hardwood patches were smaller and had higher complexity (i.e. were more fragmented).

CR Province hardwood dynamics. The current analysis of changes in hardwood cover in the CR Province suggests that: a) hardwood cover in the Coast Range Province has increased; b) hardwood patches have become smaller, more dispersed, and more complex; and c) variability in these conditions occurs at several spatial scales. In this analysis, hardwood cover in the CR Province increased from **4% to 5% (Table 1A, 1B).** Other studies have also shown an increase in hardwood cover from historic conditions. (Wimberly and Ohman 2004) describe a 100% increase in CR hardwood cover since the 1930's, from 3.6% to 7%. In contrast, (Kennedy and Spies 2004) describe a decrease in hardwood for the central CR Province in the period 1939-1994 at a small scale (20 m) of spatial resolution. This difference in direction of change is probably an artifact of spatial variability. (Wimberly and Ohman 2004) also show a decrease in hardwood cover in hardwoods in the Alsea basin, a primary portion of the (Kennedy and Spies 2004) analysis area. (Wimberly and Ohman 2004) state that this decrease was more than offset by increases in hardwood cover in the Siuslaw, Umpqua, Coos, and Coquille subbasins, resulting in an overall increase in hardwood cover in the CR Province as a whole. Published studies of even larger landscapes seem to support the hypothesis that red alder has increased in the Pacific Northwest generally over historic (last several centuries) conditions (Niemiec, Ahrens et al. 1995). Pollen data (Cwynar 1987) suggest that modern red alder cover levels are far above those of 900 years ago and are more comparable to those of 11,000 years ago. Decadal analysis (through 2006) suggested a net increase of 14% for red alder cover in Oregon (Ahrens 2006).

Hardwood patch size and arrangement in the CR Province also changed from historic conditions. Modern (1994) hardwood patches were 1/10th the size of 1930s hardwood patches, with 75% of modern patches < 80 ac. (**Table 1A, 1B**). Modern hardwood patches were far more dispersed (lower Clumpiness, lower Connectance) than historic (1930s) patches. These conditions are evident visually at the CR scale (**Figure 1)**. Patch complexity (PAFRAC) and diversity (SHDI) were roughly comparable between the two time periods. (Kennedy and Spies 2005) also found decreasing hardwood patch sizes between 1939 and 1994, as well as higher hardwood patch complexity. During this study period, > 30% of hardwood patches changed type, either through succession or management (Kennedy and Spies 2004). Although this rate of change is high, hardwood patches were one of the most stable patch types in the central CR landscape during this period, perhaps due to maintenance by fluvial disturbance processes and less intensive management during the analysis period.

2.2.5. Coquille Subbasin

Modern (1994) hardwood cover in the Coquille subbasin was estimated as **4.5%** in this analysis, roughly comparable to CR Province hardwood cover (**Table 2B**). Moderately small patches made up the bulk of the sample (50% of the hardwood cover in the basin was provided by patches < 198 ac.), and hardwood patches were highly dispersed within the basin (Clumpiness 0.27). (Wimberly and Ohman 2004) estimated 1994 cover by hardwoods in the Coquille subbasin at 14%, significantly higher than this analysis, probably due to the smaller grain size used in their analysis. Using a 25 m grain size for the current analysis provided an estimate of 13.4% hardwood cover, comparable to (Wimberly and Ohman 2004) data and closer to (Kennedy and Spies 2004) estimates for the central CR (**Table 2C**). If mixed hardwood stands are considered a separate class, hardwood-supporting cover types would be roughly 14% (**Table 2D**).

Coquille subbasin hardwood patch dynamics. Comparison of the smoothed, aggregated 1994 WODIP map of the Coquille subbasin to the composite1930s cover type map (Harrington 2003) for the same area suggests that: a) hardwood cover in the Coquille subbasin has doubled since the 1930s (**Table 2A, 2B**) and may have increased 10-fold (**Table 2D**); b) hardwood patch number has increased dramatically, while patch size has dramatically decreased; c) hardwood patch dispersion has greatly increased, increasing landscape diversity/ fragmentation (**Table 2A, 2B**). Historic hardwood cover in the Coquille subbasin was estimated as **1.2%** (**Table 2A**), comparable to (Wimberly and Ohman 2004) estimates for the Coquille subbasin (1.5%)[3]. Modern (1994) hardwood cover in the Coquille subbasin was estimated as

[3] Pre-settlement hardwood cover in bottomlands (prior to 1930s cover maps) may have been higher (see below).

4.5% using a comparable (400 m) grain size (**Table 2B**). (Wimberly and Ohman 2004) also described large increases in hardwood cover in the Coquille subbasin since the 1930s, larger than changes in other basins. Historic basin-level fragmentation increases are similar to those described in (Kennedy and Spies 2005). Basin data analyzed at a 25 m grain size suggest that much of the hardwood patch structure in the basin (and probably in the CR Province) comes from very small (< 60 ac.) patches (**Table 2C, 2D**). These patches occur within larger coniferous patches and, in conjunction with "mixed" hardwood patch types, provide significantly more hardwood function to the landscape than is implied by larger (400 m)-grained analyses.

2.2.6. Brummit EA Action Area (Brummit Subwatershed)

The original EA estimated modern cover by pure hardwood patches in the analysis area (the upper portion of Brummit Creek Subwatershed) as roughly 8**%;** EA estimates of cover by mixed stands (with any hardwood component) was estimated at almost 40% (**Table 4**). These estimates differ from the above analyses, probably due to: a) use of stand-typed polygons which are sensitive to the presence of hardwood in mixed stands; and b) having a different analysis landscape (subwatershed vs. subbasin or Province).

2.2.7. Hardwood variability in different landscape/ topographic positions

To assess the importance of valley bottoms in supporting hardwood in the landscape, a separate analysis was performed for modern (1994) data quantifying hardwood cover in valley bottom areas (defined as areas within 400 m of large streams), using a 25 m grain size (**Figure 1; Table 1D**). Modern valley bottom areas had roughly similar and slightly lower hardwood cover than the modern CR Province as a whole (**Table 1D; Figure 1**); non-forested cover types in valley bottoms were far higher than the CR Province as a whole. These results may have been influenced by smoothing functions which lumped small hardwood patches with larger non-forested or conifer patches. (Nierenberg and Hibbs 2000) found roughly 50% of unmanaged stream valley areas as treeless; roughly 30% supported mixed and pure conifer, and roughly 20% were typed as hardwood. (Kennedy and Spies 2005) observed hardwood cover > 20% in lower slope positions in modern central CR, an increase from historic conditions.

Much of the action area for the EA is in an upper watershed position. Based on microclimatic/ autecological relationships (described below), upper watershed landscape positions would be predicted to have supported low cover by hardwood patches historically, except following periods of intense disturbance such as in the central CR immediately following European influence. Hardwood patches were not extensive in the 1930s in the upper Coquille Subbasin surrounding the action area (**Figure 2**). Historic (1959) photos of the action area, typified by the Scattered Skeeter area shown in **Figure 4**, depict little harvest disturbance, strong fire disturbance patterning of conifers, limited mass wasting patterning, and few hardwood patches (**Figure 3**).

2.2.8. Differences in hardwood cover estimates in different studies

Different studies produce different estimates of hardwood cover and hardwood dynamics (change) in the landscape. Differences in estimates of hardwood cover for the studies considered in this Addendum are probably attributable to differences in: a) grain size; b) cover type classifications (*contrast* **Table 2B-D** *with* **Table 4**); and c) the inherently high spatial variability in hardwood cover within the CR Province (**Figure 1**) and within the Coquille subbasin (**Figure 2**), leading to different results for different analysis areas and time periods. Analyses using stand-typing estimated historic (Ripple, Hershey et al. 2000) and modern (Brummit EA, Pg. 31, *included here as* **Table 4**)[4] hardwood cover as higher than comparable studies. Only one study (Kennedy and Spies 2005) showed a decrease in hardwood cover since European

[4] Note that estimates using stand type definitions (Ripple et al. 2000, Brummit EA pg. 31) observed far higher levels of mixed conifer-hardwood stands.

settlement, in a portion of the landscape which had experienced hardwood invasion prior to the study period. The direction and magnitude of change in red alder cover in our analysis is consistent with reports by (Niemiec, Ahrens et al. 1995) and pollen data in (Cwynar 1987) suggesting a large increase in PNW red alder levels above long-term historic conditions.

2.3. *Current conditions for red alder in aquatic systems*

Environmental baseline for in-stream and riparian large wood

While it is not possible to quantify what the reference stream conditions were in the East Fork Coquille stream system, it is easy to demonstrate that current aquatic habitat conditions have been dramatically changed, in most part by human manipulation. This manipulation includes harvest of riparian vegetation, splash dams and log drives, and development of an extensive road network. These practices have resulted in the following negative effects to the aquatic system within this watershed: loss of instream complexity, down-cutting of stream channels, high water temperatures, increased sedimentation, loss of connectivity with floodplains, and overall in-stream habitat simplification (USDI 2000).

Two of the main habitat components that have been most affected by these practices are instream large woody debris and available large wood from adjacent riparian stands. ODFW aquatic habitat stream surveys as well as additional field surveys associated with this project reveal these current conditions in each sub-watershed.

Large wood: The effects of large woody debris (LWD) as a key component of high quality aquatic habitat for fish has been well documented (Harmon, Franklin et al. 1986; Bisson, Bilby et al. 1987; Sedell, Bisson et al. 1988). Past management practices, including riparian harvest and "stream cleaning" have depleted the current levels of LWD within the East Fork Coquille watershed. The following table is a summary of the current condition taken from the ODFW aquatic habitat surveys and includes the addition of LWD planned for the summer of 2007.

Summary of Stream Reach Data for existing and future LWD as aquatic structures. The Threshold mentioned in the last column is from ODFW and the East Fork Coquille Water Quality Management Plan, which suggest a minimum of 50 Key pieces per mile of stream as the environmental Threshold.

Stream Name	Total Reaches	Average Key pieces / stream mile	Pieces added (2007)	Cumulative Key pieces / stream mile	Pieces needed to reach Threshold in each reach
China Creek and Trib A	3	40.01	40	57.71	18.98
West Fork Brummit	9	18.26	119	36.38	120.50
Middle Fork Brummmit	4	79.23	0	79.23	6.90
East Fork Brummit	6	33.72	0	33.72	133.96
Karl Creek	5	60.80	20	70.85	72.11

Riparian Stand Condition: These surveys also completed a Riparian Zone Summary. This component of the survey is important because it correlates and complements the other survey categories concerning fish habitat quality. These zones are surveyed to determine the potential for the recruitment of large woody debris and maintenance of high quality habitat (Foster, Stein et al.). The following table shows the current condition of surveyed reaches within the project area. In every reach for both categories, the benchmark rating is "poor."

Summary of Stream Reach Data for Riparian Zones surveyed. The numbers are the summary extrapolation to 1000 feet along the stream. The Hardwood (HW) numbers are included to show the comparison.

Stream Name	Total Reaches	Total HW / 1000 ft	Total Con / 1000 ft	Tot. Con >20" DBH / 100 ft	Habitat Benchmark Rating[5]	Tot. Con >30" DBH / 1000 ft[6]	Habitat Benchmark Rating
China Creek	3	744	37	12	Poor	12	Poor
China Creek Trib A	1	975	20	20	Poor	0	Poor
Middle Fork Brummit	5	540	279	70	Poor	35	Poor
East Fork Brummit	6	1037	400	20	Poor	10	Poor
West Fork Brummit	9	1028	56	5	Poor	2.7	Poor
Karl Creek	4	705	444	139	Poor	69.7	Poor

There are currently more hardwoods than conifers, and of these conifers, there are few that if they fell towards the stream channel, would be able to function as large woody debris. Only Karl Creek has some short-term (0-50 years) possibility of contributing to aquatic habitat through the introduction of large wood.

2.4. *Summary: Hardwood cover and arrangement*

Several conclusions can be drawn from modeling and primary literature describing historic and modern hardwood cover and arrangement in the analysis area landscape.

1. The historic distribution of hardwood patches included patches of modest size, somewhat clumped in the western portions of the CR Province at lower elevations within basins. Hardwood patch cover increased slightly at the scales of the CR Province (very roughly 4% to 5%) and Coquille subbasin (very roughly 1% to 5%) from the 1930s to 1994 (this analysis and (Wimberly and Ohman 2004)). These analyses may under-represent hardwoods in mixed stands; it is unclear whether mixed stands have functions similar to hardwood-dominated stands. Although there is some difference in estimates of magnitude of hardwood changes, large-scale studies ((Cwynar 1987), (Niemiec, Ahrens et al. 1995)) suggest that modern red alder cover levels in the PNW are far higher than historic conditions.

2. (Kennedy and Spies 2005) suggest that "the current pattern of hardwoods probably results from a combination of topographic positions, vegetation types, and management practices that vary by ownerships, and from the historical conditions particular to the study area" (pg. 371). The disturbance history unique to the CR produced a **range** in hardwood cover levels through time (HRV); different disturbance histories in different portions of the CR Province (i.e. basins) produced a range in hardwood covers across the Province at any point in time. Historic range in hardwood cover for the entire CR Province has not been modeled. The **range in 1930s hardwood cover** for the 13 **basins** within the CR Province analyzed by (Wimberly and Ohman 2004) was **0-13%** (mean **3.6%).** The **1996 range** in hardwood cover in the CR was from **3.2%** (Middle Willamette)-**13.7%** (Coquille). The Coquille subbasin has experienced one of the most dramatic increases in hardwood cover in the last 60 years (1.5%-13.7% according to (Wimberly and Ohman 2004), **Table 4**). Pollen data (Cwynar 1987) and comparison to early (1912) surveys (DeBell 2006) suggest that modern (1994) hardwood cover levels in the PNW approach the high end of historic variability for the current climatic period, perhaps responding to widespread fires at the turn of the century (especially in the central CR) and large increases in road construction and other disturbance. The magnitude and direction of change in hardwood dynamics in the CR Province can be contrasted with late-successional forest dynamics in the same landscape. Late-successional coniferous forest has been reduced from > 50% in the CR Province to <11%, far outside its historic range (Wimberly, Spies et

[5] Poor = 150 trees or less >20" DBH, Desirable = 300 trees or more > 20"DBH
[6] Poor = 75 trees or less >30" DBH, Desirable = 200 trees or more >30" DBH

al. 2000); hardwood cover in the CR Province was probably never very large, and has increased (predicted future changes discussed below).

3. The arrangement of hardwood patches on the landscape (CR Province and Coquille subbasin) also changed from the 1930s to 1994; hardwood patch number increased, patch size decreased, and hardwood patches became more dispersed. Analyzed modern (1994) hardwood patches were 1/5th-1/10th the size of 1930s hardwood patches, with 75% of modern patches < 80 ac. (**Table 1**). Modern hardwood patches were far more dispersed than historic (1930s) patches (**Table 1;** see also (Kennedy and Spies 2005)). These conditions are evident visually at the CR scale (**Figure 1)**, and obvious at the basin scale (**Figure 2**). The importance of hardwood patch fragmentation in hardwood function and species support is considered below.

4. Hardwood cover is variable by topographic position within larger landscape units, and there have been changes in hardwood topographic relationships since European settlement in the Province including loss of hardwoods from some key landscape positions. Prior to European settlement, hardwoods may have been restricted to fluvially-disturbed or fire-disturbed areas. "Expansion of hardwoods beyond near-stream areas may have occurred prior to the 1940s, following the large fires that occurred in the settlement period. Hardwoods may be declining across the [Central CR] landscape and becoming restricted to near-stream areas partly in relation to this prior expansion." ((Kennedy and Spies 2005), pg. 371). In upper slope/upper watershed portions of the action area, typified by upper Karl Creek drainage **(Figure 2, Figure 3**), hardwoods appear to have invaded following 1930s logging which removed late-successional conifer patches. A "decline" in current hardwood cover levels would actually represent a return towards pre-European historic mean conifer/ hardwood cover levels within the action area.

5. Variability in hardwood cover also occurs at larger landscape units. Post-settlement loss of historic bottomland hardwood communities (such as the lower Coquille subbasin) (((DEQ) 1988)**; Table 3**) occurred prior to the 1930s and so is not considered in most published change detection analyses. These historic bottomland hardwood communities (classed primarily as nonforest or conifer in 1930s cover type maps) made up < 4% of the Coquille subbasin, but may have provided key hardwood forest functions historically.

6. Land ownership has also played a complex role in hardwood dynamics in the CR Province. In the central CR, (Kennedy and Spies 2005) observed decreases in federal hardwood cover (probably due to succession and active management of extensive post-fire hardwood resources), while hardwood cover on nonindustrial forest ownerships increased. In contrast, hardwood cover in both private and federal ownerships in the Brummit Creek analysis area has increased since the 1930s. Much of the hardwood cover in federal and state ownership is passively managed currently.

7. Streams in the analysis area are deficient in high quality large woody debris. Red alder is abundant near streams in the analysis area, but provides LWD with limited function (described below).

2.5. *Red Alder Distribution on the Landscape*

Red alder distribution on the landscape is determined by the autecology of the species, site conditions, presence of other species, and disturbance regime. Red alder is associated with moist, warm climatic and microclimatic conditions; this autecology influences its distribution at multiple spatial scales. At the Province-scale, red alder is therefore most prevalent/productive at elevations < 450 m and within 200 km of the ocean (Harrington 2006). At the topographic position/ landform-scale, red alder's association with moist microclimates leads to the following site relationships:

Broad landform scale. The west/ coastal side of Coast Range features (where tall north-south ridges cause rapid orthographic uplift of storm fronts resulting in localized pockets of high annual rainfall) generally provide moist environments favorable to red alder. Current red alder distributions on the west side of the CR Province reflect post-settlement loss of historic bottomland hardwood communities, hardwood conversion, and hardwood expansion due to modified disturbance regimes.

Topographic position scale. Red alder distribution is highly influenced by moisture gradients associated with distance upslope and away from concave topographic features. Hardwood and nonforest cover decrease with increasing distance from streams, in both historic (Ripple et al. 2000) and modern unmanaged (Nierenberg and Hibbs 2000) landscapes. Red alder density tends to be greater on flat surfaces close to streams (Hibbs and Bower 2001). In contrast, Douglas-fir is slightly more common on south slopes, with increased distance from the water, and only rarely occurs on flat (valley floor) surfaces or < 1 meter elevation above water (Hibbs and Bower 2001).

Prior to European settlement, hardwoods may have been restricted to fluvially-disturbed or fire-disturbed areas. Expansion following large fires was replaced by gradual decline and restriction to historic positions (Kennedy and Spies 2005). Fire and logging disturbances occurred later in the action area than in the central CR, and thus higher hardwood patch densities remain in upper slope/upper watershed positions in the action area (**Figure 2, Figure 4**).

Red alder distribution is also affected by the aspect of topographic features. In individual sites, red alder is more common on north- and east-facing slopes (Knapp et al. 1984). Red alder is not found on droughty soils, and so is often absent from south-facing sites.

Variability by Plant Association. Red alder and Douglas-fir both have broad ecological amplitudes, which overlap but do not entirely coincide. Plant associations can assist in identifying sites which would be predicted to support one or both of these species under a pre-European settlement disturbance regime (i.e. infrequent, pulsed fire return in the CR Province). **Plant associations** are diagnostic assemblages of plant species that develop under a particular set of innate site, soil, climatic, and broad disturbance conditions, and are therefore useful as taxonomic and predictive tools describing site conditions, vegetative processes, and responses to management and natural disturbances. "Drier"/ "colder" associations within the analysis area, such as western hemlock/evergreen huckleberry (TSHE/VAOV2), usually support low **absolute cover** in red alder except following certain disturbance types; field observations suggest these associations do not have prolific red alder regeneration. "Wetter" associations within the analysis area, such as western hemlock/ salmonberry (TSHE/RUSP), have higher absolute cover in red alder, and have been observed to support dramatic red alder natural regeneration.

Disturbance regime. Whether alder, or Douglas-fir, or a mix of the two, occupies a site depends on **disturbance pattern, frequency,** and **intensity**. In moist environments, under a pattern of high intensity and frequent disturbance, red alder can replace Douglas-fir as the dominant species on a site. (Nierenberg and Hibbs 2000) determined high intensity fluvial disturbances occurred at least 2.6 times/stream km/century in unmanaged riparian areas in the central Oregon Coast Range, maintaining red alder. Frequent, intense fire returns in moist environments would also be predicted to select for red alder. Soil altering disturbance, such as landslides or compaction, can also give alder a competitive advantage on sites that conifers would otherwise dominate. Seed source composition and abundance, the amount of moisture available at the time of germination and establishment, and seedbed condition also interact to affect stand composition following a stand replacement event. Disturbance regimes in the CR Province have changed dramatically in the recent past, from an infrequent/ pulsed/ intense disturbance regime (prior to European influence), to an intense management and fire disturbance regime (early European influence) to a patchwork of high (private) and lower (public) frequency non-fire, stand-replacing disturbances (current influence). Red alder has responded vigorously to this change in disturbance regime.

2.6. *Red alder patches within the analysis area*

Red alder patches considered for hardwood conversion occur across a number of topographic positions, including upper, mid- and lower slope areas**.** The EA described hardwood communities in the analysis area as occurring "in association with moist, disturbed soils, primarily: a) in riparian contexts; b) in lower slope positions (especially in the southwestern portion of the analysis area); c) associated with poorly-regenerated fillslopes, or in some combination of the above contexts" (EA, pg. 30). Red alder hardwood patches, mixed conifer-hardwood patches and conifer-dominated patches currently form **a mosaic** in the analysis area (environmental baseline). Coquille subbasin-scale diversity is moderate (Shannon's diversity index (SHDI) = 0.80), considering that only three structural classes (conifer, hardwood, nonforested) were discriminated (**Table 2; Figure 1**).

Hardwood conversion units in the action area support a range of plant associations in the western hemlock (TSHE) series. Associations in midslope positions would include western hemlock/ swordfern (TSHE/ POMU-SWO7). Associations in moister, lower slope, often north-facing positions would include TSHE/RUSP (Atzet et al. 1996) (Forest Ecology Technical Report for EA). TSHE/ POMU associations would be predicted to support little red alder in the absence of disturbance; TSHE/RUSP associations frequently support red alder as an understory species, and occasionally as an overstory species. Many of the forest patches in the TSHE/RUSP association in the analysis area were eliminated from treatment consideration due to proximity to fish-bearing streams.

3.0 Red Alder Functions

Red alder trees, patches, stands, and larger landscape units (e.g., whole drainages dominated by hardwoods) provide different sets of ecological functions than conifers do in these settings. Red alder influences ecosystem functions including: 1) nutrient (especially nitrogen) dynamics and soil relationships; 2) stand structure, including overstory, understory, shrub/herb components; and 3) legacy structures, including snags and downed wood provided to both to terrestrial and fluvial systems. Red alder community characteristics and functions support a distinct biotic community in terrestrial, aquatic, and riparian contexts. Red alder functions and the suite of species supported by hardwood communities are described more fully below, including both terrestrial and aquatic support functions.

3.1. *Red alder support of terrestrial functions*

<u>Nitrogen/nutrient dynamics and soil relationships</u>

In forest ecosystems, nitrogen (N) is a critical nutrient that regulates plant growth and the cycling of other essential nutrients, such as calcium (Perakis, Maguire et al. 2006). Nitrogen fixation in red alder may be an adaptation to cycles of nitrogen depression following episodes of intense reburns, as well as to the nutrient-poor soils in fluvially-disturbed landscape positions. Red alder increases N levels in terrestrial environments and adjacent stream segments through nitrification. On nitrogen deficient sites, red alder may improve soil and stand productivity, stimulating tree growth and uptake of calcium (Miller and Murray 1977).

For sites with higher quality (e.g., Site Class II), there is negligible increase in site productivity from added Nitrogen (Miller, Obermeyer et al. 1999). There have been no recent large, intense re-burns in much of the Coast Range; soil nitrogen levels on approximately a third of the Oregon Coast Range forest sites are high enough that adding nitrogen would not register an increased conifer growth response. Nitrogen inputs by red alder on sites that are already nitrogen rich can have undesirable effects on soil calcium, magnesium, and phosphorus availability ((Compton, Church et al. 2003), (Perakis, Maguire et al. 2006)). Excess nitrate lost to groundwater and streams (nitrate leaching) strips positively charged base

[7] Due to recent (1970s) disturbance, plant associations in hardwood conversion units are not immediately apparent. Adjacent unmanaged stands at similar elevations and aspects provide reference for action area stands.

cations (i.e. calcium and other nutrients) vital for continued plant growth. Trees growing in soils with over-abundant nitrogen can thus develop nutrient imbalances. High levels of stream nitrogen from alder-dominated coastal watersheds may lead to eutrophication of estuaries and change estuarine community composition (Cloern 2001 cited in (Compton, Church et al. 2003)).

Deciduous (red alder) stands have different quantity (more), timing (pulsed), and quality (higher; more N) of litter input to terrestrial and aquatic (Hart 2006) systems. Red alder is also often associated with disturbed sites. Thus soils under red alder patches are often distinct from that under conifer patches.

Stand structure in red alder patches

Red alder is a pioneer species, intolerant of shade. Pure red alder stands are more commonly associated with stream bottoms, lower slopes or other disturbed, mesic sites. Red alder-dominated patches support high tree densities (Niemiec, Ahrens et al. 1995) with little vertical diversity and low densities of some decay structures (e.g., cavities). Red alder hardwood patches generally support higher herb species richness/diversity but lower shrub richness and density than adjacent coniferous stands (Hibbs and Bower 2001).

Hardwood (red alder) patches within mixed conifer stands play a different structural role. Red alder in mixed stands increases horizontal diversity by creating patches which develop into canopy gaps through succession. Alder increases vertical structural diversity in mixed stands by providing multiple canopy layers (conifer overstory, hardwood midstory and conifer seedlings) in early succession; later in succession the loss of red alder facilitates understory reinitiation by shade tolerant conifers (Duncan 2004). Hardwood patches within mixed stands also increase stand-level plant diversity, by incorporating hardwood associates within coniferous stand matrices.

Legacy structures in red alder communities

Red alder legacy structures (snags and downed wood) do not persist in stands, and alder patches produce far lower volumes of large woody debris during succession, due to alder's smaller bole sizes, short lifespan, and fast decay rate compared to conifers (Duncan 2004). Red alder, once dead, is not decay resistant, and alder wood is comparatively weak/ breakable (Niemiec, Ahrens et al. 1995); red alder structures loose structural integrity due to advancing decay and breakage within a few years in aquatic habitats (Keim, Skaugset et al. 2000). Unlike other hardwoods, red alder provides limited large cavities, due to its ability to compartmentalize heart rot. Legacy structures produced by red alder are used by a number of terrestrial species, and these structures function in aquatic systems when transported there by disturbance. Support of terrestrial and aquatic functions and species by red alder is discussed below.

Support of terrestrial species

Red alder provides an important deciduous component in the predominantly coniferous forests of the Northwest. Red alder provides a source of nutrients and energy distinct from conifers, as well as a different cover resource (McComb 1994). Over 136 vertebrate species probably use red alder forests for reproduction and > 178 vertebrate species use red alder patches for feeding; these numbers are lower than predicted numbers for conifer stands, and are probably underestimates (McComb 1994). The suite of taxa associated with red alder communities and their functions is summarized below:

- Plants. Herb species richness is higher in conifer-dominated stands with a hardwood component than without (Hibbs and Bower (2001)). Herb/shrub species diversity decreases from active fluvial surfaces to hillslopes (Pabst and Spies 1998), as does red alder presence. Red alder patches support a distinct and diverse epiphytic lichen and bryophyte community ((Muir, Mattingly et al. 2002), (Nietlich and McCune 1997)), including the cyanolichen *Lobaria pulmonaria* (Nietlich and McCune 1997).
- Arthropods. Red alder patches have high arthropod diversity (Muir, Mattingly et al. 2002), and support higher allochthonous invertebrate biomass than adjacent coniferous stands (see Section 3.2). Foliage-dwelling invertebrates are the dominant food of many breeding birds in forested systems (McComb 1994).

- Birds. The diversity of breeding birds in red alder stands may be somewhat lower than (at least *Mature*) conifer stands (McComb 1994). Red alder communities do support a number of bird associates such as downy woodpecker (*Picoides pubescens*) (McComb 1994), as well as several neotropical migrants ((Hayes and Hagar 2002)) (Weikel, Donaghy Cannon et al. 2003). Bird species richness in young conifer-dominated stands was found to be positively correlated to within-stand hardwood components (Muir, Mattingly et al. 2002); thus red alder may be important as a patch type that increases stand-level bird diversity.
- Mammals. Small mammal richness in red alder stands may be somewhat lower than in conifer stands (McComb 1994); small mammal diversity may be slightly higher in red alder stands (McComb and Anthony 1993). A number of small mammals, such as the Pacific water shrew, are more abundant in red alder communities (McComb 1994). The white-footed vole (*Arborimus albipes*), a (State-listed) sensitive species, is "uncommon in the Coast Range of Oregon but most abundant in riparian areas dominated by hardwoods" ((McComb 1994), pg. 135). Red alder patches have higher densities of bat foraging than adjacent coniferous stands (Hayes 1994). Also, elk and deer may preferentially choose red alder stands on valley floors for early morning feeding (McComb 1994).
- Herpetiles. (McComb and Anthony 1993) did not find differences in amphibian richness between riparian and upslope stand types. Several amphibians are associated with red alder patches, including Dunn's salamander and tailed frogs (McComb 1994). Most steam-associated amphibians (e.g., torrent salamander) are observed closer to the wettest portions of upland habitats (Sheridan and Olson 2002) and would thus be predicted to have higher densities in areas supporting red alder.
- Old-forest associates. Several species associated with red alder patches are also associated with old-growth Douglas-fir forests in the CR of Oregon (McComb 1994). These include 3 birds (Pacific slope flycatcher, winter wren, Swanson's thrush), 2 mammals (Pacific water shrew, shrew-mole), and 3 amphibians (Dunn's salamander, rough-skin newt, and tailed frog). Old alder stands may have been important components of some landscapes prior to human disturbance (*Starkey, pers. comm. in* (McComb 1994)).
- Sensitive species. Several Federally protected species have some association with red alder patches. These species included the bald eagle and several salmonids. The occurrence of these species and effects of the proposed action on these species was discussed fully in the Brummit EA.

At a landscape-scale, support of assemblages of riparian bird, mammal, amphibian, and other species increases landscape-scale species diversity (Duncan 2004).

3.2. *Support of aquatic functions and species*

The role of red alder in support of large in-stream wood

The effects of large woody debris (LWD) as a key component of high quality aquatic habitat for fish has been well documented (Harmon, Franklin et al. 1986; Bisson, Bilby et al. 1987; Sedell, Bisson et al. 1988). Wood pieces play an important role in the storage of nutrients within the stream system. "By slowing water flow, enhancing particulate matter storage, and reducing transport efficiency, downstream movement of nutrients is reduced (Bilby 2003)." Other authors go further to clarify additional aspects: "Large wood also facilitates primary production [of fish] by providing attachment sites for microbes and algae, sources of nutrients, and storage zones for organic matter (Dolloff and Warren 2003)." The loss of large wood allows for organic and nutrient matter to be flushed further downstream, defeating the utility of their function in the aquatic food web of the local area. Past management practices, including riparian harvest and "stream cleaning" have depleted the current levels of LWD within the East Fork Coquille watershed and within much of the managed forested landscape.

Although red alder may produce LWD which enhances stream function, alder LWD is generally smaller and less permanent than conifer LWD. Wood large enough to be effective in enhancing stream functions tends to be of coniferous origin. In a study of undisturbed old-growth forested stream systems in southwestern Washington, the results found that 80% of the woody debris consisted of coniferous origin,

particularly Douglas fir and western red cedar. In all three sizes of streams sampled, less than 5% of woody debris was from hardwood species (Bilby and Ward 1989). It is interesting to note that this study used a smaller definition for large wood than is used today, 10 cm in diameter. Today the standard smallest size is approximately 50 cm in diameter.

Compared to conifers, red alders do not have the capacity to function as well as instream large structure. From research done in Washington, authors found that "hardwood species are being transported from the channel, buried in the floodplain, or broken down to less than the measurement threshold [of LWD] faster than conifers (Hyatt and Naiman 2001)." Further, there was a greater amount of hardwoods standing than there were as LWD, and conifers comprised more LWD in the stream than there was standing in the riparian zone.

The readily quick decay attributes of alder also prohibit it from performing successfully as in-stream large wood (Niemiec, Ahrens et al. 1995). Keim and coauthors also found that the effects of adding alder to streams were of short duration:

> *Although tree-length alder debris anchored to the bank with attached roots was clearly effective in trapping CWD and forming accumulations, its effectiveness appear short-lived. By the third year after treatment, the pulled-over alders were losing structural integrity due to advancing decay and breakage.* (Keim, Skaugset et al. 2000)

<u>Red alder support of aquatic species</u>

Red alder has been called a keystone species in support of aquatic ecosytems (NCASI 2005), principally for its provision of nutrient-rich allocthanous litter. Red alder organic litter benefits various aquatic species. Although alder provides only seasonal autochthonous detritus, the quality of hardwood inputs is higher than that of coniferous inputs (Bilby and Bisson 1992). As stated earlier, alder has a higher component of nitrogen than coniferous species.

In a recently published study, many nuances of alder litter were studied. Hart (2006) indicated that alder stands provide more litter to streams when compared to Douglas-fir stands. In addition, Hart observed that deciduous sites produced a strong pulse of litter in the fall and a moderately large pulse in the spring. The conifer sites produced more regular inputs of litter in the form of overlapping pulses throughout the year (Hart 2006).

Alder organic matter has also been shown to support different species and quantities of macroinvertebrates. A study in southeast Alaska observed "more invertebrates in streams with more riparian red alder; and red alder stems and leaf litter supported greater invertebrate species richness than conifers" (Wipfli, Deal et al. 2003). This enhancement in aquatic invertebrate communities has been shown to influence diet in coastal cutthroat trout (Romero, 2003), suggesting that red alder may support higher biomass and diversity in streams.

3.3. *The influence of topographic position on red alder function*

Red alder patches probably provide very different functions depending on topographic position. For example, hardwood patches on ridgelines would be predicted to be very infrequent contributors to in-stream structure, and small contributors to nutrient (N) export; these same hardwood stands might be productive for neotropical migrants due to proximity to flyways. Without manipulative experiments it is impossible to differentiate causation from correlation in red alder-species associations, other than where clear mechanisms are present (such as in-stream relationships). The red alder patches proposed for management in the EA action area include principally mid-slope and upper slope positions, as well as some red alder patches containing intermittent channels. Perennial streams were all designed with stream buffers.

4.0 Predicted effects of removal of red alder patches from the action area

Removal of red alder from the action area would change the cover, arrangement, and function of red alder patches in the analysis area and surrounding landscapes. The direct, indirect and cumulative effects of removal of red alder patches in the action area on **forest structure** were analyzed in the Brummit Creek EA (as part of the Proposed Action), and contrasted with a No Action Alternative. These effects are summarized below:

Summary of effects on red alder associated with the **No Action Alternative**

According to the Brummit EA, in the short term hardwood stands would remain as described for the environmental baseline (EA, pg. 45). Under the No Action alternative, hardwood stands < 80 years old would cover approximately 7% of the analysis area, including both riparian influenced areas and disturbed, mesic upland area. Relative densities in these stands would remain high (> 60 years old), suggesting competition, mortality and stagnation of tree growth.

In hardwood stands not maintained by fluvial disturbance, unstable soils, or very moist conditions, succession towards conifer dominance could eventually occur. Succession to conifer dominance in these stands could require up to 100 years, and might not occur where mixed stands had low conifer densities and high salmonberry (or vine maple) cover. By 2100, hardwood cover was predicted to fall to roughly 2% in the analysis area (upper Brummit Subwatershed) (**Figure 3**), due to succession (in federal lands) and active management (in private lands).

Effects of **Proposed Action** on red alder and red alder functions

The direct, indirect and cumulative effects of removal of red alder patches in Scattered Skeeter units within the action area on **forest structure** were analyzed in the Brummit Creek EA (as part of the Proposed Action). These effects (for the Preferred Alternative) are summarized below.

Direct changes to forest structure

- "Alternative 2 would convert approximately 513 acres of young hardwood communities into (predominantly) seedling conifer stands, reducing cover by hardwood communities in the analysis area from 6.6% to 4.9%. An **additional** 477 acres of mixed hardwood units (conifer-dominated but with significant hardwood cover) would have hardwoods removed and conifers thinned. Hardwood snags and down wood would be left in these converted units at densities of 2/acre (each); conifer snags and down wood would be left at densities from 0-10/acre (Table 8-4" (EA, pg. 50)[8].
- "Thinning in **first-order riparian communities** would immediately shift these communities away from dominance by red alder and would facilitate development of large-boled conifers; this would also change shrub and herb communities in these ecotones. Hardwood conversion areas would be shifted from red alder-dominated communities (often with sword fern or salmonberry understories) in canopy closure or mature stages to ecosystem initiation stages, with mixed conifer seedlings **and > 2 snags and pieces of down wood/acre provided by red alder from the converted unit**"(EA, Pg. 50).

- "Hardwood trees (specifically red alder) would not be entirely eliminated from hardwood conversion areas for several reasons: a) proposed treatment unit sizes are smaller than actual hardwood/mixed stands; b) treatment units would not include stream and terrace areas; c) maintenance in conversion areas is often incomplete, allowing hardwoods to occupy treated areas; d) fluvial and hillslope disturbances within treated units create moist, disturbed soils favorable to red alder invasion.

Cumulative (future) changes in hardwood communities and forest structure

- "…Thus, Alternative 2 would result in large structural changes at unit scales (e.g., creation of gaps, larger trees), moderate changes at the subwatershed scale (e.g., ***decrease in cover by hardwoods***, more late-successional cover over time), and minimal change in conditions at the LSR or province levels (e.g., slightly shorter time to achieve > 50% late-successional cover)" (EA, Pg. 52).

- "The cumulative effects of federal and private activities associated with Alternative 2 would include > 25% reduction in hardwood communities in the analysis area, to levels < 5%; mixed conifer hardwood stands would retain cover > 25%." (EA, Pg. 53)

[8] The 5 EA units protested in the Scattered Skeeter Timber Sale represent 140 ac. of the 477 ac. analyzed in the EA.

- "Alternative 2 would reduce cover by red alder communities in the analysis area to roughly ½ of the mean historic cover for hardwood stands in the Oregon Coast Range (Ripple, Hershey et al. 2000); however, this cover is probably within the historic range of natural variability for hardwood cover in upper watershed positions" (EA, Pg. 53)

- "The potential effects of the proposed action on forest successional stages and forest cover types has been modeled and contrasted with a No Action alternative, over a 100 year time horizon (Analysis File section 1.17). Results of this modeling suggest a substantial **decrease in hardwood community types** under the proposed action, moving the analysis area closer to the lower limit of the historic range of natural variability in hardwood cover. The proposed action would initially increase cover by early successional types (due mostly to hardwood conversion), but would facilitate development of **higher late-successional cover over time**. (EA, pg. 100).

The **indirect effects** of changes in hardwood forest structure **on terrestrial and aquatic functions** and **species** were not fully discussed in the original EA. This addendum describes the predicted effects on red alder-associated functions/ species of conversion of 513 acres of hardwood communities into seedling conifer stands, as well as the effects of converting an additional 477 acres of mixed hardwood units into thinned *Competitive Exclusion*-stage conifer stands.

4.1. *Effects of hardwood conversion on terrestrial function and terrestrial species*

Nitrogen/nutrient dynamics

Red alder influences nitrogen levels in terrestrial environments and adjacent stream segments through nitrification. All but one hardwood or DMT/hwd unit (Unit 36) proposed for conversion in the EA is Site Class II or better. Additionally, there are large patches of red alder in areas downstream from the action area. Based on high site quality, as well as cover of red alder in the analysis landscape at or above HRV, it is unlikely that the action area or adjacent streams are nitrogen limited. In fact, removal of red alder from the action area may decrease nitrate leaching and nutrient imbalance in downstream areas, if these situations exist. Testing would be required to quantify the actual nutrient dynamics in drainages of the analysis area.

Terrestrial legacy structures in red alder communities

Conversion of pure red alder stands and patches within mixed stands would remove future red alder legacy structures. Red alder legacy structures in the action area are mostly small diameter, short life span pieces with few cavities. Due to increases in red alder cover in the action area since European settlement and considering the effects of moderately frequent windstorm events (the most recent in 2004) in the analysis area, these modest value legacy structures would not be limiting in either the No Action or the Proposed Action Alternative. Mitigation for this loss, proposed in the EA, included 2 created red alder snags per acre in hardwood conversion units (discussed below).

Red alder support of terrestrial species

Hardwood conversion of roughly 500 ac. and removal of alder patches from roughly 480 ac. would be predicted to indirectly displace or kill individuals in species associated with red alder communities in the action area (quantified below). The following changes would be predicted **within converted stands**:

- Decrease in herb, lichen and bryophyte richness and diversity.
- Decrease in arthropod richness, diversity, and density.
- Change in bird richness and assemblage, including loss of red alder associates (e.g., Pacific slope flycatcher).
- Modest changes in mammalian richness, decreased mammal diversity, and loss of a number of small mammals associated with red alder patch types, such as the Pacific water shrew and the white-footed vole.
- Loss of amphibians associated with red alder types, including Dunn's salamander and tailed frogs.
- Effects could also occur to species associated with red alder patches and also associated with old-growth Douglas-fir forests in the CR of Oregon (McComb 1994), described above.

- Several Federally protected species have some association with red alder patches. These species include the bald eagle and several salmonids. The occurrence of these species and effects of the proposed action on these species was discussed fully in the Brummit EA.

Predicted impacts to individuals in species associated with red alder communities in the action area would be very roughly quantified as:

- Loss of individuals or sub-populations (10's to hundreds) each for affected small mammals and amphibians within WF Brummit Drainage and along China Creek. Loss of sub-populations (thousands) for affected arthropods.
- Change in behavior and decreased fitness for 10's of affected large mammals and birds within WF Brummit Drainage and along China Creek.
- No change in meta-population dynamics at the drainage-scale or larger, for any species. I.e. no loss of any species from WF Brummit Drainage, or from the Brummit Subwatershed (the analysis area).
- Potential effects to IDT-identified sensitive species associated with red alder patch types (e.g., bald eagle, salmonids) were analyzed in the EA.

Loss of these hardwood communities would be predicted to indirectly decrease species diversity at the stand-, drainage-, and subbasin-scales within the analysis area (the environmental baseline). However, these effects on species diversity would not be predicted to lead to dramatic changes in the human environment for the following reasons:

- Red alder cover, including potential habitat for red alder associated species, has increased across the landscape since European settlement. Few of the species described above are considered sensitive, and the sensitive species above are probably not limited by the amount of red alder cover on the landscape.
- Since red alder is a pioneer species and red alder stands are mostly early seral, (McComb 1994) suggests that most wildlife species associated with patches of alder would be well-adapted to colonization of other alder stands following disturbance. Thus, although individual red alder patches have become smaller and more widely dispersed since European settlement, and even been eliminated from valley bottoms such as the lower Coquille subbasin, species associated with this early seral community have probably adapted to relatively high levels of disturbance (unlike late-successional conifer associates).

Treatments in mixed stands would eliminate individuals from species strongly tied to red alder trees (some described above). Species associated with hardwood (not just red alder) diversity could be maintained in these treated stands, since some non-red alder hardwoods would be maintained in treated units (see *Mitigation*). Species assemblages associated with non-alder hardwood diversity in conifer stands would include some lichens and bryophytes, arthropods and birds. Creation of *Stand Initiation* conifer habitat in converted stands would support a number of young forest associates and generalists in the analysis area (Muir, Mattingly et al. 2002). By 2100, these areas might directly support a number of species associated with *Mature* forest, and provide buffering to adjacent interior late-successional forest habitat.

<u>White-footed voles</u>

White-footed vole (*Arborimus albipes)* is a federal Species of Concern and a state sensitive species associated with riparian areas and red alder communities. This species has not been identified by BLM as a Special Status Species. White-footed vole was not identified as an Issue in the EA, and this species was not specifically addressed in the EA. Impacts to riparian associates within the action area were addressed generally in the EA: " Conversion/loss of hardwood communities in the analysis area could impact species dependent on these communities within the subwatershed (e.g., neotropical migrants (Weikel, Donaghy Cannon et al. 2003), emergent insects, others). However, hardwood communities are not limited in the remainder of the 5th field watershed or Coast Range in general" (Brummit EA, Pg. 53). As with most species considered above, the effects of the proposed action would be predicted to have little effect on the white-footed vole because:

- Hardwood communities would be maintained in the analysis area at levels at or above HRV. Thus habitat loss would be predicted to lead to loss of subpopulations at the stand/patch scale (10's of individuals or less), and no decrease in population levels at drainage and larger scales.
- If populations of this species are being threatened by increased predation, disease, or other factors, the proposed action would be predicted to minimally affect these factors, through slightly increased fragmentation of hardwood patches. Hardwood refugia would remain in analysis area at the drainage-scale and above. Natural disturbance regimes in this landscape and maintenance of Riparian Reserve land use allocations would be predicted to maintain this habitat type at levels close to HRV (**Figure 2**).

4.2. *Effects of hardwood conversion on Aquatic function and on Aquatic species*

Effects of the No Action on riparian/ aquatic function

The Interdisciplinary team analyzed in the No Action Alternative what the consequences would be to aquatic resources within this watershed if the project (including hardwood conversion) did not occur. "[L]arge number[s] of young riparian conifer stands would continue to develop under conditions of high competition and growth suppression. …As a result, contributions of woody material to the aquatic environment would be likely to occur, but the wood would be of smaller size and would decompose relatively quickly. (EA P.69)"

Effects of the Proposed Action on riparian/ aquatic function

The proposed action incorporates instream wood placement of large, whole conifers to form complex wood jams and improve the quality of aquatic habitat. These structures are expected to provide some stream channel complexity that would remain until the riparian areas have grown enough conifers to supply this debris naturally. The loss of alders outside the no-touch buffers would have little impact to the overall health and population levels of resident fish within the project areas. "[T]his alternative is expected to have a beneficial affect upon aquatic species in terms of improving riparian conditions over the long term. … This, coupled with instream and road related restoration, is expected to contribute to improved stream channel conditions and therefore benefits to aquatic organisms within the East Fork Coquille Watershed (EA p.70)."

With this conversion project, there would be a very small reduction in the amount of alder particulate matter reaching the stream. McDade and coauthors observed that more than 83% of hardwood debris pieces in streams originated within 10 meters (33 feet) of the channel and 100% originated from within 25 meters (82 feet)(McDade, Swanson et al. 1990). With the 50 foot no-touch buffers, more than the 83% of debris pieces would be retained on the landscape scale. The 30 foot buffers would retain just under this 83%. As the proposed project is only converting 310 acres within the Riparian Reserve, at the sub-watershed level, this loss would be un-measurable.

Conifers trees capable of providing Large Woody Debris would in the long-term benefit the adjacent aquatic systems. Lack of Large Wood has been determined to be a current risk factor for salmonids by contributing to simplified aquatic habitat (USDI 2005). By coupling hardwood conversions and instream wood placement projects within the same watershed, immediate positive effects from increased stream complexity would likely remain in the stream systems until the planted conifers have grown to a size to be naturally contributed as large wood (approximately 60 yrs.)

The inclusion of no harvest buffers along fish-bearing stream channels are intended to maintain the contributions of alder and develop the future contributions of conifer. Both types of canopies are provided by this project.

Compliance of the Proposed action on attainment of ACS Objectives

"The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and their aquatic ecosystems on public lands (USDI 1995)." The ACS was designed to halt further declines in watershed condition and to improve the ecological condition of watersheds in the NWFP area from several years to decades (FEMAT 1993).

The four components of this strategy are Riparian Reserves, Key Watersheds, Watershed Analysis, and watershed restoration. While the East Fork Coquille Watershed is not designated as a Key Watershed, the other three components apply. The Watershed Analysis for this basin was competed in May 2000 and Riparian Reserves are designated within the project area. In-stream restoration in the form of the placement of large wood and silvicultural prescriptions to enhance development of large conifers are the watershed restoration goals applied within this project.

The Watershed Analysis listed a subset of priorities for management of stands. The first priority category was to target mixed-conifer stands where conifers can be released. The second priority was to re-establish conifer where there currently is none, in other words stand conversion (USDI 2000). The Brummit watershed in particular was suggested for hardwood conversion in the Riparian Reserve Assessment.

As stated earlier, positive effects from this portion of the project are anticipated to be long-term, likely 50 years or more. In FEMAT, it was anticipated that the more degraded a watershed, the longer the time for recovery which could be 100+ years. In an assessment of the first ten years of the implementation of the ACS and NWFP, Reeves and co-authors found that the larger and more numerous the conifers were in areas that influence the aquatic ecosystem, the better the condition of the watershed (Reeves, Williams et al. 2006). By re-establishing conifers on traditional sites that would have a positive effect to aquatic habitat, albeit in the long term range of decades, this proposal meets the intent and objectives of the Aquatic Conservation Strategy.

4.3. *Effects on Red Alder Communities: Summary/Conclusions*

The Proposed Action would be predicted to lead to changes in red alder cover, arrangement, structure, functions, and support of species. These changes are summarized below.

1. Cumulative changes to red alder/ hardwood cover and arrangement. The proposed action was predicted to reduce hardwood cover directly in the analysis area (roughly 500 acres conversion/ 480 acres modified). Following 100 years of federal management under the RMP and private management using 40-year rotations (**Figure 3**), conversion of hardwoods and forest succession was predicted to reduce total hardwood cover in the Brummit Creek subwatershed to historic cover levels (2%) estimated for the Coquille subbasin ((Wimberly and Ohman 2004), and **Table 2**). Using a range in 1930s hardwood cover of 0-13% (mean 3.6%) as a surrogate for temporal range (*described above*), **future** hardwood cover in the EA analysis area would be predicted to be lower than the historic mean hardwood cover for the CR Province, but greater than the 1st quartile for historic conditions, i.e. at the low end but within (recent, hypothesized) historic ranges for hardwood cover in the CR Province[9]. The arrangement of red alder patches in future landscapes would be predicted to be fragmented and localized to fluvially- or management-disturbed portions of the landscape, similar to current conditions.
2. Cumulative changes to red alder/ hardwood structure. Pure red alder stands would be converted to *Stand Initiation* conifer stands, with decreased vertical and structural diversity. Mixed conifer stands would be converted to single-layer conifer stands with gaps. In the future (> 2080), hardwood conversion areas would develop into late-successional conifer stands, directly increasing total late-

[9] Comparison between subwatershed and Province scales and use of a space-for-time comparison is dubious, but comparable spatial and temporal data is not available.

successional forest cover in the analysis area (**Figure 3**) and indirectly buffering adjacent (interior) late-successional coniferous forest. Mixed stands with red alder removed would be predicted to develop late-successional conditions by roughly 2050, including large gaps supporting younger mixed species cohorts.

3. Cumulative changes in legacy structures related to red alder changes**.** Conversion of pure red alder stands and removal of alder patches within mixed stands would remove future red alder legacy structures. Red alder legacy structures in the action area are mostly small diameter, short life span pieces with few cavities.
4. Cumulative changes in terrestrial species and functions due to changes in red alder cover. Removal of red alder from roughly 500 acres of pure stands and roughly 480 ac. of mixed stands would decrease nitrification in WF Brummit drainage and China Creek. These areas are probably not nitrogen limited, and reductions in nitrogen leaching may actually facilitate retention of essential cations in these systems. Litter nutrients and depth would initially be decreased (through site preparation), and would be eventually reflect the conifer overstory.
5. Cumulative changes in aquatic species and functions due to red alder removal. Replacement of red alder patches with young conifer stands outside fish-bearing stream buffers was predicted to have little impact on resident fish within the analysis area. Stream/riparian restoration for the proposed action was predicted to have a beneficial effect on aquatic species and improve riparian conditions over the long term within the East Fork Coquille Watershed (EA, p.70).

Loss of hardwood patches would be predicted to indirectly decrease species diversity at the stand- and drainage-scales within the analysis area (the environmental baseline). Hardwood conversion of roughly 500 ac. would be predicted to decrease the species richness and diversity of plants (herbs, lichens, bryophytes) and arthropods, and eliminate red alder associated birds (e.g., Pacific slope flycatcher), mammals (Pacific water shrew, white-footed vole), and amphibians (Dunn's salamander, tailed frogs) within converted stands. Species lost within converted stands would be (with exceptions below) common species which would remain common at drainage- and larger spatial scales. Several federally protected species (bald eagle, salmonids) have some association with red alder patches. The occurrence of these species and effects of the proposed action on these species was discussed fully in the Brummit EA. No change would be predicted in meta-population dynamics at the drainage (or larger) spatial scale, for any species. No species would be predicted to be lost from WF Brummit Drainage, or from the Brummit Subwatershed (the analysis area). Some species associated with hardwood (not specifically red alder) diversity (e.g., bryophyte, arthropod and bird assemblages) could be maintained in these treated stands, since non-red alder hardwoods would be maintained in all treated units. Creation of *Stand Initiation* conifer habitat would also support a number of young forest associates and generalists in the analysis area (Muir, Mattingly et al. 2002). By 2100, these stands would be predicted to directly support a number of species associated with *Mature* coniferous forest, as well as providing microclimate/cover buffers to adjacent interior late-successional forest habitat.

5.0 Mitigation relevant to changes in red alder cover and functions

Mitigations for reducing impacts to hardwood communities in the analysis area were considered at within stand-, stand-, and analysis area-scales, and were included in the Proposed Action. These mitigations included: a) retention of non-alder hardwoods within stands; b) creation of hardwood structural legacies in conversion units; c) streamside treatment buffers; and d) avoidance of hardwood patches with distinct composition. These mitigations were described in the EA, and are summarized and discussed below.

Retention of non-alder hardwoods. Some non-alder hardwoods would be retained in conversion stands under the Proposed Action. The EA states that within conversion units: "some large bigleaf maple and myrtle, greater than 20 inches DBH, will be reserved for habitat diversity." (EA, pg. 20). In practice, myrtle < 7 in. DBH would also remain in conversion stands. Stump sprouting of cut hardwoods would

provide additional hardwood diversity in developing conifer stands following conversion. Other non-alder hardwood species (e.g., chinquapin, tanoak) are currently lacking from proposed conversion units. Retention of non-alder hardwoods (as well as conifer such as western red cedar) in conversion units would retain some hardwood diversity in converted units, and increase structural diversity through retention of diverse growth forms.

Creation of legacy structures. Retention of existing snags and creation of new hardwood snags in conversion units would act as a short-term structural legacy "bridge" while *Stand Initiation*- stage conifer patches developed. Provision of snags in hardwood conversion units is discussed in the Brummit EA design features. Existing snags would "be retained and protected during logging operations to the extent possible. Snags will be reserved from cutting except those that must be felled to meet safety standards…Any snags felled or accidentally knocked over will be retained on site …" (EA, pg. 23). New red alder snags would be created in conversion units, at densities detailed in EA Table 8-4; generally (but not always) 2 snags per acre were prescribed for conversion units. The EA also states: "Hardwood snags will be left along the edges of units to leave a safe working environment during planting and subsequent maintenance" (EA, pg. 23). All existing down logs would be reserved from cutting and removal during logging operations. Although red alder snags would quickly decay, they would provide some level of legacy function for several years following creation.

Avoidance of distinct hardwood patches (Special Habitat Areas). Old red alder stands may have been important components of some landscapes prior to human disturbance (*Starkey, pers. comm. in* (McComb 1994)). Hardwood stands in the analysis area which the IDT believed provided key ecological functions or which were on appropriate trajectories (towards target conditions described in the LSRA) were eliminated from treatment consideration. The EA states: "Roughly 95 acres of hardwood stands were eliminated from treatment in the EA process because they supported special habitat features (e.g., wetland areas), structures or treatment to meet LSR goals was considered unnecessary" (EA Table 8-1, page 89). Avoidance of these patches/stands would retain some habitat type diversity at drainage- and larger spatial scales and retain some refugia for hardwood-associated species and functions.

Streamside buffers. Streamside buffers along fish-bearing streams would minimize effects of hardwood conversion on aquatic function and species support. Lateral litter inputs originate less than 5 m (16.4 ft.) from the stream and are unaffected by the understory (Hart 2006, p.50). "No Harvest" buffers along fish-bearing stream channels would be a minimum of 30 feet (most are 50 feet), measuring from the edge of valley bottom. At these distances, the vast majority of the lateral input to streams from deciduous vegetation would be maintained.

6.0 Citations

Ahrens, G. R. (2006). Overview of supply, availability and regulatory factors affecting red alder in the Pacific Northwest. Red Alder-A State of Knowledge. PNW-GTR-669. R. L. Deal and C. A. Harrington. Portland, OR, USFS.

Bilby, R. E. (2003). "Decomposition and Nutrient Dynamics of Wood in Streams and Rivers." 135-148 in S.V. Gregory, K.L. Boyer, and A.M. Gurnell, editors. The ecology and management of wood in world rivers. American Fisheries Society, Symposium 37, Bethesda, Maryland.

Bilby, R. E. and P. A. Bisson (1992). "Allochthonous versus autochthonous organic matter contributions to the trophic support of fish populations in clearcut and old-growth forested streams." Can. J. Fish. Aquat. Sci. **49**: 540-551.

Bilby, R. E. and F. R. Ward (1989). "Changes in characteristics and function of woody debris with increasing size of streams in western Washington." Transactions of the American Fisheries Society **118**: 368-378.

Bisson, P. A., R. E. Bilby, et al. (1987). Large woody debris in forested streams in the Pacific Northwest: past, present, and future. Streamside management: forestry and fisheries interactions. E. O. Salo and T. W. Cundy. Seattle, WA, University of Washington - Institute of Forest Resources**:** 143-190.

Compton, J. E., M. R. Church, et al. (2003). "Nitrogen export from forested watersheds in the Oregon Coast Range. The role of N2-fixing red alder." Ecosystems **6**: 773-785.

Cwynar, L. C. (1987). "Fire and the Forest History of the North Cascade Range." Ecology **68**(4): 791-802.

DeBell, D. S. (2006). History of research and attitudes about the biology and management of red alder. Red Alder-A State of Knowledge. PNW-GTR-669. R. L. Deal and C. A. Harrington, USDA.

(DEQ) (1988). Action Plan for Oregon Coastal Watersheds, Estuary, and ocean Waters. Prepared for USEPA Grant X-000382-01. Near Coastal Waters National Pilot Project.

Dolloff, C. C. and M. L. Warren (2003). "Fish relationships with large wood in small streams." Pages 179-193, *in* S.V. Gregory, K.L. Boyer, and A.M. Gurnell, editors. The ecology and management of wood in world rivers. American Fisheries Society, Symposium 37, Bethesda, Maryland.

Duncan, S. (2004). Ecological payoffs from red alder in southeast Alaska. Science Findings 63. Corvallis, OR, Pacific Northwest Research Station. **63:** 5.

FEMAT (1993). Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. FEMAT. Washington DC, Forest Ecosystem Management Assessment Team (FEMAT).

Foster, S. C., C. H. Stein, et al. A Guide to Interpreting Stream Survey Reports, Oregon Department of Fish and Wildlife**:** 59.

Harmon, M. E., J. F. Franklin, et al. (1986). "Ecology of coarse woody debris in temperate ecosystems." Advances in Ecological Research **15**: 133-302.

Harrington, C. A. (2003). The 1930s Survey of Forest Resources in Washington and Oregon. Portland, OR, USDA, Forest Service**:** 10.

Harrington, C. A. (2006). Biology and Ecology of Red Alder. Red Alder: A State of Knowledge. PNW-GTR-669. PNW, USFS**:** 150.

Hart, S. K. (2006). Riparian litter inputs to streams in the central Oregon Coast Range. Forestry, Oregon State University**:** 102.

Hayes, J. P. (1994). Habitat relationships and riparian zone associations of bats in managed forests of the Coast Range: a new adaptive COPE study. C. Report. Newport, OR, OSU**:** 5-7.

Hayes, J. P. and J. C. Hagar (2002). Ecology and management of wildlife and their habitats in the Oregon Coast Range. Forest and Stream Management in the Oregon Coast Range. S. D. Hobbs and J. P. Hayes. Corvallis, Oregon, OSU Press**:** 99-134.

Hibbs, D. E. and A. L. Bower (2001). "Riparian forest in the Oregon Coast Range." Forest Ecology and Management **154**: 201-213.

Hyatt, T. L. and R. J. Naiman (2001). "The residence time of large woody debris in the Queets river, Washington, USA." Ecological Applications **11**(1): 191-202.

Keim, R. F., A. E. Skaugset, et al. (2000). "Dynamics of coarse woody debris placed in three Oregon streams." Forest Science **46**(1): 13-22.

Kennedy, R. S. H. and T. A. Spies (2004). "Forest cover changes in the Oregon Coast Range from 1939 to 1993." Forest Ecology and Management **200**: 129-147.

Kennedy, R. S. H. and T. A. Spies (2005). "Dynamics of hardwood patches in a conifer matrix: 54 years of change in a forested landscape in Coastal Oregon, USA." Biological Conservation **122**: 363-374.

McComb, B. (1994). Red Alder: Interactions with Wildlife. The Biology and Management of Red Alder. D. E. Hibbs, D. S. DeBell and R. F. Tarrant. Corvallis OR, OSU Press.

McDade, M. H., F. J. Swanson, et al. (1990). "Source distances for coarse woody debris entering small streams in western Oregon and Washington." Canadian Journal of Forest Research **20**: 326-330.

Miller, R. E. and M. D. Murray (1977). The effects of red alder on growth of Douglas-fir. Utilization and Management of Alder. GTR PNW-70. D. G. Briggs. Portland, OR, USDA FS.

Miller, R. E., E. L. Obermeyer, et al. (1999). Comparative effects of precommercial thinning, urea fertilizer, and red alder in site II, coast Douglas-fir plantation. PNW-RP-513. Portland, OR, USDA.

Muir, P. S., R. L. Mattingly, et al. (2002). Managing for biodiversity in young Douglas-fir forests of Western Oregon. R. L. Mattingly. Corvallis, OR, U.S. Geological Survey - Forest and Rangeland Ecosystem Science Center (FRESC)**:** 76.

Niemiec, S. S., S. G. Ahrens, et al. (1995). Hardwoods of the Pacific Northwest. Corvallis, Oregon, Forest Research Laboratory, Oregon State University.

Nierenberg, T. R. and D. E. Hibbs (2000). "A characterization of unmanaged riparian areas in the central coast range of western Oregon." Forest Ecology and Management **129**: 195-206.

Nietlich, P. N. and B. McCune (1997). "Hotspots of epiphytic lichen diversity in two young managed forests." Conservation biology **11**: 172-182.

Nighbert, J., J. O'Neil, et al. (1997). WODIP (Western Oregon Digital Image Project) guidebook, USDI Bureau of Land Management (Oregon State Office).

Pabst, R. J. and T. A. Spies (1998). "Distribution of herbs and shrubs in relation to landform and canopy cover in riparian forests of coastal Oregon." Canadian Journal of Botany **76**(298-315).

Perakis, S. S., D. A. Maguire, et al. (2006). "Coupled nitrogen and calcium cycles in forests of the Oregon Coast Range." Ecosystems **9**: 63-74.

Reeves, G. H., J. E. Williams, et al. (2006). "The Aquatic Conservation Strategy of the Northwest Forest Plan." Conservation Biology **20**(2): 319-329.

Ripple, W. J., K. T. Hershey, et al. (2000). "Historical forest patterns of Oregon's central Coast Range." Biological Conservation **93**: 127-133.

Sedell, J. R., P. A. Bisson, et al. (1988). What we know about large trees that fall into streams and rivers. From the Forest to the Sea: A Story of Fallen Trees. C. Master, R. F. Tarrant, J. M. Trappe and J. F. Franklin. Portland, OR, U.S. Dept. of Agriculture - Forest Service Pacific Northwest Research Station & U. S. Dept. of Interior - Bureau of Land Management**:** 47-81.

Sheridan, C. D. and D. H. Olson (2002). "Amphibian assemblages in zero-order basins in the Oregon Coast Range." Can. J. For. Res. **33**: 1452-1477.

USDI (1995). Final - Coos Bay District Proposed Resource Management Plan Environmental Impact Statement and Its Record of Decision. North Bend, OR, U.S. Dept. of Interior - Bureau of Land Management.

USDI (2000). East Fork Coquille Watershed Analysis. North Bend, OR, U.S. Dept. of Interior - Bureau of Land Management.

USDI (2005). Western Oregon Plan Revision Analysis of the Management Situation. Portland, OR, Bureau of Land Management**:** 166.

Weikel, J. M., M. Donaghy Cannon, et al. (2003). Breeding birds in riparian forests of the central Coast Range. CFER annual report 2003. Corvallis, OR, USDI Burea of Land Management**:** 69-72.

Wimberly, M. C. and J. L. Ohman (2004). "A multi-scale assessment of human and environmental constraints on forest land cover change on the oregon (USA) coast range." Landscape Ecology **19**: 631-646.

Wimberly, M. C., T. A. Spies, et al. (2000). "Simulating historical variability in the amount of old forests in the Oregon Coast Range." Conservation Biology **14**(1): 167-180.

Wipfli, M. S., R. L. Deal, et al. (2003). Compatible Management of Red Alder-Conifer Ecosystems in Southeastern Alaska. Compatible Forest Management. R. A. Monserud, R. W. Haynes and A. C. Johnson. Dordrecht, Kluwer Academic Press.

Addendum #2 to the Brummit Creek Density Management and Restoration Environmental Assessment (EA No. OR128-03-24)

1.0 Introduction

This addendum to the Brummit Creek Density Management and Restoration Environmental Assessment, EA# OR128-03-24 ("EA", hereafter), has been produced to analyze additional treatment in a portion of the analysis area not discussed in the original EA.

2.0 Change in the *Proposed Action* and *Affected Environment*

The change from the original EA involves treatment of a forest patch (stand) originally considered for treatment (referred to as 15s in preliminary analyses), adjacent to and southwest of EA Unit 15. This patch is roughly 5.5 acres in size. Treatment of this patch (Unit 15s) was not discussed in the original (published) EA. Treatment of Unit 15s is here analyzed as an addendum to the original EA. DMT treatment in Unit 15s would include thinning from below, producing a residual stand with 75 TPA (from 190) and a mean diameter of 22" (from 17"); trees > 26" DBH would generally be reserved from cutting. Roughly 0.2 miles of existing dirt road accessing Unit 15s would be renovated and maintained for BPA access following treatment.

Patch description: Unit 15s is roughly 67 years old. This patch is a natural stand, developing following stand-replacing fires in the 1940's, and is somewhat open grown due in part to the unit's rocky substrate. Unit 15s is in the *Biomass Accumulation* structural stage, with a mean diameter of 27" and individual dominant trees ≥ 30" DBH. Dominant trees are < 175 ft. tall and have limited late-successional structure. Unit 15s appears to be a fragment within a larger patch matrix (including Unit 15) with a similar initiation date and similar structure.

Patch context: No perennial or intermittent streams flow within 220 ft. of Unit 15s. No sensitive (Threatened or Endangered or Bureau Special Status) plants or animals were identified in this patch, or in stands adjacent to this patch. The nearest late-successional forest (roughly 110 years old) is over 200 m from Unit 15s.

3.0 Changes in Effects of the Action

The additional treatment of Unit 15s would have the following effects: 1) increase in acres of density management thinning above that considered in the original EA, with indirect effects on achieving LSR objectives and fitness of wildlife and plant species; 2) additional road renovation in a location not discussed in the original EA; 3) creation of stand legacy structures; and 4) minor soil and within-stand disturbance, associated with harvest.

With the additional treatment of Unit 15s, roughly 5.5 acres of density management would occur in this area. This patch would be expected to enter the *Understory Initiation* structural stage earlier than without treatment, and would more quickly meet LSR objectives including maintaining functional, interacting, late-successional forest ecosystems (RMP, pg. 2-32). Some late-successional forest-associated species would be predicted to utilize structures developing in Unit 15s as they developed. Treatment in Unit 15s would include creation of 5 snags/ac. and 1 piece of downed wood/ac., greatly increasing legacy densities in this patch.

Renovation of 0.2 miles of road 28-10-9.7 needed to thin Unit 15s would be predicted to have very limited effect on within-stand microclimate or species disturbance, since this disturbance corridor already exists. Some road renovation and creation anticipated for this portion of the analysis area (associated

with DMT of Unit 57w) has been dropped from consideration; thus the total renovation in this portion of the analysis area is actually less than that analyzed in the original EA. Harvest would be predicted to disturb < 10% of the soil in this unit, and have short-term disturbance effects on species associated with young stands with negligible interior forest habitat. Thinning in this unit would be predicted to have no effect on aquatic species or functions (including ACS objectives).

4.0 Conclusion

This addendum considers the effects of treating an additional 5.5 acres of young (*Biomass Accumulation*-stage) forest to facilitate development of late-successional characteristics. DMT in this unit helps meet and is consistent with the *Purpose and Need* of the original EA, and is within the scope of work and effects anticipated in that analysis. Short-term disturbance of species associated with developing stands is anticipated, as is small-scale soil disturbance. No disturbance to late-successional associates, aquatic species, or other sensitive species is anticipated.