State Forests Division

Implementation Monitoring Report

AOP YEARS 2002-2006

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EXECUTIVE SUMMARY

Implementation monitoring broadly seeks to determine if management and conservation strategies specified in the Oregon Department of Forestry's Forest Management Plans (FMP) are being properly implemented. It also helps establish baseline conditions from which to measure effectiveness of the strategies. This type of monitoring measures on-the-ground indicator variables to assess how management practices are put into practice and is an accounting of what we did. Further, it seeks to determine to what degree post-operation conditions reflect original management intent defined in pre-operational prescriptions. Lastly, Implementation Monitoring helps assess the feasibility and achievability of strategies and targets.

This study addressed the metrics and strategies established by the Landscape Strategies and the Aquatic & Riparian Strategies in the FMP, as well as the strategies for management of Salmon Anchor Habitat areas.

A total of 55 stands across seven operational districts were sampled from Annual Operation Plan years 2002-2006. Data was collected in the upland areas using standard inventory methods and, separately, data was collected in the Riparian Management Areas (RMAs) of these stands using methodology derived from a 2008 pilot study. Additionally, a set of questions was answered by contract administrators for each of the sales in the study to assess implementation of strategies that were not quantitatively measureable.

Overall Implementation Monitoring showed:

- Department staff indicated understanding and intent to implement the strategies in the FMPs.
- Broad compliance with FMP strategies in the upland and riparian management areas, with a few areas of over or under achievement of strategies.
- A number of areas where the FMP targets or goals are unlikely to ever be achieved without significant investment (e.g. converting hardwood riparian areas to conifer)

Through adaptive management, results of this study will inform implementation of strategies to achieve goals in the forest management plans and will also provide insight into improvement of the definitions and standards in the forest management plans themselves.

INTRODUCTION

The forest management plans for Northwest and Southwest Oregon were adopted in 2001. These have similar approaches to management and provide the framework for this study (ODF 2001a, b). The forest management plan (FMP) strategies focus on an integrated approach to forest management that synthesizes knowledge from various natural resource disciplines. This integrated approach is intended to provide for "*…a balance of social, economic, and environmental benefits from the forest over time*" (ODF 2001a, pg. 4-5). Strategies for integrated forest management include those for landscape management, aquatic and riparian conservation, and forest health.

As described in the FMP, landscape management uses a structure-based management approach to provide a range of structure-types across the landscape. Structure-based management is "*… designed to emulate many aspects of natural stand development patterns and to produce structural components found in naturally developing stands, but in fewer years*" (ODF 2001a, pg. 4-7). The various Landscape Management Strategies (LMS) laid out in the FMP provide specific goals and targets to accomplish structure-based management at an operational level. In this same manner, the FMP defines targets for effectively managing riparian areas, detailed by the Aquatic & Riparian Strategies (ARS) and Appendix J of the FMP.

Implementation monitoring broadly seeks to determine "*…if the objectives, standards, guidelines, and management practices specified in the FMP are being accomplished*" (ODF 2001a, pg.5-19). This type of monitoring measures on-the-ground indicator variables and is designed to assess how management affects these variables. Further, it seeks to determine to which degree post-operation conditions reflect original management intent defined in pre-operational prescriptions.

Specifically, the goal of implementation monitoring is to determine if Landscape and Riparian and Aquatic Management Strategies, as defined by the FMP and the rules for management of Salmon Anchor Habitat, are being implemented as intended. Variables will be assessed at the operational level, district-wide level, and across all districts to provide an overall evaluation of these strategies across the landscape. The following questions will be addressed to help determine if overall objectives are being met and to synthesize all the data:

1. How often do post-operation conditions reflect the retention or creation of structural attributes designed to achieve the LMS and ARS?
2. Are there particular components of LMS and ARS objectives that are difficult to evaluate in post-operational assessments?
3. In aggregate, are there particular components that have a higher or lower frequency of matching LMS and ARS targets?
4. How often do districts "post-out" RMA's instead of choosing to actively manage them to FMP standards?
5. Are there opportunities to improve the implementation of the LMS and ARS through the development of guidance, technical notes, training, or other means?

Through this process, opportunities will be identified to improve State Forest program administration, operator education, and knowledge transfer.

METHODS

Study Design

Sales in the 2002-2004 Annual Operation Plans (AOPs) were selected for inclusion in the study. After selection of these sales, three ended up being placed in later AOP years (2005 and 2006). A random sample of 20% of all partial cuts and clearcuts in each district were chosen from each original planned AOP resulting in a total of 55 stands across seven operational districts to be sampled (Table 1). A total of 28 clearcuts and 27 partial cut stands are in the study.

Table 1. Sale names, areas, and locations of all stands sampled in the study.

District	Sale Name	Sale Area	Type	AOP / Fiscal Year	Stand ID	Sale Number	Location	Acres	SAH	notes
Astoria	Bigfoot Combination	IV	CC	2005	23317	0564	T8N,R7W,S36	25		
Astoria	Cole mountain Combo	III	CC	2006	24612	0638	T4N R9W S14	30		
Astoria	Cole mountain Combo	VI	PC	2006	24681	0638	T4N R9W S24	236		
Astoria	Deep Creek Thin	I	PC	2003	24499	0406	T5N,R6W,S13	172		
Astoria	Foster Divide	VII	CC	2003	23681	0321	T6N,R6W,S5	68		
Astoria	Hunt Creek LSD	VI	PC	2002	23295	0212	T8N,R6W,S33	119		
Astoria	Nettle Meyer Combo	II	PC	2002	24048	0306	T5N,R6W,S29	510		
Astoria	Nettle Meyer Combo	IX	CC	2002	24115	0306	T5N,R6W,S34	92		
Astoria	Nettle Meyer Combo	VI	CC	2002	24159	0306	T6N,R6W,S6	82		
Astoria	Nettle Meyer Combo	V	PC	2002	24502	0306	T4N, R6W, S5	44		
Astoria	Simmons Ridge Combo	V	PC	2004	24651	0493	T7N,R8W,S23	84		
Astoria	West Green Mountain Combo	II	CC	2004	23523	0535	T7N,R9W,S25	17		no rma
Cascade	Cold Wash Thin	III	PC	2004	12440	0532	T9S,R4E,S22	38		no rma
Cascade	Fractured Rock Combo	VIII	CC	2003	12773	0467	T10S,R3E,S15	85		
Cascade	Fractured Rock Combo	II	PC	2003	12774	0467	T10S,R3E,S16	153		
Cascade	Nexta Burbank		CC	2004	12612	0482	T10S,R4E,S4	66		
Forest Grove	C Saw	I	PC	2004	7931	0461	T1N,R6W,S16	221		
Forest Grove	Dark Bark	II	PC	2004	7304	0441	T3N,R6W,S17	184		
Forest Grove	Mac Attack	I	CC	2004	7187	0475	T4N,R6W,S26	84		no rma
Forest Grove	Ought To Thin	I	PC	2002	7770	0237	T2N,R6W,S33	177		
Forest Grove	Sappington Creek	II	PC	2003	8309	0353	T3N,R6W,S31	177		
Forest Grove	Scoggins Combo	I	CC	2002	7993	0458	T1N,R5W,S20	43		no rma
Forest Grove	T. Wally Thin	II	PC	2002	8134	0319	T1S,R6W,S15	45		
Forest Grove	Willaminor	I	PC	2004	8269	0522	T4S,R6W,S18	26		
Southwest	Coleman Cleansin	II	CC	2003	5248	0404	T38S,R2W,S36	8		no rma
Southwest	Xroad Combo	II	PC	2004	5034	0552	T31S,R5W,S32	34		
Tillamook	Bale Bound	IV	CC	2003	30999	0379	T3S, R7W,S20	98	Y	
Tillamook	Bobcat	V	CC	2002	38015	0226	T1S,R7W,S20,21	89		
Tillamook	Buck Mountain	I	PC	2003	38023	0419	T3N,R8W,S22	305		
Tillamook	Cook East	IV	CC	2003	30732	0386	T2N,R8W,S10	78	Y	
Tillamook	Ed's BSM	VII	CC	2003	37571	0416	T2S,R8W,S15	61		
Tillamook	Ed's BSM	II	CC	2003	37622	0416	T2S,R8W,S11	9		
Tillamook	Fox Ridge Thin	II	PC	2002	30988	0322	T1N,R7W,S4	37		
Tillamook	Gold Peak	VI	CC	2003	30673	0415	T2S,R8W,S1	60		
Tillamook	Kilo	III	CC	2003	30969	0383	T1N,R8W,S16	45	Y	
Tillamook	Lost Alder	I	CC	2002	36008	0246	T3N,R9W,S25	59		
Tillamook	Lower Roller Road	IV	CC	2003	30964	0429	T1N,R9W,S21	37	Y	
Tillamook	Miami High	I	CC	2003	31880	0455	T2N,R9W,S11	48	Y	
Tillamook	Mutt Peak	III	CC	2004	32202	0469	T1N,R8W,S19	124	Y	
Tillamook	Nehalem Divide	II	PC	2002	30934	0413	T3N,R9W,S10	36		
Tillamook	South Coast Range	I	CC	2004	32044	0446	T2S,R8W,S25	74		
Tillamook	Toll Four	III	CC	2004	35446	0444	T2S,R7W,S9	87		
Tillamook	White Creek	II	CC	2002	30951	0325	1N,R8W,S29,30,3	39	Y	no rma
Tillamook	Zig Zag	I	CC	2003	31002	0418	T1S,R7W,S28	103		
West Oregon	Barkshot Thin	II	PC	2004	18513	0505	T12S,R8W,S1	123		
West Oregon	Cline Thin	II	PC	2002	18408	0249	T11S,R8W,S21	54		
West Oregon	Deer Salmon Thin	V	PC	2002	18571	0310	T11S,R9W,S26	10		no rma
West Oregon	Hatchery Combination	I	CC	2003	18968	0348	T10S,R8W,S5	38		
West Oregon	Long Haul Thin	V	PC	2003	18145	0402	T11S,R8W,S32	68		
West Oregon	Long Haul Thin	VI	PC	2003	18622	0402	T11S,R8W,S32	24		no rma
West Oregon	Lucas Creek Thin	I	PC	2004	18681	0509	T9S,R8W,S28	9		
West Oregon	North Baber	I	CC	2004	18974	0423	T11S,R9W,S9	23		no rma
West Oregon	Shroyer Ridge Thin	IX	PC	2003	18835	0408	T11S,R7W,S19	11		
Western Lane	North Nelson	II	PC	2004	15079	0490	T17S,R7W,S6	44		
Western Lane	Sturtevant	I	PC	2003	15310	0358	T18S,R6W,S26	104		

DATA COLLECTION

Two different approaches were taken to collect data for this project: 1) an interview-based approach to collect qualitative and quantitative data on the administration of plans and contracts to accomplish the goals of the FMP, and 2) a field-based approach which measures target resources in the field to assess how well FMP-defined targets are being met. Specific methodology for each is defined below. The field-based measurements are further broken down into three categories, each with its own methodology; riparian management area sampling, clearcut sampling, and partial cut sampling.

Contract Administrative Review (CAR)

CAR collects qualitative, office-based data on operational planning and contract administration at both the site and landscape-level on each district. District staff were asked a series of questions pertaining to Annual Operation Plans (AOP), the Implementation Plan (IP), and strategies addressed in the FMP. Questions were developed from specific targets and goals described in each of these documents and designed to determine if contract language is consistent with the intent of the FMP. AOP-level questions were directed at including all operations within a given AOP while site-level questions focused specifically on the randomly selected stands used in this study.

Riparian Management Area (RMA) Sampling

The implementation monitoring riparian management area (RMA) sample was designed to capture streamside vegetation characteristics and results from forest management activities within RMAs for streams, lakes, ponds, and wetlands. A series of questions was assembled to assess the level of success for managing riparian areas consistent with Appendix J in the FMP and the Salmon Anchor Habitats protection strategies. These questions were subsequently abbreviated and incorporated into a handheld data collection program know as HHMonRIP2. Field sampling occurred from May to October of 2008. Components of the RMA sampling are as follows:

RMA Plot Design

RMA sampling was accomplished using a rectangular plot radiating outward from the stream or wetland edge (Figure 1). To balance the need for cost effectiveness and minimization of measurement error, the tree sample plot size for all measured RMAs was kept at 60’ wide. The stream sample begins at the edge of the high water mark of the aquatic zone and extends 170’ uphill. If the stream had a channel migration zone or a stream-associated wetland, the plot was established adjacent to the migration zone or wetland edge. Stream zones were delineated into Streambank (0-25’), Inner (25’-100’), and Outer (100-170’) zones. Wetlands that were > 1 acre had a 100-foot RMA sample. Wetlands ¼-1 acre in size and wetlands less than ¼ acre had a 50 foot RMA sample. With each plot size, the downwood transect and tree sample ended at their associated 100’ or 50’ RMA width edges. Percent cover measurements were taken on Perennial Type N streams at 200’, 300’, and 400’ from the confluence of Type F streams. Four measurements were taken at each point with a convex densiometer and averaged to get the total % cover within 500’ feet of the confluence of Type F streams. Percent shade is dependent upon time of day so percent cover was substituted as an alternative.

All trees and snags ≥ 6” were measured for DBH and recorded in their respective zone category. The same was done for downwood pieces ≥ 6” that intersected the transect(s). Each plot had a 170’ transect, which was the center line of the plot. Fish streams and Large and Medium Type N streams had two additional transects. One perpendicular to the centerline at 60’ from the aquatic zone and one

at 135’ from the aquatic zone. These additional transects were added to the midway points of the Inner and Outer zones to increase confidence in the downwood sample for these streams that have downwood retention requirements. Wetlands that were greater than 1 acre had a 100’ transect and smaller wetlands had a 50’ transect. (Figure 1).

Plot Placement

All stream, lake, pond, and wetland RMAs that existed within a selected timber sale unit or that overlapped with the unit boundary were sampled. For example, an RMA could be completely inside a unit or an RMA could parallel the stand edge. In the latter case, portions of the stream that were within 170’ from the unit boundary were sampled (Figure 2).

The first plot for a stream segment was placed 200’ upstream from the confluence with a larger stream. This was done to avoid samples overlapping with another streams RMA. Additional plots were placed at 500’ intervals. The side of the stream for plot placement was selected based on whether the plot number was odd or even. Odd numbered plots were established on the left side of the stream facing downhill and even on the right side facing downhill. Subsequent plots on the same stream alternated sides as the plot numbers increased (Figure 3).

Figure 1. Riparian management area plot design and layout for **A)**Type F and Large and Medium Type N streams; **B)** Small Perennial and Small Seasonal Type N streams; **C)** Lake/Pond/Wetland >1 acre; and **D)** Lake/Pond/Wetland <1 acre.

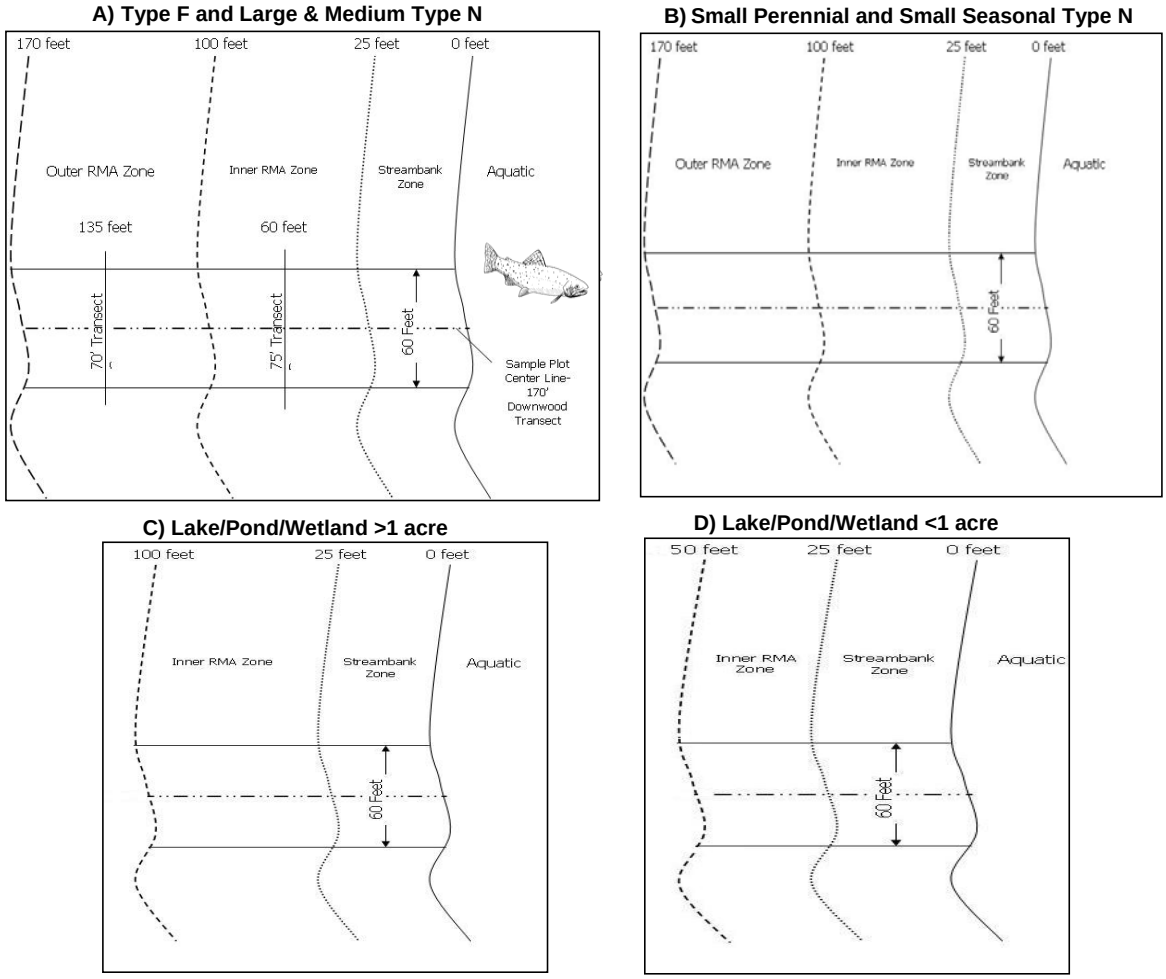
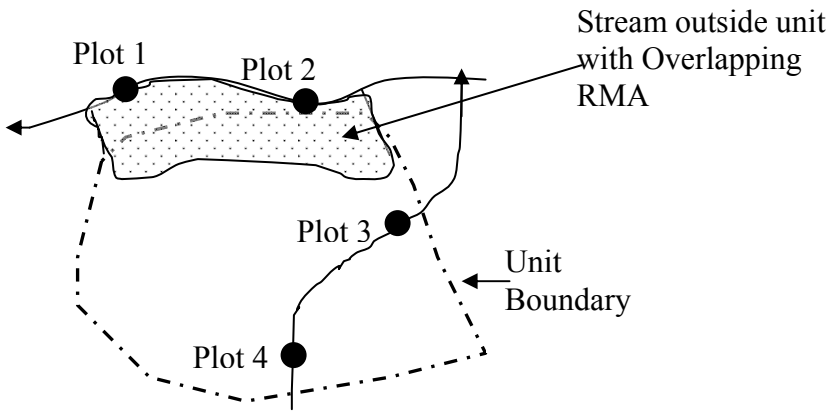


Figure 2. Example of plot placement strategy for streams inside a timber sale unit (plots 3 & 4) or within 170' from unit boundary (plots 1 & 2).



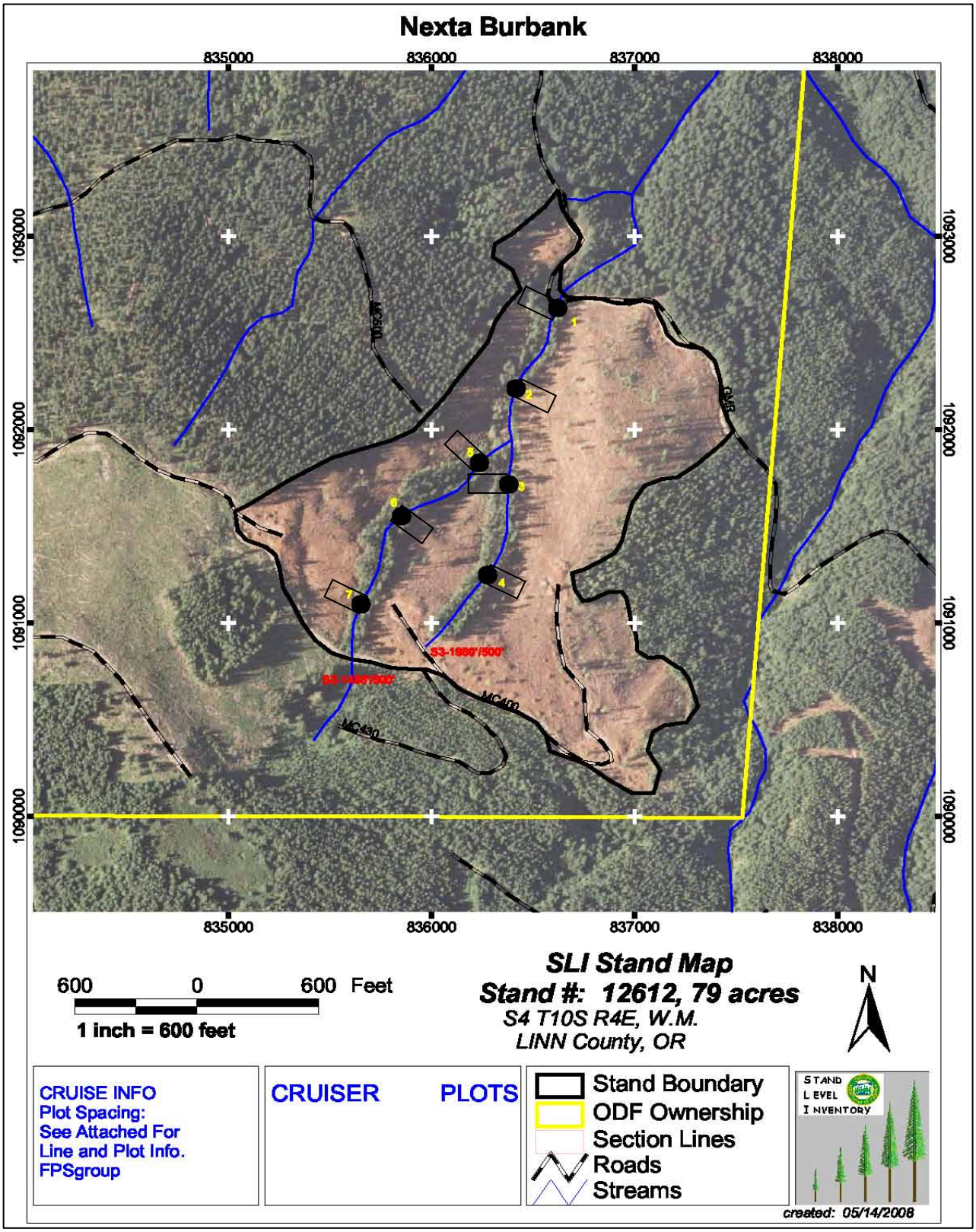
Stream Identification and Validation

A map of each timber sale unit was developed in GIS and each districts GIS stream layer was used as a preliminary identifier for fish presence and stream locations within a unit. The criteria for RMA sampling included the presence of a channel bed and a bank. Draws with overland flow did not get sampled unless they met these two criteria. Small perennial and seasonal Type N streams were verified by field crews and updated to their appropriate seasonal or perennial classifications if necessary. At the time of sampling it was unknown how up-to-date GIS stream layers were and so field crews inspected every stream shown on the map for that unit (Figure 3).

Through sampling it was found that stream layers were often incorrect about the locations and frequency of streams in many selected units, and as a result of this a post-measurement assessment of GIS stream-layer accuracy was performed with the following results:

A total of 443 streams in 55 stands were identified from GIS stream layers and a total of 222 of the streams were non-existent on the ground. 119 in Tillamook, 52 in Astoria, 10 in North Cascade, 21 in Forest Grove, 5 in Southwest, 12 in West Oregon, and 3 in Western Lane. In some cases the timber sale exhibit A's showed buffers for streams that did not exist on the ground. Future monitoring efficiency can be improved by ensuring district stream layers are updated upon completion of timber sale layout.

Figure 3. Example of a stand map with the stream layer and plot placement for RMA sampling.



Data Collection

Along each stream type, a plot (or plots) was installed and the pertinent management zones for each stream type were delineated with flagging (i.e., Streambank, Inner, & Outer zones). A crew member would visit each zone, measure all trees and snags ≥ 6" DBH and answer the stream type and zone-related questions on the handheld. Data on down wood pieces that intersected the plot centerline transect and were ≥ 6" at the large end were also collected in every zone of every plot. Table 2 represents the HHMonRIP2 handheld data collection questions and field structure that was used to answer the questions in Appendix J of the FMP by stream type. Table 3 displays all variables assessed for trees, snags, and downwood.

Table 2. Field data collected in the handheld data collection program at each plot for each stream type. x = always collected; o = sometimes collected; shaded boxes = not applicable.

CRUISE LEVEL	Fish (S1)	Large/Med Type N (S2)	Perennial Type N (S3)	Seasonal N: High energy (S4)	Seasonal N: Potential Debris Flow (S5)	Other Seasonal N (S6)	>1 ac Wetland (L1)	1/4-1 acre Wetland (L2)	<1/4 acre Wetland (L3)	Estuaries (L4)	Bogs (L5)
Stand ID	x	x	x	x	x	x	x	x	x	x	x
Cruiser	x	x	x	x	x	x	x	x	x	x	x
Salmon Anchor Habitat?	x	x	x	x	x	x	x	x	x	x	x
Date	x	x	x	x	x	x	x	x	x	x	x
PLOT LEVEL	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
Plot #	x	x	x	x	x	x	x	x	x	x	x
Stream Type	x	x	x	x	x	x	x	x	x	x	x
Stream #	x	x	x	x	x	x	x	x	x	x	x
Distance from Boundary or larger stream	x	x	x	x	x	x	x	x	x	x	x
Bank (Left or Right)	x	x	x	x	x	x	x	x	x	x	x
Inside or Outside Unit Boundary	x	x	x	x	x	x	x	x	x	x	x
RMA Buffer Width	x	x	x	x	x	x	x	x	x	x	x
Ycoordinates	x	x	x	x	x	x	x	x	x	x	x
Xcoordinates	x	x	x	x	x	x	x	x	x	x	x
%Cover1 within 500' of fish stream			x								
%Cover2 within 500' of fish stream			x								
%Cover3 within 500' of fish stream			x								
GORGE	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
Inner Gorge Present?	x	x	x								
RMA width adjusted for gorge?	o	o	o								
STREAMBANK ZONE	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
% area with ground disturbance	x	x	x	x	x	x	x	x	x	x	x
Trees cut in zone?	x	x	x	x	x	x	x	x	x	x	x
Cable yarding in zone?	x	x	x								
% area with veg disturbed	x	x	x								
Felled or dmg trees left in zone?	x	x	x								
Splash zone harvesting?	x	x	x								
Strm channel integrity maint?	x	x	x	x	x	x					
INNER ZONE	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
Partial Cutting in zone?	x	x	x				x			x	x
% area with veg disturbed	x	x									
Tractor within 50' of aquatic?	x	x	x								
Tractor on slopes >35%?	x	x	x								
% area with ground disturbance	x	x									
OUTER ZONE	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
GTR pref to dom/codom in inner zone?	x	x									
% area with ground disturbance	x	x									
SALMON ANCHOR HABITAT	S1	S2	S3	S4	S5	S6	L1	L2	L3	L4	L5
SDI <25% or>25% in upland			x	x	x	x					
% area with ground disturbance in 0-50'	x	x	x	x	x	x					
Harvest in 0-50'			x	x	x	x					
Harvest within 100' of fish or L/M Type N?	x	x									

Table 3. Variables collected for trees and down wood within each RMA plot and plot zone.

TREES/SNAGS	DOWN WOOD
Plot #	Plot #
Tree #	Transect A/B/C
Zone (Streambank/Inner/Outer)	Piece #
Inside or Outside Posted Buffer	Zone (Streambank/Inner/Outer)
Snag or Live Tree	Inside or Outside Posted Buffer
Species	Species
DBH	Type (Shape)
Crown Class	Intercept Diameter
Damage	Diameter 2 (if different from Int. Diam.)
Severity	Tilt in degrees
Defect %	Large End Diameter if >= 24"
Condition	Length if diameter >=24”
Usage	Condition
Man Made or Natural Snag	Old/Recent Blowdown/Recent cut hard

Clearcut Sampling

Upland sampling of clearcut stands was accomplished using a grid-based plot layout within each stand. Plots were sampled using a modified horizontal line transect sampling methodology described in the ‘Implementation Monitoring Field Guide – Clear Cut Protocol’ document found at: \\StateForests\Research & Monitoring\Implementation Monitoring\IM CC Field Guide

Partial-cut Sampling

Upland sampling of partial cuts was accomplished using standard SLI protocols. Plots were placed on a grid and sampled using a variable-size plot based on the Basal Area Factor. Detailed protocols can be found in the SLI Field Guide at: \\salem3a\slihome\SLIDocs\SLIfieldguide-JAN2008.pdf

Data Analysis

All data collected in RMA’s were averaged across all plots within a stream type at three different levels: within a stand, within a district, and across all districts. These data were also stratified by stream presence in or outside of a salmon anchor habitat basin. Quantitative data collected on trees, down wood, and snags were expanded out to get an estimated mean value per acre per stratum sampled.

Upland data (clearcuts and partial cuts) were stratified in a similar fashion, with values averaged across all plots within a stand. Acres-weighted means of variables for each stand, district, and across all stands were calculated.

RESULTS

Results are presented in the following order and format:

I. Contract Administrative Review (CAR) responses to questions focusing on the Annual Operations Plan years included in this study; 2002-2006.

II. Upland data (clearcuts and partial cuts). CAR responses and quantitative results of unit-level field data organized by Landscape Management Strategies/Aquatic & Riparian Strategies.

III. Riparian Management Area sampling data

I. Contract Administrative Review (CAR) - Annual Operation Plan Questions

CAR questions focusing on specific sale-plan or AOP years addressed Landscape Management Strategies 1-3 in the FMP. These questions referred to sale plan years 2002-2004 and are further stratified by their relevance to either all sales within an AOP, to clearcuts only, or to partial cuts only. Three sales that were originally planned for a 2003 AOP were moved into later AOP years. Workload constraints have limited us to keep the focus on AOP years 2002-2004 and not display the detailed analysis for AOP years 2005-2006 since so few sales are reflected in these two years. The three sales moved into later AOPs are summarized in the CAR reports for their original planned AOP years.

AOP-level questions were broad in scope and all districts had similar responses (Table 4). All operations were planned with the goal of achieving the recommendations of the FMP and conducted according to the specifications in the IP and AOP's (q.3). In most cases, districts implemented harvest prescriptions to create complex structure in stands that did not have a complex desired future condition (DFC), i.e., 'LYR' or 'OFS' DFC (q.5). Responses included the terms "wherever present" and "when possible" for districts being able to maintain "anchor" habitats, species corridors, and connectivity between basins (q.7,9,10). In all but one case, measures were taken to promote a range of patch sizes across the landscape. Prescriptions naturally create variability and gaps in the landscape and scattered ownerships also contribute to a range of patch sizes (q.8).

All districts were able to retain hardwood trees where available (q.22). An additional question posed was regarding contract language to specify green tree retention. For clearcut prescriptions specifically, the contract language regarding green tree retention included species-specific retention requirements which often included hardwoods. This contract language was found in the 'Reserve Timber' section of the timber sale contracts and could also include diameter limits, quantity specifications, types of retention patches, and specific tree retentions such as bearing and wildlife trees.

For those units with a clearcut prescription, there were two instances of acreage being harvested outside the range of the IP recommendations, one above and one below the range provided in the IP (Table 5). This was for AOP year 2002. In the same year there were three instances of range exceedance for partial cuts (Table 5). The ranges provided reflect the IP recommendations for AOP years 2002-2006, although there have been subsequent revisions to these ranges since.

Table 4. District-level responses to CAR questions that pertain to Annual Operation Plan years 2002-2004. A total of seven districts were interviewed and the number in each cell reflects 'number of districts' for each response unless otherwise stated.

Q #	Question	FMP Source	Response	AOP Year 2002	2003	2004
AOP-LEVEL QUESTIONS						
3	Have operations been planned with the goal of achieving the proportions of forest structure types recommended in the FMP?	LMS1	*Yes*	7	7	7
			No	-	-	-
			N/A	-	-	-
5	Were there any prescriptions to create complex structure outside of LYR and OFS DFC?	LMS1	*Yes*	6	4	4
			No	1	3	3
			N/A	-	-	-
7	Have "anchor" habitat areas been maintained?	LMS2	*Yes*	5	4	4
			No	-	-	-
			N/A	2	3	3
8	Were any measures taken to promote a range of patch sizes across an AOP?	LMS2	*Yes*	4	6	5
			No	-	-	1
			N/A	3	1	1
9	Have corridors for key species been established and / or maintained?	LMS2	*Yes*	4	6	6
			No	-	-	-
			N/A	3	1	1
10	Has connectivity been maintained between basins and across the landscape?	LMS2	*Yes*	4	6	6
			No	-	-	-
			N/A	3	1	1
22	Have hardwood trees been retained, especially Oregon white oak and bigleaf maple, where possible?	LMS3b	*Yes*	7	7	7
			No	-	-	-
			N/A	-	-	-
CLEARCUTS ONLY						
1	Does the number of clearcut acres harvested fall within the range prescribed by the IP?	LMS1	*Yes*	5	6	6
			No	2	-	-
			N/A	-	1	1
4	Are all clearcuts not in areas slated for LYR and OFS forest?	LMS1	*Yes*	4	3	4
			No	3	3	2
			N/A	-	1	1
PARTIAL CUTS ONLY						
1b	Does the number of partial cut acres harvested fall within the range prescribed by the IP?	LMS1	*Yes*	4	7	7
			No	3	-	-
			N/A	-	-	-
16	Was the total number of acres managed for OFS in areas slated for OFS within the range specified by the IP?	LMS3a	*Yes*	7	4	5
			No	-	-	-
			N/A	-	3	2
17	Was there any OFS felled in areas designated as OFS in desired future condition?	LMS3a	*Yes*	-	-	1
			No	7	7	6
			N/A	-	-	-
38	What is the number of acres of CSC thinned to promote layering?	LMS3e	*# of acres*	4180	3755	5462
43	What is the number of units with a prescription that will result in gap creation?	LMS3h	*# of units*	6	21	28

Table 5. The number of proposed and actual partial cut and clearcut acres harvested. The Implementation Plan acreage shown reflect ranges as they were in the 2002-2004 AOPs, not any subsequent revisions. This table addresses Landscape Management Strategy 1 in the FMP.

District	Implementation Plan clearcut	Actual clearcut acreage			Implementation Plan partial-cut	Actual partial-cut acreage		
		2002	2003	2004		2002	2003	2004
Astoria	**400-1100**	712	722	828	**2100-3400**	2768	2861	2735
Forest Grove	**338-506**	385	421	367	**2365-3547**	2447	2615	3093
North Cascade	**180-270**	268	259	225	**800-1200**	967	1087	907
Southwest	**0**	40	0	0	**180-270**	593	259	263
Tillamook	**3500-6200**	2316	3692	4236	**1000-1400**	2146	1192	1311
West Oregon	**70-110**	86	106	108	**700-1100**	1118	1009	848
Western Lane	**0-280**	0	142	120	**0-500**	360	197	266
Total Acres		***3,807***	***5,342***	***5,884***		***10,399***	***9,220***	***9,423***

Across all AOP years in this study, two to three districts per year planned clearcut operations in areas slated for complex forest structure (q.4, Table 4). Partial cut prescriptions were more often assigned in areas slated for complex forest structure rather than were clearcuts. Table 6 reflects the total number of acres harvested in each district with the intent of moving the stands to more complex structure. Partial cut prescriptions that were intended to promote complex forest structure included a variety of techniques such as patch cuts, retention harvests, low relative density thinnings, and heavy or moderate thinning regimes.

Additional CAR questions concerning partial cuts related to landscape strategies that promote structural diversity. Anywhere from ~3700 to 5500 acres harvested in each AOP year were closed-single-canopy stands thinned to promote layering (q.38, Table 4). Furthermore, many of the AOP units for each year had specific prescriptions for the creation of gaps across the landscape (q.43, Table 4), although only a few of these fell into our study.

Table 6. Acreage of clearcuts and partial cuts that were harvested with the intention of moving stands to more complex structures within the given AOP years. This table addresses Landscape Management Strategy 1 in the FMP.

District	Clearcut acreage			Partial cut acreage		
	2002	2003	2004	2002	2003	2004
Astoria	0	0	0	1394	1352	911
Forest Grove	0	0	0	550	944	1311
North Cascade	0	4	150	136	824	440
Southwest	0	0	0	0	259	154
Tillamook	0	860	720	1563	1192	1245
West Oregon	0	106	0	537	153	325
Western Lane	0	0	0	0	0	0
Total Acres	***0***	***970***	***870***	***4180***	***4724***	***4386***

II. Unit-level Questions – CAR and Upland Quantitative Data (clearcuts and partial cuts)

At the unit (or stand) level, CAR questions and field-collected upland data broadly focus on three different strategies within the FMP. The first, Landscape Management Strategy 3 (LMS3) states that the ODF should "*Actively manage the state forest landscape to incorporate structural habitat components into the forest at a landscape level.*" This strategy has numerous subcomponents that help fine-focus efforts towards achieving this goal. These subcomponents are addressed individually below, with the corresponding responses to the CAR questions posed for each of the 55 stands in our study. Results of the field-collected upland data of clearcuts and partial cuts are presented here along with quantitative comparison to FMP targets.

LMS3a: "REMNANT OLD GROWTH TREES - RETAIN REMNANT OLD GROWTH TREES OR PATCHES OF OLD GROWTH."

Only five units in our study had old growth trees identified in them (q.11, Table 7). In four of these five units, the old growth was marked for retention. In the unit where this didn't occur, foresters found it necessary to cut some of the old growth during a prescribed burning mop-up. In this case, the old growth was also left for down wood. Otherwise, all sampled stands across all districts maintained all their remnant old growth, if any was present.

Stands classified as Older Forest Structure (OFS) typically have structures that are similar to old growth and OFS is "…*the managed stand type that is intended to emulate some, and possibly many, of the structures and functions of old growth*" (FMP 2001, p.4-18). Only one unit in our study was classified as OFS. This stand, Hunt Creek LSD Area VI, was subsequently managed for OFS with a partial cut prescription target of 160 ft^2 of Basal Area (BA) and a minimum of 20 green trees per acre (TPA). However, this stand suffered severe weather-related damage and was recently salvaged, post-measurement. Our pre-salvage measurements support the original management goals with a residual BA of 167 ft^2/acre of trees ≥ 6" diameter (Table 8) and an average of 37 green TPA ≥ 18" and 100' tall (data not shown).

Table 7. Responses to CAR questions addressing LMS3a. Numbers in cells are the number of units for that response and the corresponding percentage of the total stands where the questions were applicable. There were 29 clearcut units and 27 partial-cut units in the study. One clearcut was dropped from the study after it was intensively salvaged but for the purposes of addressing the CAR questions, that clearcut stand was still assessed.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
11	Were any old growth trees/patches identified in sale preparation?	*Yes*	2	*6.9%*	3	*11.1%*
		No	27	*93.1%*	24	*88.9%*
		N/A	-	-	-	-
12	Were old growth trees/patches marked for retention?	*Yes*	2	*100.0%*	2	*66.7%*
		No	-	*0.0%*	1	*33.3%*
		N/A	27	-	24	-
13	Were any old growth trees cut?	*Yes*	1	*50.0%*	-	*0.0%*
		No	1	*50.0%*	3	*100.0%*
		N/A	27	-	24	-
15	If old growth was cut, was it left for down wood?	*Yes*	1	*100.0%*	-	*0.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	28	-	27	-

Table 8. Partial cut unit-level averages of data collected in upland areas. Numbers in bold are weighted district-level or all stands-level averages.

District	AOP Year	Stand	Acres	Plots	Residual Basal Area ≥ 6"	Residual SDI ≥ 6"	All snags ≥ 6"	Snags/Ac ≥ 15" Class 1-2	*(ft^3/ac) Downwood 1-2*	*(ft^3/ac) Downwood 1-5*	*Downwood Class 1-2 >24" Pieces/Ac*
WO	2002	Cline Thin II	54	24	134	34%	1.4	0.0	211	355	0.0
WO	2002	Deer Salmon Thin V	10	12	153	31%	9.1	5.2	806	930	0.0
WO	2003	Long Haul Thin VI	24	12	148	32%	9.6	6.1	460	1,184	0.0
WO	2003	Shroyer Ridge Thin IX	11	9	140	37%	7.2	0.0	245	964	0.0
WO	2003	Long Haul Thin V	68	19	107	29%	5.3	1.4	344	574	0.0
WO	2004	Luca Creek Thin I	9	25	142	34%	13.2	2.1	451	2,810	0.0
WO	2004	Barkshot Thin II	123	19	187	38%	24.0	0.5	420	625	0.0
		Weighted Average						***2.9***	***411***	***962***	***0.0***
TL	2002	Fox Ridge Thin II	37	15	144	34%	2.1	1.2	425	5,818	0.0
TL	2002	Nehalem Divide II	36	17	72	18%	26.6	4.5	2,228	5,036	3.2
TL	2003	Buck Mountain I	305	31	195	53%	28.2	0.3	800	4,344	0.0
		Weighted Average						***2.8***	***1,120***	***4,601***	***0.3***
AS	2002	Nettle Meyer Combo II	510	54	143	32%	7.8	2.1	1,306	3,315	0.7
AS	2002	Nettle Meyer Combo V	44	11	164	38%	48.5	1.4	416	1,463	0.0
AS	2002	Hunt Creek LSD VI	119	20	167	36%	9.0	1.2	1,160	2,877	5.8
AS	2003	Deep Creek Thin I	172	19	154	30%	1.6	0.4	843	1,880	1.8
AS	2004	Simmons Ridge Combo V	84	21	123	27%	7.4	1.3	1,237	3,861	0.0
AS	2004	Cole Mtn Combo VI	236	25	157	33%	7.4	0.8	728	3,600	0.0
		Weighted Average						***1.7***	***1,137***	***2,147***	***2.5***
NC	2003	Fractured Rock Combo II	153	33	194	45%	14.0	1.5	741	3,861	0.0
NC	2004	Cold Wash Thin III	38	15	112	30%	29.9	0.0	349	2,016	0.0
		Weighted Average						***1.2***	***699***	***3,649***	***0.0***
FG	2002	T Wally Thin II	45	17	96	21%	0.6	0.5	1,078	4,978	0.7
FG	2002	Ought To Thin I	177	33	122	31%	6.1	0.0	474	4,988	0.0
FG	2003	Sappington Creek II	177	31	165	44%	7.2	1.8	871	3,266	0.2
FG	2004	C Saw I	221	31	139	33%	15.8	1.4	709	3,481	0.4
FG	2004	Dark Bark II	184	30	152	33%	18.5	3.4	1,299	5,170	5.0
FG	2004	Willaminor I	26	23	162	39%	23.4	1.5	297	1,694	0.0
		Weighted Average						***1.9***	***971***	***4,371***	***3.3***
SW	2004	Xroad Combo II	34	20	153	46%	7.4	0.0	93	2,363	0.0
WL	2003	Sturtevant I	104	23	96	22%	10.4	1.0	801	2,269	0.0
WL	2004	North Nelson II	44	10	128	34%	22.7	0.0	443	1,510	0.0
		Weighted Average						***0.7***	***733***	***2,102***	***0.0***
		All Stands - Weighted Average				TOTALS:	***19.5***	***1.9***	***1,014***	***3,797***	***1.9***

LMS3B: "RESIDUAL LIVE TREES - RETAIN AN AVERAGE OF 5 GREEN TREES PER ACRE DURING REGENERATION HARVEST."

CAR questions addressing this landscape strategy were meant to determine if general and specific targets for residual green trees were being met in individual units and across the landscape. Beyond the FMP target of 5 green TPA, contract language typically also specified number of trees to be reserved for a species along with their grouping or location. The number of live green trees remaining after a clearcut was requested as part of the CAR process, but was a variable typically not kept on record. Field measurement of live green trees per acre showed that, on average, ***17 green TPA ≥11" diameter*** were retained on the landscape in clearcuts. This exceeds the LMS3b target of 5 green TPA and one individual stand had an average of 64 TPA in accordance with the individual unit prescription (Table 10).

In all clearcut units, green tree retention included a component of defective and sound, healthy trees (q.20, Table 9). These trees had variable spatial arrangements, typically scattered throughout the stand. Generally, trees were left 'wherever they were' and this resulted in even, clumped, and/or individual dispersion. Natural clumping patterns were also formed by trees in riparian zones and green tree retention patches. The 'Reserve Timber' contract language specifying green tree retention was typically very specific and included the following phrases, varying for each individual unit: reserve trees within posted buffers, sub-merchantable trees, wildlife trees, trees other than a specific species designation with or without height and/or DBH specifications.

In all but a few cases, additional green trees for future recruitment of snags and down wood were left where a current stand was deficient, in all but a few cases (q.24, Table 9).

Hardwood tree retention was done wherever available in both clearcuts and partial cuts (q.22, Table 9). The units in our study where hardwoods were not retained were clearcut timber sales with hardwoods as the 'take' species. There were no stands in our study where Oregon white oak was known to exist. The primary hardwood component in these stands was red alder and bigleaf maple.

Table 9. Responses to CAR questions addressing LMS3b. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable. There were 29 clearcut units and 27 partial cut units in the study. One clearcut was dropped from the study after it was intensively salvaged but for the purposes of addressing the CAR questions, that clearcut stand was still assessed.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
20	Does green tree retention include a component of defective trees and sound and healthy trees?	*Yes*	29	*100.0%*	-	-
		No	-	*0.0%*	-	-
		N/A	-	-	-	-
22	Have hardwood trees been retained, especialy Oregon white oak and bigleaf maple, where possible?	*Yes*	24	*85.7%*	27	*100.0%*
		No	4	*14.3%*	-	*0.0%*
		N/A	1	-	-	-
24	Where snag and down wood was deficient or minimum, were additional green trees retained for future recruitment?	*Yes*	24	*96.0%*	8	*72.7%*
		No	1	*4.0%*	3	*27.3%*
		N/A	4	-	16	-

Table 10. Unit-level averages of data collected in upland areas of clearcut stands. Numbers in bold are weighted district-level or all stands-level averages.

District	AOP Year	Stand	Acres	Plots	Green TPA ≥ 6"	Green TPA ≥ 11"	Snags/Ac ≥15" Class 1-2	*(ft^3/ac) Downwood 1-2*	*(ft^3/ac) Downwood 3-5*	*(ft^3/ac) Downwood 1-5*	(ft^3/ac) Downwood 1-2 Recent Cut	*(ft^3/ac) Downwood 1-2 Recent Blowdown*	*Downwood Class 1-2 >24" Pieces/Ac*
TL	2002	White Creek II	39	14	11.0	7.7	0.00	939	2100	3039	906	33	0
TL	2002	Bobcat V	89	28	64.2	41.8	0.49	551	2643	3194	547	3.5	0
TL	2002	Lost Alder I	59	25	11.9	9.1	0.87	590	1094	1684	405	186	0.53
TL	2003	Ed's BSM VII	61	25	13.9	13.9	0.65	301	1863	2163	---	---	0
TL	2003	Gold Peak VI	60	26	8.4	6.0	0.51	780	1789	2569	742	38	0
TL	2003	Lower Roller Road IV	37	15	9.6	6.6	0.30	684	614	1299	683	1	0
TL	2003	Kilo III	45	25	7.7	5.6	0.62	547	1934	2482	543	0	1.14
TL	2003	Cook East IV	78	23	10.9	7.0	0.59	692	2291	2984	634	56	0
TL	2003	Zig Zag I	103	24	13.8	11.7	0.56	979	1354	2333	973	6	0
TL	2003	Bale Bound IV	98	26	4.7	3.0	0.28	433	1192	1624	422	9	0
TL	2003	Miami High I	48	23	15.3	12.6	1.86	469	2375	2844	346	122	0
TL	2003	Ed's BSM II	9	0	9.7	6.6	0.11	733	5459	6192	733	0	0
TL	2004	Mutt Peak III	124	24	17.0	6.1	1.36	753	4655	5408	---	---	0
TL	2004	South Coast Range I	74	23	2.6	2.4	0.07	766	2153	2919	756	9	0.72
TL	2004	Toll Four III	87	25	0.5	0.5	0.00	675	3169	3844	643	---	0.32
		Weighted Average			***33.0***	***21.3***	***0.9***	***713***	***2,855***	***3,423***	***695***	***106***	***0.2***
AS	2002	Nettle Meyer Combo VI	82	26	10.4	2.3	0.2	1,467	1,083	2,550	1,396	---	2.41
AS	2002	Nettle Meyer Combo IX	92	23	10.1	6.7	0.5	844	565	1,409	816	28	0.29
AS	2003	Foster Divide VII	68	21	14.4	13.1	0.57	1,128	627	1,755	1,094	33	2.19
AS	2004	Bigfoot Combo IV	25	16	6.0	5.7	1.90	582	1,148	1,730	518	64	0
AS	2004	Cole Mtn Combo III	30	17	16.6	14.5	0.42	653	2,215	2,868	653	145	0.07
		Weighted Average			***12.2***	***10.3***	***0.9***	***1,133***	***1,194***	***2,123***	***1,086***	***82***	***0.7***
WO	2003	Hatchery Combo I	38	21	20.3	15.9	0	169	377	546	161	8	0
WO	2004	North Baber I	23	10	1.4	1.3	0.79	1,145	591	1,736	1,106	---	0.54
		Weighted Average			***20.0***	***15.2***	***0.3***	***954***	***481***	***1,329***	***923***	***8***	***0.2***
FG	2002	Scoggins Combo I	43	17	4.2	2.5	1.25	1,590	2,168	3,758	283	---	1.74
FG	2004	Mac Attack I	84	21	7.3	5.5	1.06	804	583	1,386	735	68	4.73
		Weighted Average			***6.6***	***4.9***	***1.1***	***1,199***	***1,622***	***2,765***	***661***	***68***	***4.3***
NC	2004	Nexta Burbank	66	22	1.9	1.08	5.73	1,598	1,716	3,314	1,471	---	0.54
NC	2003	Fractured Rock Combo VIII	85	23	7.1	5.67	2.54	1,061	2,635	3,696	1,029	32	0
		Weighted Average			***6.2***	***5.1***	***4.6***	***1,350***	***2,326***	***3,539***	***1,262***	***32***	***0.2***
SW	2003	Coleman Cleansin II	8	10	15.7	2.4	0.26	442	765	1,207	41	---	0
		All Stands Weighted Average		TOTALS:	***26.7***	***17.2***	***2.2***	***956***	***2,567***	***3,191***	***897***	***92***	***1.3***

LMS3C: "SNAGS - DURING HARVEST ACTIVITIES, RETAIN ALL EXISTING SNAGS. MANAGE TO PROVIDE AT LEAST 2 HARD SNAGS PER ACRE, AT LEAST 15" IN DIAMETER, ON AVERAGE ACROSS THE LANDSCAPE ON EACH DISTRICT. MANAGE TO PROVIDE AT LEAST 6 SNAGS PER ACRE IN OLDER FOREST STRUCTURE STANDS, AT LEAST 2 OF WHICH MUST BE 24" OR LARGER IN DIAMETER."

In all cases snags were excluded from harvest by contract language (q.25, Table 11). The spatial arrangement of all the retained snags was variable. They were generally scattered across the landscape, very rarely in groups unless they were present in green tree retention patches. Snags were cut only if it was necessary for safety or operational needs. If these snags were cut, they were always left for down wood (q.29, Table 11).

There were few cases of snag creation in the units we sampled (q.30, Table 11). In most cases no snags were created because there were no known deficiencies across the landscape. Where snags were created, they were from a variety of conditions; green, healthy, almost dead, defective or wolfy trees, or those with logging damage or already broken tops. If snags were created specifically by topping, then the tops were always left for down wood (q.32, Table 11).

Most partial cuts planned for complex forest structures were managed to achieve the OFS snag retention target of six snags per acre, two of which are 24" or larger in diameter (q.26, Table 11). The one stand in our study currently at OFS, Hunt Creek LSD VI, had an average of 9 snags per acre ≥ 6" diameter and 3 of them were ≥ 24", thereby meeting LMS3c OFS targets. Although managed with OFS in mind, no other stands were currently at OFS and were therefore in too early of a stage for these targets to be met. Partial cut stands, on average, met the minimum targets set here by LMS3c. We measured an average of ***20 snags per acre ≥ 6" diameter and >4.5' tall*** and an average of ***2 hard snags per acre ≥ 15" diameter*** across all partial cut stands (Table 8). Clearcut stands, on average, also met the LMS3c target with ***2 hard snags per acre ≥ 15" diameter*** (Table 10). Although the LMS3a sets these targets at a district-wide level, the sample size for each individual district was too small in most cases to make any inference about these targets being met at this level and are therefore presented across all stands.

Table 11. Responses to CAR questions addressing LMS3c. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable. There were 29 clearcut units and 27 partial cut units in the study. One clearcut was dropped from the study after it was intensively salvaged but for the purposes of addressing the CAR questions, that clearcut stand was still assessed.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
25	Were snags marked for retention or excluded by contract language?	*Yes*	29	*100.0%*	26	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	-	-	1	-
26	Are partial cuts planned for complex forest structure types managed to achieve OFS snag retention targets (i.e., 6 snags/ac, 2≥24" dbh)	*Yes*	-	-	7	*70.0%*
		No	-	-	3	*30.0%*
		N/A	-	-	17	-
29	If snags were cut were they left for down wood?	*Yes*	29	*100.0%*	26	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	-	-	1	-
30	Where there were <2 hard snags/ac, were additional snags created?	*Yes*	4	*14.8%*	8	*32.0%*
		No	23	*85.2%*	17	*68.0%*
		N/A	2	-	2	-
32	Where snags were created by topping, were the tops left for down wood?	*Yes*	4	*100.0%*	8	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	25	-	19	-

LMS3D: "DOWN WOOD - DURING HARVEST ACTIVITIES, RETAIN EXISTING DOWN LOGS. DURING REGENERATION HARVEST, RETAIN AN AVERAGE OF 600 TO 900 CUBIC FEET OF HARD CONIFER LOGS (DECAY CLASS 1 AND 2) PER ACRE, INCLUDING AN AVERAGE OF 2 LOGS PER ACRE GREATER THAN 24" IN DIAMETER (AT THE LARGEST END), WHERE AVAILABLE. MANAGE TO ACHIEVE OFS STANDS THAT CONTAIN 600-900 CUBIC FEET PER ACRE OF SOUND DOWN LOGS (DECAY CLASS 1 OR 2), OR 3000 TO 4500 CUBIC FEET OF DOWN LOGS IN ANY OR ALL DECAY CLASSES (1-5)".

Seven of the 27 partial cuts in this study were managed for OFS down wood targets (q.34, Table 12). Instances where this did not occur include stands not planned for complex forest structure or, in many cases, stands that were first entry thinnings. Down wood was typically supplemented in the partial cuts, though rarely was this done directly (q.35, Table 12). Supplementation was typically indirect through logging slash or blowdown.

The exact amount and size class of down wood retained after harvest in partial or clearcuts was not known by operation managers. Districts tried to meet FMP retention targets based on visual inspection of the stands. Our measurements indicate there were, on average, ***1,014 ft^3/acre of hard down wood (decay class 1-2)*** in partial cut stands with a total of ***3,797 ft^3/acre of down wood*** in all decay classes (Table 8). Both measurements exceed the minimum LMS3d requirements across the landscape for OFS stands. Unit-level values did vary greatly however. In clearcut stands there were averages of ***956 ft^3/acre of hard down wood (decay class 1-2)*** and a total average of ***3,191 ft^3/acre of down wood*** in all decay classes – again exceeding the minimum LMS3d requirements for OFS stands (Table 10). The additional requirement in clearcuts of an average of 2 logs/acre >24" diameter fell short at a landscape-level, with a resulting average of ***1.3 down wood pieces/acre >24" (decay class 1-2).*** Although all pieces >3' long were recorded for this study, the minimum length for reporting of >24" pieces was set at 6 ft.

Salvaging occurred in five partial cut units in our study (q.37, Table 12). In these cases, merchantable logs and sub-merchantable wood were left as down wood. Blowdown in stands was also left as down wood. Typically, removal of old windfalls was not allowed which contributed to the down wood in those units. In one unit, West Green Mountain Combo, multiple salvaging events occurred because of excessive blowdown and essentially turned the partial cut prescription into a clearcut stand and has subsequently been managed as such.

Table 12. Responses to CAR questions addressing LMS3d. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable. There were 29 clearcut units and 27 partial cut units in the study. One clearcut was dropped from the study after it was intensively salvaged but for the purposes of addressing the CAR questions, that clearcut stand was still assessed.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
34	Were partial cuts managed to achieve OFS targets (i.e., 600 – 900 ft^3/ac of class 1 and 2 wood or 3000 – 4500 ft^3/ac of class 1-5 wood) over time?	*Yes*	-	-	7	*33.3%*
		No	-	-	14	*66.7%*
		N/A	-	-	6	-
35	Was down wood supplemented during partial cuts?	*Yes*	-	-	9	*36.0%*
		No	-	-	16	*64.0%*
		N/A	-	-	2	-
37	Did salvaging occur in unit?	*Yes*	1	*3.4%*	5	*18.5%*
		No	28	*96.6%*	22	*81.5%*
		N/A	-	-	-	-

LMS3E: "MULTI-LAYERED FOREST CANOPIES - MANAGE VEGETATIVE COMMUNITIES TO CREATE COMPLEX MULTI-CANOPIED FORESTS OR AT LEAST TO INCREASE THE AMOUNT OF LAYERING IN MOST STANDS."

Acreage of closed-single-canopy forest type thinned to promote layering was assessed for each AOP year (q.38, Table 4), with anywhere from ~3700 to 5500 acres thinned to promote layering. Unfortunately, heights of all species were not recorded so we cannot directly answer the questions of whether management is contributing to layering. However, the residual species mix (major species) and basal area for each partial cut stand is reported here to highlight at least the species composition and resulting density contributing to layering in the stand (Table 13).

Table 13. Residual species mix and corresponding basal area in partial cut stands (n=27).

District	AOP Year	Stand ID	BA per species in stand
Astoria	2004	Cole Mountain Combo VI	DF 139; RA 15; SS 4
Astoria	2003	Deep Creek Thin I	DF 147; RC 7
Astoria	2002	Hunt Creek LSD VI	DF 100; WH 53; RC 12; SS 1.5
Astoria	2002	Nettle Meyer Combo II	DF 93; WH 28; RA 19; WC 1.5; SS 1; NF 0.5;
Astoria	2002	Nettle Meyer Combo V	DF 138; WH 16; NF 3.5; RA 3.5; GF 1.8
Astoria	2004	Simmons Ridge Combo V	WH 62; SS 30; DF 20; RA 11
Forest Grove	2004	C Saw I	DF 115; NF 18; RA 4; WH 2
Forest Grove	2004	Dark Bark II	DF 96; WH 50; NF 3; RC 3
Forest Grove	2002	Ought To Thin I	DF 118; WH 3; RA 1
Forest Grove	2003	Sappington Creek II	DF 105; WH 51; RC 5; BM 3; NF 2;
Forest Grove	2002	T. Wally Thin II	DF 94; RA 1; BC 1
Forest Grove	2004	Willaminor I	DF 145; RA 16; BM 1
N. Cascade	2004	Cold Wash Thin III	DF 101; RA 5; WH 5
N. Cascade	2003	Fractured Rock Combo II	DF 135; WH 40; BM 14; RC 4; RA 1;
Southwest	2004	Xroad Combo II	DF 85; LO 18; LP 17; PM 11; GC 7; RC 5; SP 1; WP 1
Tillamook	2003	Buck Mountain I	WH 87; RA 63; DF 32; NF 9; RC 2; SS 2
Tillamook	2002	Fox Rdige Thin II	DF 97; WH 24; RA 16; RC 3; SS 1; CH 1;
Tillamook	2002	Nehalem Divide II	DF 39; WH 33
W. Oregon	2004	Barkshot Thin II	DF 180; RA 7
W. Oregon	2002	Cline Thin II	DF 130; RA 4; BM 0.5
W. Oregon	2002	Deer Salmon Thin V	DF 153
W. Oregon	2003	Long Haul Thin V	DF 94; RA 8; BM 5
W. Oregon	2003	Long Haul Thin VI	DF 148
W. Oregon	2004	Lucas Creek Thin I	DF 71; WH 66; RA 5
W. Oregon	2003	Shroyer Ridge Thin IX	DF 127; BM 9; RA 4.5
Western Lane	2004	North Nelson II	DF 124; BM 4
Western Lane	2003	Sturtevant I	DF 93; BM 2; RA 1

LMS3F: "MULTIPLE NATIVE SPECIES (CONIFERS AND HARDWOODS) - MANAGE TO INCLUDE A VARIETY OF NATIVE SPECIES."

Similar in scope to LMS3e above, LMS3f specifically looks to preserve native species on the landscape. In partial cut stands, the post-operation composition was compared with the pre-operation composition. The verbal assessment of this comparison revealed that there is typically a very similar species mix pre- vs. post-ops, with slightly less of the target harvest species.

Contract language provided very specific requirements for reserving species within the stand. A qualitative target was often set and followed for the retention of individual species, and there were also blanket phrases for hardwood, diameter limits, and minor species reservations – all of which promote retention of native species.

LMS3H: "GAPS - MANAGE STANDS FOR GAPS TO PROVIDE HORIZONTAL DIVERSITY. NATURAL OPENINGS DUE TO WINDTHROW, INSECTS, AND DISEASE, ETC. WILL SUFFICE IN MANY CASES. HOWEVER, WHERE A DEFICIENCY EXISTS, CONSIDER CREATING GAPS THROUGH MANAGEMENT ACTIVITIES."

Seven of the 27 partial cut units had a prescription to create gaps (q.44, Table 14). Gaps were prescribed mostly as treatments for Phellinus root rot, but did also occur for other reasons as needed. For instance, 80' gaps were created in the Southwest Oregon District around sugar and ponderosa pines per contract language for patch cuts in this stand.

Table 14. Responses to CAR questions addressing LMS3h. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable. There were 29 clearcut units and 27 partial cut units in the study. One clearcut was dropped from the study after it was intensively salvaged but for the purposes of addressing the CAR questions, that clearcut stand was still assessed.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
44	Was there a prescription to create gaps?	*Yes*	-	-	7	*29.2%*
		No	-	-	17	*70.8%*
		N/A	-	-	3	-
45	Of those units with a prescription for gap creation, were the gaps actually created?	*Yes*	-	-	7	*100.0%*
		No	-	-	-	*0.0%*
		N/A	-	-	20	-

Aquatic and Riparian Strategies

The other two strategies within the FMP that Implementation Monitoring focused on include the Aquatic and Riparian Strategies 2 and 5 (ARS2 and ARS5). These and additional ARS strategies were designed to provide for landscape- and site-specific resources to promote healthy and functioning aquatic systems. Implementation monitoring did not test for compliance with ARS3: "Restore aquatic habitats" or ARS4: "Apply alternate vegetation treatment to achieve habitat objectives." Of the 55 stands in our study, 9 had no streams or aquatic features in them and therefore had no application to these questions.

ARS2: "ESTABLISH AND MAINTAIN RIPARIAN MANAGEMENT AREAS ADJACENT TO ALL STREAMS, IN ACCORDANCE WITH THE STANDARDS DESCRIBED IN THE PROPOSED *WESTERN OREGON STATE FORESTS HABITAT CONSERVATION PLAN*, AND APPENDIX J OF THIS PLAN."

The following section presents results from our CAR evaluations only, with the field data results presented in the following section III of this report.

According to district managers, all 46 stands with aquatic features were identified properly as such and their aquatic zones were consistent with standards (q.46, 48, Table 15). Standards were satisfied by cooperation with ODF&W and the use of their stream survey data. Fish presence was also determined in streams by shocking methods applied by ODF employees. Additional stream features or aquatic habitats, if present, were properly identified by the districts (q.50, 51, 55, Table 15), however there were very few of these. There was only one instance of a debris flow track reach being present in a clearcut, and in this case a geotechnical expert was consulted.

In 22 of the 46 sampled stands, harvesting occurred in the Inner RMA (q.49, Table 15). Only three of these stands were clearcuts, one of which was a hardwood harvest and no conifers were taken. In the partial cuts, the Inner RMA was thinned to specifications in the timber sale contracts. Appendix J of the FMP sets targets for green tree retention in the Inner zone of all RMAs. A footnote to these goals states that if there is a conifer deficiency in the Inner zone, retention targets will increase in the Outer RMA zone to compensate. Managers felt that this occurred in all applicable situations (q.54, Table 15). However, it was also felt that there were rarely any deficiencies occurring in partial cut stands and in the clearcut units it was typical to leave conifers even in cases where there were no real deficiencies. Quantitative results presented in the following section show that where deficiencies did exist, they occurred mostly in clearcuts.

The question of whether particular components of harvest prescriptions that were difficult to implement was also asked with regards to this strategy. This question was asked in order to understand whether the standards create difficulties for implementation (q.52, Table 15). For 16 of the stands, there were comments on aspects of the sales that foresters found difficult, although the overall consensus was that most sales were straightforward and easy to complete. Some of the comments included:

- Riparian standards in clearcuts can be difficult to implement;
- It's sometimes difficult to access some Inner RMA's and there is a concern for resource damage;
- It can be difficult to know what is 80% shade over a perennial type N stream;
- It can be difficult to not harvest in an Inner RMA zone; and
- It can be hard to meet snag and down wood targets because of size and species mix of timber

Table 15. Responses to CAR questions addressing ARS2. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
46	Have all aquatic zone features been properly identified?	*Yes*	26	*100.0%*	24	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	3	-	3	-
48	Are RMA zones consistent with standards?	*Yes*	26	*100.0%*	24	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	3	-	3	-
49	Was there harvesting in the Inner RMA?	*Yes*	3	*11.5%*	19	*79.2%*
		No	23	*88.5%*	5	*20.8%*
		N/A	3	-	3	-
50	Where there was variation in zone widths, are they correlated with management unit features?	*Yes*	25	*100.0%*	21	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	4	-	6	-
51	Were seasonal high energy streams and debris flow track reaches properly identified?	*Yes*	1	*100.0%*	2	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	28	-	25	-
52	Were there units with particular prescriptive considerations that were difficult to implement?	*Yes*	12	*44.4%*	4	*16.0%*
		No	15	*55.6%*	21	*84.0%*
		N/A	2	-	2	-
54	Have conifers been left in the outer RMA to compensate for deficiencies in the inner zone?	*Yes*	8	*50.0%*	8	*88.9%*
		No	8	*50.0%*	1	*11.1%*
		N/A	13	-	18	-
55	Have perennial special emphasis areas on Type N streams been properly identified and protected?	*Yes*	17	*100.0%*	4	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	12	-	23	-

ARS5: "APPLY SPECIFIC STRATEGIES TO OTHER AQUATIC HABITATS. ESTABLISH AND MAINTAIN RIPARIAN MANAGEMENT AREAS ADJACENT TO OTHER AQUATIC HABITAT AREAS IN ACCORDANCE WITH THE STANDARDS DESCRIBED IN THE PROPOSED WESTERN OREGON STATE FORESTS HABITAT CONSERVATION PLAN AND APPENDIX J OF THE NORTHWEST OREGON STATE FORESTS MANAGEMENT PLAN."

ARS5 specifically focuses on aquatic habitats other than those associated with streams. These "other" aquatic habitats have special protection rules that are described in Appendix J of the FMP. 10 stands in our study were identified as having a stream-associated wetland, swamp area, pond, or wetland present. However, our sampling only captured three wetland areas: two, <¼ acre wetlands and one, ¼-1 acre wetland. When present, strategies for protection were followed for each (q.57, Table 16).

Table 16. Response to CAR question addressing ARS5. Numbers in cells are the number of units for the response and the corresponding percentage of the total stands where the questions were applicable.

No.	Question	Response	Clearcut Units	Clearcut %	Partial cut Units	Partial cut %
57	Were protection measures applied for other aquatic habitats according to Apendix J?	*Yes*	2	*100.0%*	8	*100.0%*
		No	-	*0.0%*	-	*0.0%*
		N/A	27	-	19	-

III. Riparian Management Area Sampling

Results of RMA sampling are presented in the following sections. These data summarize measurements taken in accordance with Appendix J of the FMP and are presented at the unit-level, district-level, and landscape-level. In summary here, results of these reports are addressed through the following questions:

1. Were Mature Forest Conditions met in the Inner Zones of Type F and Large and Medium Type N streams RMAs as described in Appendix J of the FMP?
2. How well did post-operation conditions meet targets defined in Appendix J of the FMP?
3. How often were RMAs "posted-out" instead of actively managed to FMP standards?
4. What are the on-the-ground differences of components measured in SAH basins and non-SAH basins?

1. Were Mature Forest Conditions met in the Inner Zones of Type F and Large and Medium Type N streams RMAs as described in Appendix J of the FMP?

18 stands in our study contained Fish or Medium Type N streams. There were a total of 27 Fish and 3 Medium Type N streams. On these 30 streams, 86 plots were installed in the RMAs. On average, this equates to 2.9 plots per stream and a total of .28 acres or 163 linear feet of Inner RMA sampled per stream.

Appendix J states we will manage for Mature Forest Condition in the Inner RMA of Fish and Medium Type N streams if it does not exist prior to harvest. Also stated is that no management activity should occur where MFC exists, or where conditions are suitable for development of MFC in a reasonable time frame without further treatment. Implicit in these statements is the goal to create mature conifer-dominated stands or hardwood-dominated stands where hardwoods are expected to be the natural plant community. Our current definition of MFC for conifer-dominated stands is ≥ 220 ft^2/ac basal area, inclusive of all conifers >11" DBH. At a mature age this is equivalent to 40-45 conifer trees 32" DBH per acre.

Beyond the basic MFC definition, Appendix J also states that at least 50 co-dominant and dominant TPA >11" DBH and an SDI of at least 25% SDI must be maintained during partial cutting. Also, up to 10 TPA will be retained as felled, girdled, or topped trees during partial cutting to reach 600-900 ft^3/ac of hard down wood. 40-45 large TPA is the ultimate goal, so the difference between this and 50 TPA during partial cutting will be the extra trees reserved for felled, girdled, or topped to provide for hard down wood. Appendix J also outlines that in the event the Inner zone is deficient in conifer trees (<45 TPA), the Outer zone retention will be increased (beyond the minimum of 10 TPA) at a rate equal to the TPA deficiency in the Inner zone.

No clear definition of conifer or hardwood-dominated stands is provided in Appendix J of the FMP, so for the purposes of this analysis, conifer or hardwood-dominated stands will be defined by the current Stand Level Inventory stand-typing procedure: conifer or hardwood-dominated is equal to either species category comprising >80% of the total basal area for the Inner RMA. All trees ≥ 6" regardless

of crown class were included in this calculation. Table 17 shows the conifer/hardwood or hardwood/conifer basal area split inclusive of all trees ≥ 6" DBH.

Table 17. Fish and Medium Type N stream Inner RMA conifer and hardwood basal area composition. Basal areas are for trees ≥ 6" DBH. An RMA with a species basal area % of >80% is considered "dominated".

CONIFER RMAS

Streams	Conifer B.A./ac	Conifer %	Hardwood B.A./ac	Hardwood %
2	132	85%	23	15%
1	227	92%	21	8%
2	87	81%	21	19%
1	192	87%	28	12%
2	220	81%	52	19%
2	133	86%	21	13%
1	153	99%	2	1%
1	72	60%	49	37%
1	84	74%	29	26%
1	157	77%	47	23%
1	136	70%	59	30%

HARDWOOD RMAS

Streams	Conifer B.A./ac	Conifer %	Hardwood B.A./ac	Hardwood %
2	69	49.6%	70	50.4%
3	31	21%	119	79%
2	51	46%	61	54%
2	98	45%	119	55%
3	75	44%	97	56%
1	24	21%	92	79%
2	64	36%	114	64%

None of the riparian areas has yet achieved Mature Forest Conditions (MFC). Harvesting did not affect whether or not any of these stands met the definition of Mature Forest Condition. This reflects the relatively young forest conditions that still exist across the majority of the forest.

Inner RMA Active Management vs. Non-Management: 22 out of 30 streams had partial cutting occur in the Inner zone and 8 did not (Table 18). 11 of 30 streams were conifer-dominated and 10 of these 11 had partial cutting in the Inner zone. Overall and on average the difference in residual conifer TPA >11" DBH for the Inner zone between active management and non management was small: i.e., the difference between 43 TPA and 49 TPA, however there was a very wide range of conditions from hardwood dominated to conifer dominated. Take trees were either on the outside edge where the riparian buffer width varied slightly around the 100 foot definition or were hardwood trees cut to prescription. The study did not quantitatively determine whether or not harvesting promoted achievement of MFC.

Conifer-Dominated Inner RMAs: Of the 11 streams with conifer-dominated Inner RMAs, the average basal area was 154 ft^2/ac of co-dominant and dominant conifers >11" DBH (Table 18). This falls short of the 220 ft^2/ac target and the highest stand-level average of this metric was 213 ft^2/ac. The average TPA for co-dominant and dominant conifers >11" DBH was 61 with a target of 50/ac. The highest stand average for this metric was 82 TPA. Two of 11 streams did not meet the 50 TPA target.

No Inner RMAs were hardwood-dominated. 15 RMAs were comprised mainly of hardwoods (50%-80% B.A./ac) with some conifers. Currently we do not have a specific MFC target for hardwood RMAs that are not considered "dominated".

The average Inner zone SDI% for the conifer-dominated RMAs was 34%. The lowest being 19% and the highest at 44%.

The sampling protocol for the RMAs of Fish and Medium Type N streams was designed to provide results for comparison with Appendix J targets. The sampling protocol answered whether stands met the Mature Forest Condition (MFC) targets of 220 ft^2 /ac basal area and 50 TPA for conifer-dominated stands. The forest management plans don't currently have explicit quantitative targets for hardwood and mixed species stands.

Implementation monitoring in RMAs adjacent to Fish and Medium Type N streams has shown that the majority of streamside tree species composition is neither conifer-dominated or hardwood-dominated (greater than 80% basal area for conifers or hardwoods (Table 17)). Most are mixed species RMAs. Mature Forest Condition could be clarified for conifer-dominated, hardwood-dominated, and especially mixed-species riparian stands. Also, tree data alone does not account for all mature forest characteristics. Future implementation monitoring samples in Fish and Medium Type N RMAs should take into account a wider variety of vegetation characteristics such as trees <6" DBH, tree height, tree age, and vegetation cover to supply the current SLI algorithm with appropriate data to determine stand conditions.

Table 18. Post-harvest conditions in Inner RMAs adjacent to Type F and Medium Type N streams grouped by stands with active management (Inner Zone Harvest = Y) and without active management (Inner Zone Harvest = N). ***FMP Inner Zone MFC targets*** if conifer-dominated: (**A**)=220 ft^2**;** (**B**)=50 TPA; (**C**)=≥ 25% SDI; (**D**)= No harvest if stand is at MFC and harvest should occur where necessary to achieve MFC in a timely manner. If partial cutting occurred, % of plots with partial cutting is shown in column D; (**E**) Outer zone conifer retention (10-45 Trees and Snags/ac target) increased if Inner zone has < 45 conifers per acre; **(F)** If (B) + (E) > 55 TPA then target is met.

District	Stand	Fish & Med. N # of Streams	# Plots	(A) Co&Dom Conifer BA >11" (ft^2/ac)	(B) Co&Dom Conifer TPA >11"	Conifer TPA ≥ 6"	(C) Conifer SDI (%) >11"	(D) Inner Zone Harvest?	(E) Outer Co&Dom Conifer TPA & Snags >11"	(F) Outer Target Met	Ave. Posted Buffer Width (ft)	MFC ?
ACTIVE MANAGEMENT IN INNER RMA												
AS	Nettle Meyer V (PC)	2	5	66	21	27	14	Y 40%	75	Yes	89	**No**
AS	Nettle Meyer VI (CC)	3	6	33	8	18	7	Y 17%	24	No*	132	**No**
AS	Foster Divide VII (CC)	2	3	47	16	26	10	Y 67%	3	No*	123	**No**
AS	Cole Mtn III (CC)	2	3	91	26	42	18	Y 67%	0	No*	67	**No**
AS	Cole Mtn VI (PC)	3	8	71	25	37	15	Y 88%	40	Yes	110	**No**
AS	Nettle Meyer II (PC)	2	6	125	42	56	27	Y 67%	60	Yes	65	**No**
TL	Toll Four III (CC)	2	3	75	52	74	19	Y 33%	52	Yes	143	**No**
FG	T. Wally Thin II (PC)	1	4	186	82	94	42	Y 75%	47	Yes	114	**No**
FG	Willaminor I (PC)	2	5	213	74	91	44	Y 20%	81	Yes	76	**No**
FG	Sappington Cr. II (PC)	2	10	119	65	91	28	Y 10%	78	Yes	N/A	**No**
WL	Sturtevant I (PC)	1	5	145	60	79	32	Y 20%	39	Yes	61	**No**
	Total/Average:	***22***	***58***	***106***	***43***	***58***	***23***	***46%***	***45***		***98***	
NO ACTIVE MANAGEMENT IN INNER RMA												
AS	Deep Cr.Thin I (PC)	1	9	213	55	68	43	N	46	Yes	100	**No**
TL	Bobcat V (CC)	1	2	23	15	24	6	N	31	No*	98	**No**
TL	Buck Mtn I (PC)	1	5	67	37	50	15	N	23	Yes	50	**No**
WO	Long Haul Thin V (PC)	1	4	74	60	82	19	N	49	Yes	99	**No**
WO	Cline Thin II (PC)	1	4	144	99	119	36	N	75	Yes	95	**No**
FG	Ought to Thin I (PC)	1	1	125	48	77	28	N	31	Yes	137	**No**
WL	North Nelson II (PC)	2	3	61	26	29	13	N	90	Yes	64	**No**
	Total/Average:	***8***	***28***	***101***	***49***	***64***	***23***		***49***		***92***	

*These sale areas and RMAs were primarily comprised of hardwoods and therefore did not meet the conifer retention targets before harvest.

2. How well did post-operation conditions meet targets defined in Appendix J of the FMP?

Similar to question 1, this question seeks to define what metrics met the targets that are defined in Appendix J of the FMP. These results are presented strictly as quantitative information against target values for each stream type in our clearcut and partial cut sampling.

Type F Streams:
Overall, there were varying levels of success in meeting App. J targets for quantitative and qualitative values in each stream type/harvest type scenario. For Fish streams in both clearcuts and partial cuts, targets were easily met for questions assessed in the Inner Gorge and Streambank zones. When present, the Inner Gorge RMA width was always adjusted for clearcuts and partial cuts. No stands had trees harvested in the Streambank zone. There was no ground disturbance in the Streambank zone for clearcuts. In one partial cut stand there were 6 plots with windthrown trees and small landslides next to two Fish streams. This resulted in 2,200 sq. ft (2.26% of all Fish stream Streambank area for PCs) of ground disturbance and 1,900 sq. ft. (1.95% of all Fish stream Streambank area for PCs) of vegetative disturbance in the Streambank zone. Typically, recording vegetative disturbance for the RMA assessment is reserved for cable corridors, but conditions resulting from windthrown trees were recorded as vegetative and ground disturbance here.

There was no ground or vegetative disturbance in the Inner zone for clearcuts. Partial cuts had 870 sq. ft. (0.3%) of ground disturbance and 400 sq. ft. (0.14%) of vegetative disturbance in the Inner zone. Cable yarding and partial cutting did occur in the Inner zone, suggesting that full suspension cable yarding occurred in the Inner zone of two Fish streams.

The Inner RMA zone of Fish streams had specific targets for down wood and TPA. 30% of the plots sampled met the down wood requirements and 37% of the plots sampled met the TPA targets. Inner zone down wood volumes averaged below 600 ft^3/acre for those in decay classes 1 & 2 and just below 3,000 ft^3/acre for down wood in all decay classes (Figure 4a). Both of these metrics fall short of the down wood targets established in Appendix J. In looking at the individual stands for these Inner zone down wood targets in Fish streams, 44% of units with fish streams met the target for class 1-2 downwood, and 31% of units averaged above the minimum requirement for down wood in all decay classes. The downwood population in RMAs is highly variable in nature and the analysis of the data showed fairly high standard errors for most decay classes. A higher concentration of plots in Fish streams would likely increase the certainty of volume per acre.

Existing low numbers of conifers in some stands kept them from meeting mature forest condition goals for conifer density. This was especially true in stands chosen for clearcuts. The partial cut Inner zone target was met on about half the plots. There were approximately 49 TPA across all plots (CC and PC) in the Inner zone, which had a target value of 50 TPA (Figure 5). The average conifer SDI% in the Inner zone of clearcut RMAs fell short of the 25% target with an average of 10%, whereas partial cuts met the target at an SDI of 27% (Figure 6).

The RMAs of 22 of the 30 Fish and Medium Type N streams met the Outer zone Snag/TPA retention requirement (Table 18). The 8 streams that did not meet the Outer zone requirement were clearcut harvests in mixed hardwood and conifer stands. The inner zones were conifer deficient and so more conifer were needed in the outer zone. The outer zones were also conifer deficient, even before harvest. Harvests here were also to remove hardwoods and leave healthy conifers. As a result of their conditions, these riparian areas are unlikely to meet the definition for mature forest condition. The average posted buffer width was 105' on these 8 streams.

Figure 4. Average down wood volumes in the Inner zones of **A)** Fish streams and **B)** Medium Type N streams. Averages are stratified across all plots in stream type and harvest type (CC = clearcut, PC = partial cut) with 90 % confidence intervals.

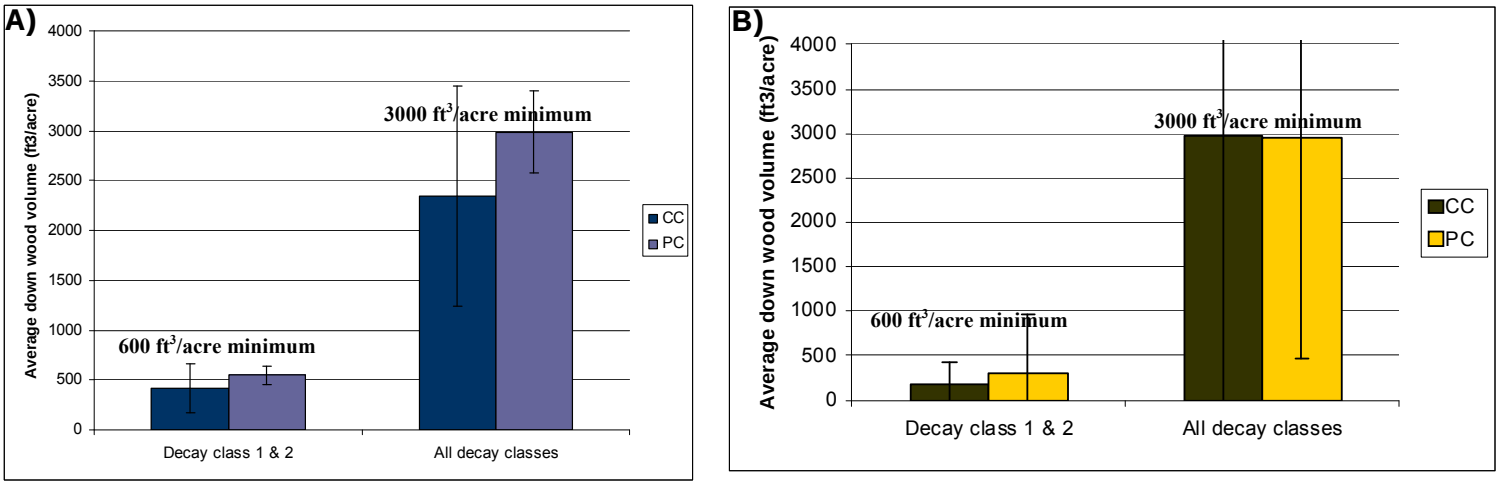


Figure 5. Average conifer (co-dominant and dominant) trees per acre > 11" DBH in the Inner zone of Fish and Med. Type N streams in clearcuts (CC) and partial cuts (PC). Averages are stratified across all plots in stream type and harvest type with 90 % confidence intervals.

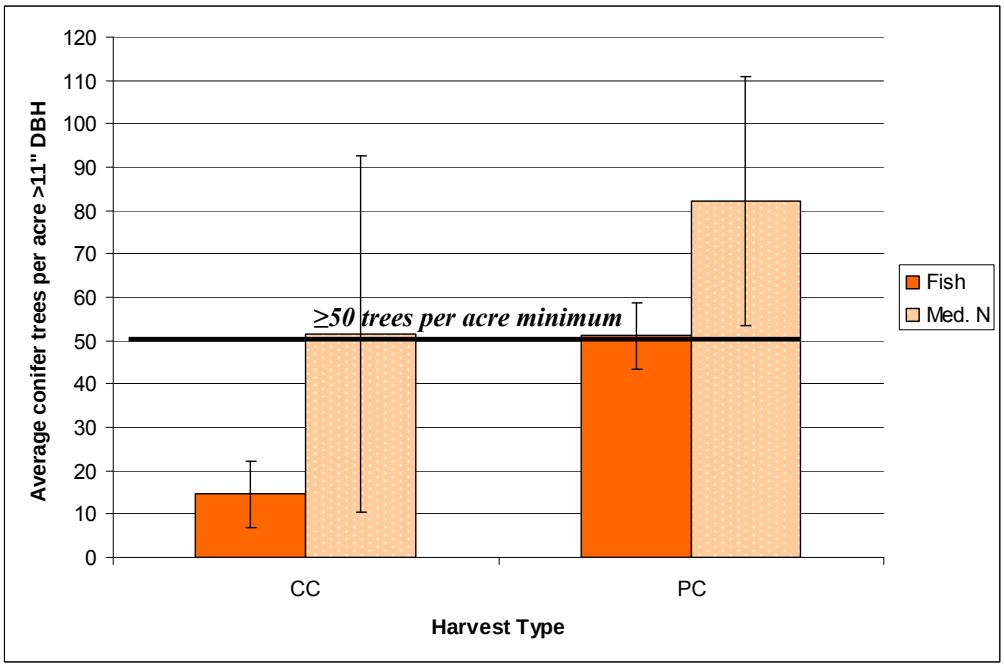
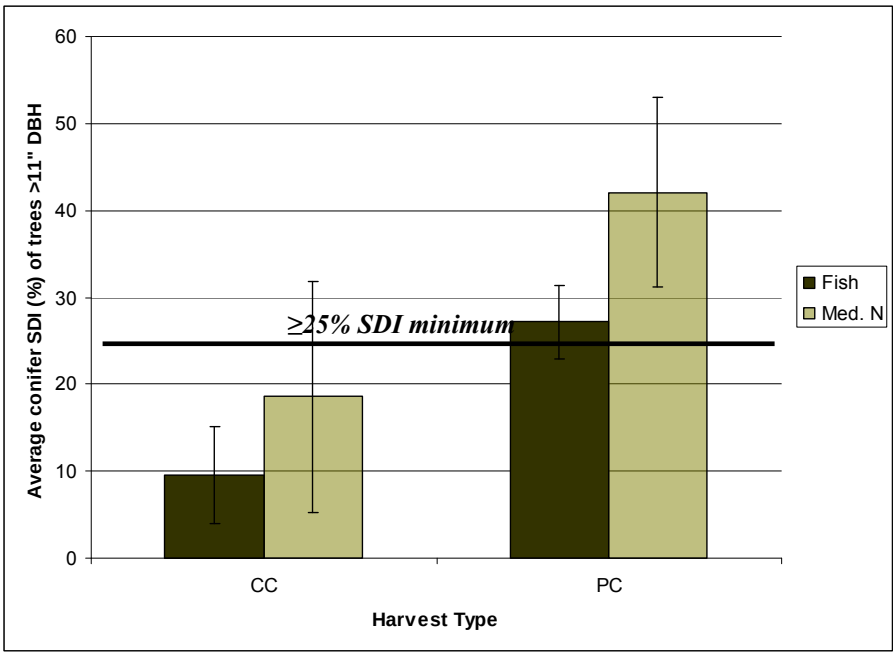
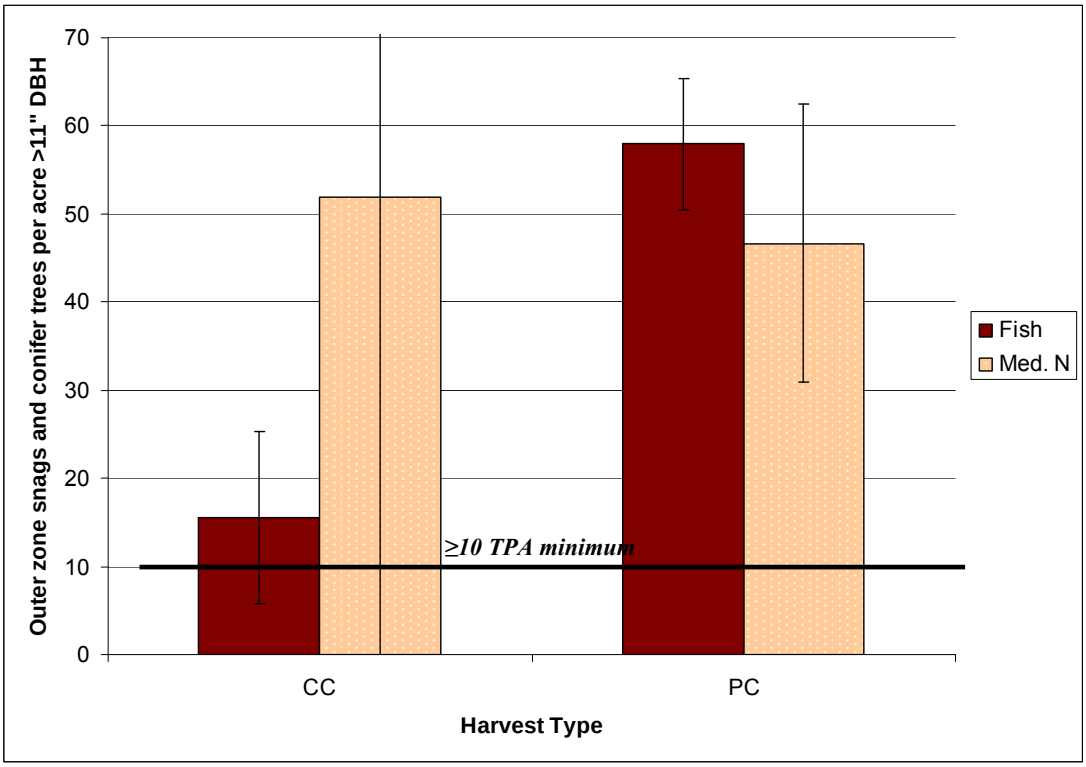


Figure 6. Average SDI % of conifers (co-dominant and dominant) > 11" DBH in the Inner zone of Fish and Med. Type N streams in clearcuts (CC) and partial cuts (PC). Averages are stratified across all plots in stream type and harvest type with 90 % confidence intervals.



The Outer RMA zone of Fish streams had retention targets of 10-45 co-dominant and dominant conifer trees and snags (all spp.) per acre. In partial cut stands, this target was easily met – with an overall average of 58 TPA. In clearcut stands this target was less likely to be met. The average was 16 TPA across all plots sampled. The Outer zone TPA target was not met in four clearcuts. In these stands the Inner RMAs were mainly comprised of hardwoods and did not meet the Inner zone target for conifers. Similarly, the outer zone was hardwood dominated. There were insufficient conifers in the Outer zone to meet the FMP requirements.

Figure 7. Average snags (all spp.) and conifer (codom and dom) trees per acre >11" DBH in the Outer zone of Fish and Med. Type N streams in clearcuts (CC) and partial cuts (PC). Averages are stratified across all plots in stream type and harvest type with 90 % confidence intervals.



Large and Medium Type N Streams:
Sampling of Med. Type N streams was limited (3 streams and 7 plots total) which greatly reduced confidence in our estimates of target values. With what we did sample, class 1-2 down wood targets in the Inner zone fell below minimums, much like those in Fish streams, but the margin of errors were so high we can't be sure that the real averages were this high or this low (Figure 4b). On average, the down wood volumes for all decay classes were very similar in both clearcut and partial cut stands and just under or at the minimum target. No Med. Type N streams had snags created in the Inner zone. Averages of TPA and the SDI measured in Inner zones of Med. Type N streams appear greater than in Fish streams, and met the target values (Figures 5 and 6, respectively). The averages of snag and conifer TPA in the Outer zone exceeded the minimum target of ≥ 10 TPA (Figure 7). Across the landscape, clearcuts appear to have adequate Outer zone TPA at 52 and partial cut Outer zones met the target with TPA at 47.

No ground disturbance or vegetative disturbance occurred in the Streambank or Inner zones for clearcuts or partial cuts. Since no ground disturbance was recorded, this suggests that full suspension cable yarding occurred in the Inner zone when partial cutting occurred. For this project, vegetation disturbance is defined as the linear opening in the crowns resulting from a cable yarding corridor.

Small Perennial Type N Streams:
There were 83 small perennial Type N streams sampled with a total of 178 plots installed. The

Shade: Aquatic zone of 10 of these streams was sampled for percent cover within 500' of a confluence of Type F streams, with a target of at least 80% shade. As a substitute for shade, cover measurements were taken at 200', 300', and 400' from the confluence in these instances. Twenty-five out of 30 points sampled had >80% cover. Overall, 8 of the10 streams sampled maintained ≥80% cover.

Retention Requirements: Inner Gorge and Streambank zone targets were met with over 90% success in all cases. When present, the Inner Gorge RMA width was adjusted on 4 out of 5 plots. The one location not adjusted for the Inner Gorge was in a partial cut. Five out of 178, or 2.8%, of plots had trees harvested in the Streambank zone. Damaged and felled trees in the Streambank zone were left on 97% of plots. There were four plots in the Streambank zone of three different streams where trees were felled and then removed. All four of these plots were located in cable corridors in two different clearcuts.

Ground Disturbance: There was no ground disturbance recorded in the Streambank zone for any Perennial Type N stream.

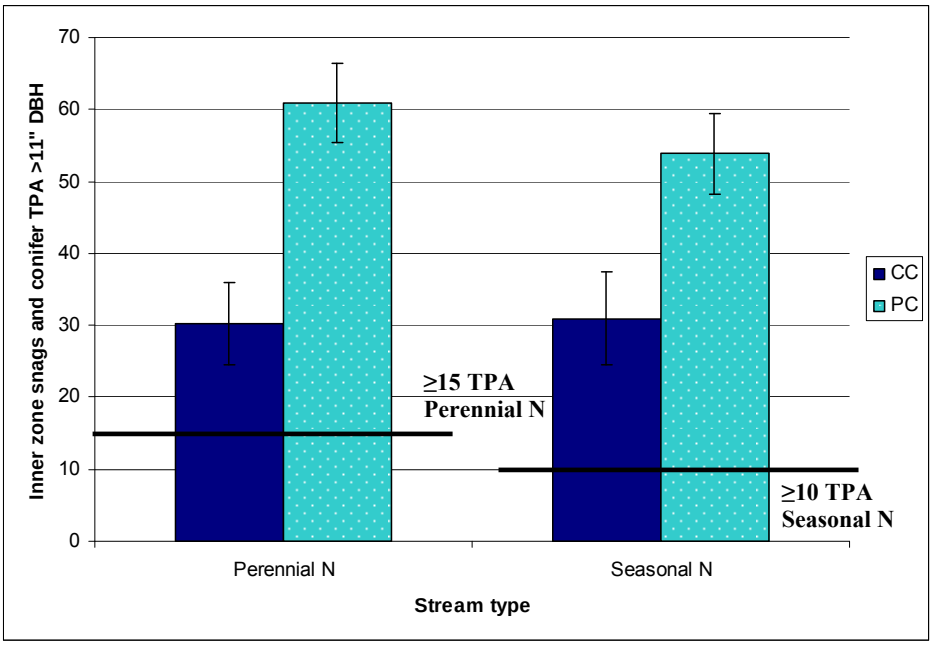
Vegetative Disturbance: One plot had vegetative disturbance in the Streambank zone of a clearcut. The target of <10% vegetative disturbance was achieved on all Perennial Type N streams sampled, with the average vegetative disturbance under 1%.

Stream channel integrity: Stream channel integrity was maintained over 99% of the time. Only one plot in a clearcut had a blocked stream channel due to a small landslide.

Appendix J requires Type N prescriptions be applied over 75% of the stream reach. Plots indicated prescriptions were applied, but cannot quantitatively determine if the 75% threshold was reached. From observation, the only time prescriptions were not applied was for corridors and stream crossings.

Inner zone snag and trees per acre target: Inner RMA zone target of 15-25 Snags/TPA in Perennial N streams were met on 91% of the plots in partial cut harvests and 65% of the plots in clearcuts harvests. The overall averages in partial cuts and clearcuts met the requirement with 61 TPA and 30 TPA across the landscape (Figure 8).

Figure 8. Average snags (all spp.) and conifer (codom and dom) trees per acre >11" DBH in the Inner zone of Small Perennial Type N and Other Small Seasonal Type N streams in clearcuts (CC) and partial cuts (PC). Averages are calculated for all plots by stream type and harvest type with 90% confidence intervals.



Outer zone snag/TPA targets: The Outer zone of Perennial N streams had a Snag/TPA target of 0-10/ac. Table 19 describes the unit-level measurements for this target in both the Inner zone and Outer zone of Perennial Type N streams. Outer zone TPA targets were not met in cases where the Inner zone was deficient and the sum of the Inner and Outer zone TPA did not equal at least the minimum of the Inner target of 15 TPA. This is per the footnote in Appendix J (pg. J-9) which states: "*In meeting the tree retention target for the Inner and Outer zones, preference will be given to retaining trees within the Inner zone. Where there are sufficient trees within the Inner zone to meet the combined target for the two zones (40 trees per 1,000 ft.), then no additional leave trees are required in the Outer zone.*" Implied in this rule is that if Inner zone targets are deficient, then additional trees should be left in the Outer zone to compensate. Two of the units' streams sampled did not meet the Outer zone compensation targets.

There were 11 plots on Perennial Type N streams that were in Salmon Anchor Habitat (SAH) basins. There was no ground disturbance within 50' of the Aquatic zone in any of these nor were there any trees cut within this zone. There was a target of 15-25 Snags/TPA > 11" DBH to be retained between 50' and 100' from the Aquatic zone in SAH basins. On average, we measured 40 Snags/TPA of this size class across all plots. This exceeds the target established for retention in this zone. Of the five individual SAH units that these Perennial Type N streams were in, one clearcut unit did not meet the minimum TPA requirement.

Table 19. Post-harvest tree and snag retention in Inner and Outer RMAs adjacent to Small Perennial Type N streams.

District	Stand	Harvest	# streams	# plots	Inner RMA TPA	Target met?	Outer RMA TPA	Target met?	Buffer Width (ft)
FG	Dark Bark II	*PC*	4	5	70	Yes	66	Yes	-
FG	Ought To Thin I	*PC*	1	3	61	Yes	55	Yes	-
FG	C Saw I	*PC*	9	17	72	Yes	63	Yes	97.7
FG	T. Wally Thin II	*PC*	1	3	58	Yes	28	Yes	73.3
FG	Sappington Cr. II	*PC*	1	4	85	Yes	62	Yes	-
AS	Nettle Meyer II	*PC*	7	24	66	Yes	58	Yes	67.1
AS	Nettle Meyer V	*PC*	1	1	77	Yes	52	Yes	103
AS	Deep Creek Thin I	*PC*	1	7	39	Yes	33	Yes	-
AS	Cole Mtn. Combo VI	*PC*	2	8	35	Yes	47	Yes	39.2
AS	Simmons Ridge Combo V	*PC*	4	6	16	Yes	24	Yes	36.7
AS	Hunt Cr. LSD VI	*PC*	1	1	19	Yes	0	Yes	76
AS	Nettle Meyer VI	CC	1	3	26	Yes	3	Yes	49.7
AS	Nettle Meyer IX	CC	5	7	37	Yes	0	Yes	43.9
AS	Bigfoot Combo IV	CC	2	2	44	Yes	0	Yes	55
AS	Cole Mtn. Combo III	CC	3	6	18	Yes	10	Yes	23.5
TL	Nehalem Divide II	*PC*	1	3	32	Yes	48	Yes	36
TL	Fox Ridge Thin II	*PC*	1	2	34	Yes	57	Yes	67.5
TL	Mutt Peak III	CC	1	2	77	Yes	57	Yes	62
TL	Miami High I	CC	1	2	58	Yes	16	Yes	93.5
TL	Zig Zag I	CC	2	6	35	Yes	12	Yes	71
TL	Bale Bound IV	CC	1	2	53	Yes	26	Yes	119.5
TL	Kilo III	CC	1	2	73	Yes	16	Yes	120
TL	Lower Roller Road IV	CC	1	3	6	No	3	No	87.3
TL	Gold Peak VI	CC	1	2	34	Yes	0	Yes	82
TL	Toll Four III	CC	1	3	16	Yes	10	Yes	71
TL	Lost Alder I	CC	2	3	10	No	3	No	54.7
NC	Nexta Burbank	CC	2	7	29	Yes	1	Yes	45.1
NC	Fractured Rock VIII	CC	4	11	25	Yes	20	Yes	34.7
NC	Fractured Rock II	*PC*	9	15	71	Yes	66	Yes	34.4
WL	Sturtevant I	*PC*	3	4	60	Yes	57	Yes	37.3
WO	Cline Thin II	*PC*	2	3	87	Yes	107	Yes	-
WO	Barkshot Thin II	*PC*	2	4	87	Yes	67	Yes	91.7
WO	Shroyer Ridge Thin IX	*PC*	1	2	68	Yes	57	Yes	45
WO	Hatchery Combo I	CC	4	5	17	Yes	15	Yes	86.8
	TOTALS/*Averages*		**83**	**178**	***47***		***34***		***65.6***

*Refer to page 32 for table explanation.

Seasonal Type N - Potential Debris Flow Track Reaches:
Only one Potential Debris Flow Track stream reach was present in the entire sample. This stream was in a hardwood-dominated clearcut stand. The entire stream reach, including the one installed plot, was hardwood-dominated. There was an Inner zone retention target of ≥ 10 snags (all spp.) and conifer (codominant and dominant) TPA > 11" DBH. This was not met due to the lack of available conifers in the RMA (Table 20). A general rule (per App. J) for the Outer zone stated that sufficient trees/snags be retained to meet landscape management strategy targets, which we assumed to be at least 5 TPA. This was met in our sample. On this one plot, there was no ground disturbance or trees harvested in the Streambank zone, and the stream channel integrity was maintained.

Table 20. Snags (all spp.) and conifer (codom and dom) TPA in the Inner and Outer zones of Small Seasonal Type N Potential Debris Flow Track Reach streams.

District	Stand	Harvest	# streams	# plots	Inner RMA TPA	Target met?	Outer RMA TPA	Target met?	Buffer Width (ft)
TL	Lost Alder I	CC	1	1	0	No	22	Yes	68

Other Small Seasonal Type N Streams:
There were 54 Seasonal Type N streams sampled in partial cuts and 53 in clearcuts. 142 plots were installed on these 107 streams. 79 of these streams had only one plot installed implying very short stream reaches.

Stream channel maintenance: There were only two instances of the stream channel not being maintained. Both were due to minor landslides delivering sediment to the channel in two different clearcut harvests.

Ground disturbance: The two landslides were the only instance of ground disturbance occurring in the Streambank zone of Seasonal Type N streams for clearcuts. In partial cuts, 5 out of 76 plots (6.6%) had ground disturbance in the Streambank zone, totaling 1,425 ft^2 of ground disturbance.

Tree retention: Across all plots, there was an average of 44 snags and conifer TPA >11" DBH in the Inner zone, which met the minimum target of ≥ 10 TPA (Table 21). Only two units' streams did not meet the Inner zone target. As previously, for the Outer zone, there was a general strategy described in App. J stating that sufficient trees/snags be retained to meet landscape management strategy targets, which we assumed to be at least 5 TPA (all spp. >6" DBH). Across all stands this target was met, with an average of 35 TPA (Table 21).

Salmon Anchor Habitat Basins: There were 26 plots on Seasonal Type N streams in SAH basins. There was no ground disturbance within 50' of the Aquatic zone in any of these plots. Nine of the plots had trees cut in this zone. There was an average of 67 conifer trees > 11" DBH and snags (all spp.) per acre retained within 50' of the Aquatic zone, which exceeds the target established for retention of 15-25 Snags/TPA in SAH.

A 100% sample would have to occur for us to answer with certainty whether or not prescriptions were applied to at least 75% of the stream reach, as stated in Appendix J. The total stream reach was not inventoried, but at a plot level results suggest that the prescription was applied at least 75% of the time.

Table 21. Snags (all spp.) and conifer (codom and dom) TPA in the Inner and Outer zones of Small Seasonal Type N streams.

District	Stand	Harvest	# streams	# plots	Inner RMA Snag + TPA	Target of ≥ 10 met?	Outer RMA TPA ≥ 11"	Target met?	Buffer Width (ft)
FG	Ought To Thin I	*PC*	4	7	72	Yes	68	Yes	-
FG	C Saw I	*PC*	5	5	56	Yes	70	Yes	-
FG	T. Wally Thin II	*PC*	2	6	37	Yes	36	Yes	29.5
FG	Sappington Cr. II	*PC*	12	14	53	Yes	47	Yes	-
FG	Willaminor I	*PC*	1	2	44	Yes	59	Yes	-
AS	Nettle Meyer II	*PC*	7	8	48	Yes	34	Yes	-
AS	Nettle Meyer V	*PC*	2	7	37	Yes	83	Yes	76.4
AS	Nettle Meyer VI	CC	3	4	58	Yes	79	Yes	63
AS	Nettle Meyer IX	CC	1	1	0	No	0	No	33
AS	Foster Divide VII	CC	4	5	31	Yes	0	No	38
TL	Mutt Peak III	CC	6	9	56	Yes	25	Yes	87.2
TL	Miami High I	CC	5	5	35	Yes	20	Yes	67.8
TL	Bale Bound IV	CC	1	2	19	Yes	0	No	52.5
TL	Kilo III	CC	3	3	32	Yes	7	Yes	53.7
TL	Lower Roller Road IV	CC	5	6	18	Yes	18	Yes	28
TL	Gold Peak VI	CC	1	1	0	No	0	No	51
TL	Toll Four III	CC	7	8	16	Yes	0	No	34.9
TL	Lost Alder I	CC	1	1	0	No	0	No	100
TL	South Coast Range I	CC	2	3	23	Yes	2	No	32
TL	Cook East IV	CC	1	1	106	Yes	0	Yes	54
TL	Ed's BSM II	CC	1	2	19	Yes	5	Yes	63.5
TL	Ed's BSM VII	CC	5	5	48	Yes	14	Yes	59.4
TL	Bobcat V	CC	3	6	19	Yes	9	Yes	61
TL	Buck Mtn. I	*PC*	1	1	97	Yes	77	Yes	-
TL	Nehalem Divide II	*PC*	3	4	65	Yes	59	Yes	61
TL	Fox Ridge Thin II	*PC*	1	1	97	Yes	68	Yes	15
NC	Fractured Rock II	*PC*	3	4	51	Yes	59	Yes	23
NC	Fractured Rock VIII	CC	4	4	10	Yes	2	No	29.3
WL	Sturtevant I	*PC*	3	5	39	Yes	27	Yes	80
WO	Cline Thin II	*PC*	3	4	73	Yes	70	Yes	-
WO	Long Haul Thin V	*PC*	3	4	56	Yes	50	Yes	-
WO	Lucas Creek Thin I	*PC*	1	1	87	Yes	47	Yes	99
SW	Xroad Combo II	*PC*	2	3	55	Yes	122	Yes	9
	TOTAL / *Average:*		**106**	**142**	***44***		***35***		***52***

*Refer to page 35 for table explanation.

¼ to 1 acre Lakes, Ponds, Weltands:

Only one Type N ¼-1 acre wetland was present in the entire sample and only one plot was installed to sample this wetland. Buffer posters were posted on trees where available to establish the required 25' no-harvest zone. The posted buffer width for the installed plot was 19 feet. Appendix J states that a 50' RMA will be established to retain at least 50% of the existing live tree basal area. It also states that, within the 25' - 50' zone of the RMA, harvest activities will retain ≥ 110 ft^2 of basal area or at least 50% of live tree basal area, whichever is greater. The zone sampled was small and no trees were captured in the one plot (Table 22).

Table 22. Inner zone (25'-50') measurements on ¼ - 1 acres wetland.

District	Stand	Harvest	# wetlands	# plots	25'-50' zone Basal Area	Target met?	Buffer Width (ft)
AS	Simmons Ridge Combo V	PC	1	1	0	No	19

<¼ acre Lakes, Ponds, Weltands:

Two Type N <¼ acre wetlands were sampled. One wetland was posted out with buffer zone posters and the other was not posted. Appendix J states that for Type N waters, hardwood trees and brush will be retained to protect the hydrologic functions and wildlife habitat. In both cases this rule was applied (Table 23).

Table 23. Answers to questions assessed for Type N <1/4 acre wetlands.

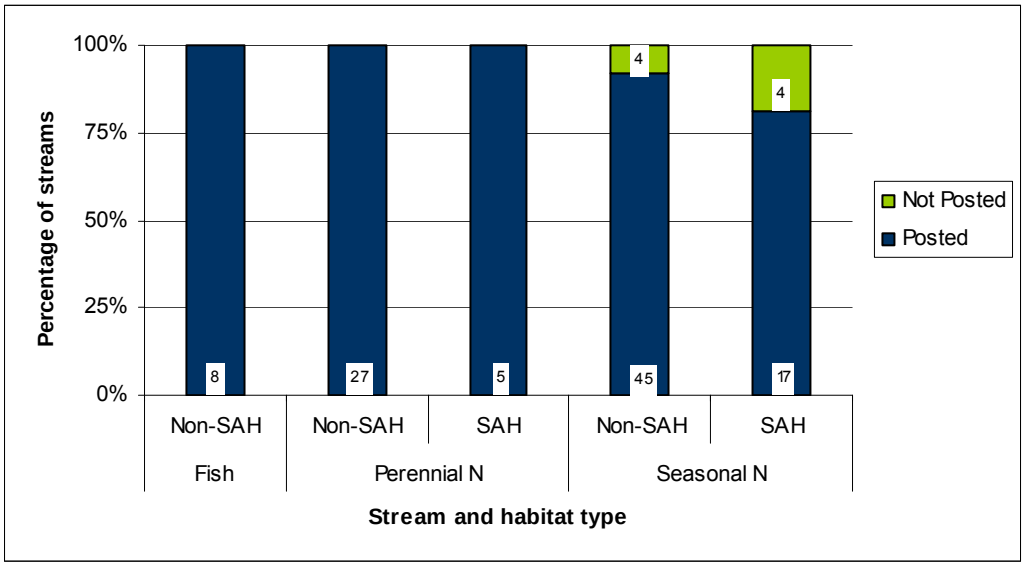
District	Stand	Harvest	# wetlands	# plots	Hardwoods Protected?	Buffer Width (ft)
WO	Barkshot Thin II	PC	1	1	Yes	-
AS	Simmons Ridge Combo V	PC	1	1	Yes	2

3. How often were RMAs "posted-out" instead of actively managed to FMP standards?

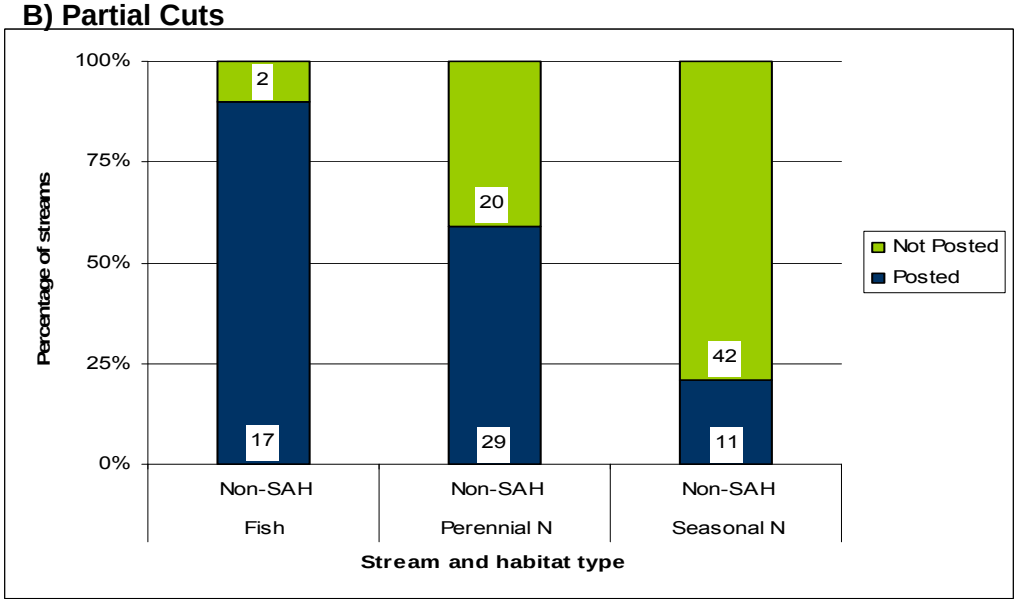
Type F Streams: 100% of the Fish streams sampled in clearcuts (n=8) and 90% sampled in partial cut stands (n=19) were posted out (Figure 9). The average buffer width for these was 111 ft in clearcuts and 87 ft in partial cuts (Figure 10). There was of course variability among the buffer widths of individual units which resulted in partial cutting occurring in some Inner RMA zones. 25% of the plots on Fish streams in PC stands and 36% of the plots in CC stands had partial cutting occur in the Inner RMA zone. In summary, 13 of 27 Fish streams in our study had active management occur in the Inner RMA zone, even with the average buffer width between 87 and 111 ft.

Figure 9. Percentage of streams with RMA buffers posted-out in **A)** clearcuts and **B)** partial cuts for three different stream types sampled: Fish streams; Small Perennial Type N streams; and Other Small Seasonal Type N streams. Numbers on bars are total number of streams sampled for each category.

A) Clearcuts



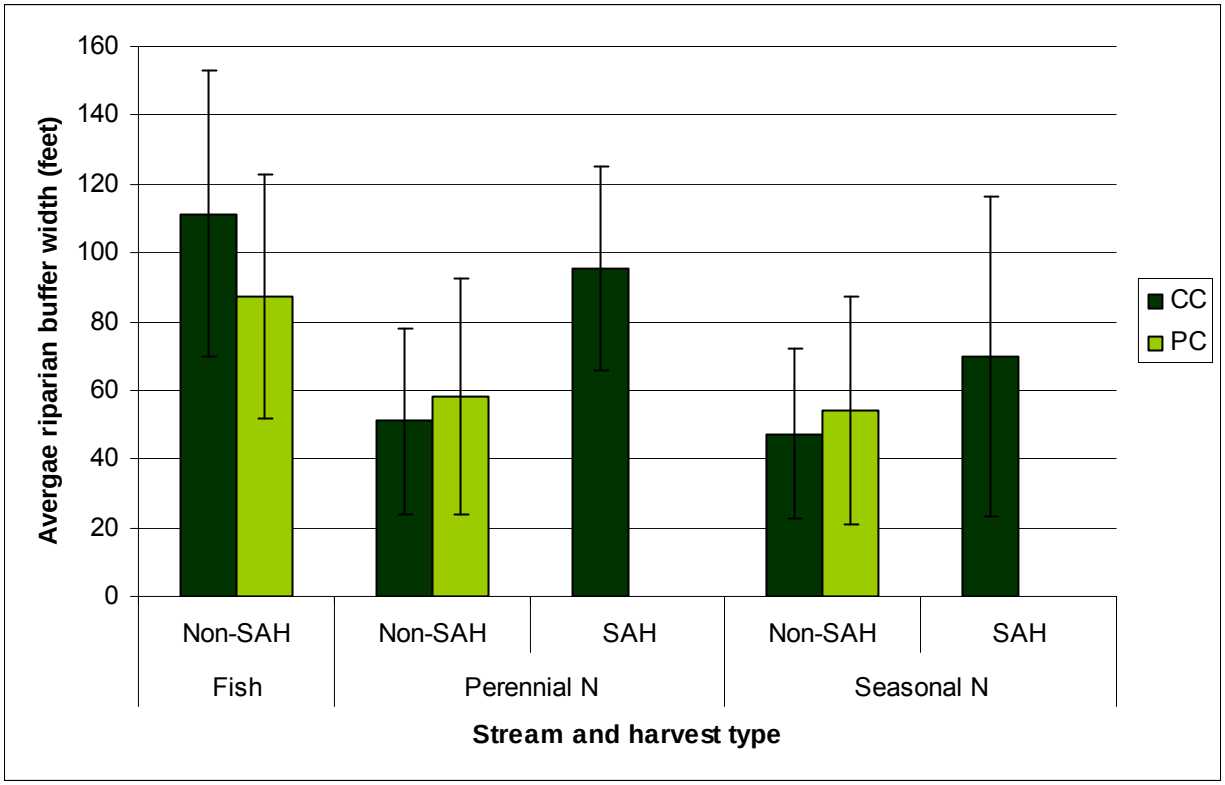
B) Partial Cuts



Small Perennial Type N Streams: In clearcuts, all Perennial Type N streams in Salmon Anchor Habitat (SAH) and non-SAH were posted out. In partial cuts stands, 60% of the streams sampled were posted out – all were in non-SAH basins (Figure 9). The average buffer width of Small Perennial Type N streams in clearcuts was 51 ft in non-SAH basins and 96 ft in SAH basins. In PC stands (all non-SAH), the average buffer width was 58 ft (Figure 10). 60% of the plots installed on Perennial Type N streams in PC stands had partial cutting occur in the Inner zone, while 69% of the plots installed on Perennial Type N streams in CC stands had partial cutting in the Inner zone. In summary, 56 of the 83 streams in our study had active management occur in the Inner RMA zone.

Other Small Seasonal Type N Streams: In clearcuts, the majority of RMAs in Seasonal Type N streams were posted out whereas the majority of RMAs in partial cuts were not posted out (Figure 9). The average buffer width of Seasonal Type N streams in CC stands was 47 ft in non-SAH basins and 70 ft in SAH basins. In PC stands (all non-SAH) the average buffer width was 54 ft (Figure 10). Inner zone harvest was not recorded for Seasonal Type N streams, so the level of active management in on these streams is not known.

Figure 10. Average buffer widths (± standard deviation) of posted RMAs in clearcuts (CC) and partial cuts (PC) for three different stream types sampled: Fish streams; Small Perennial Type N streams; and Other Small Seasonal Type N streams.

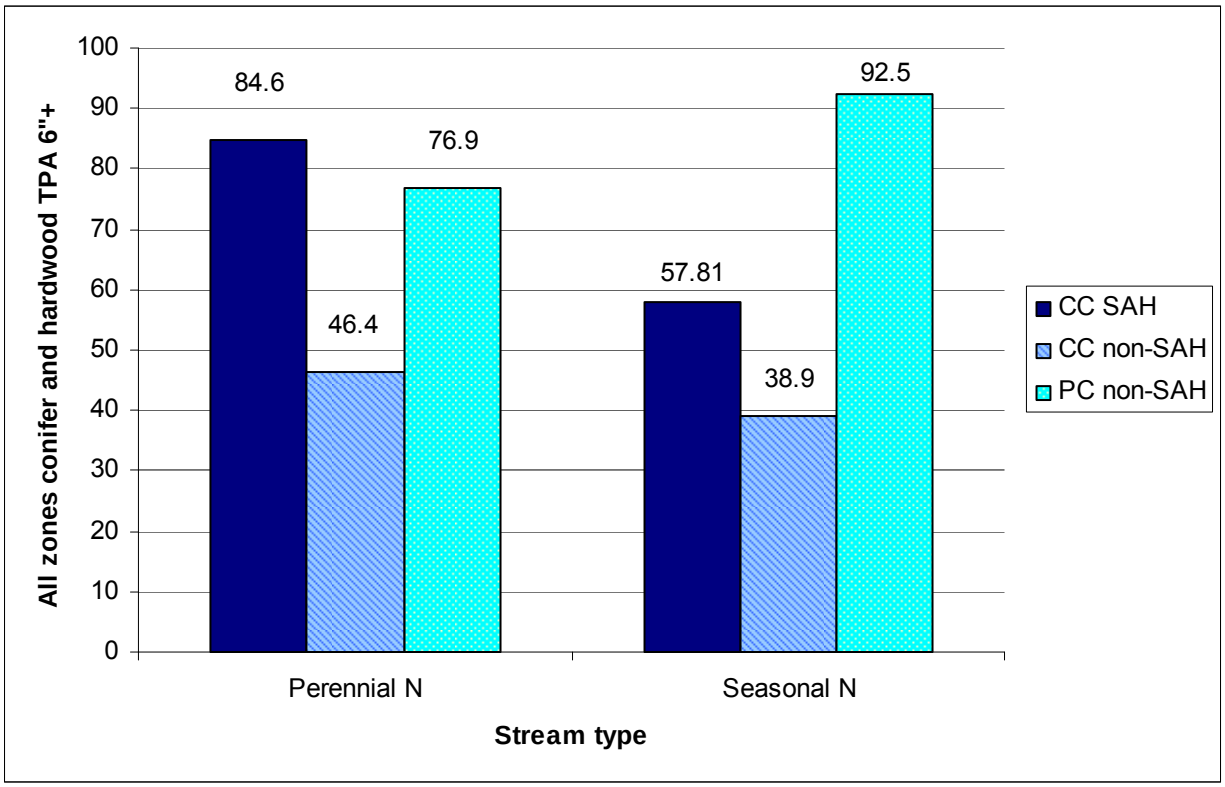


4. What are the on-the-ground differences between plots in SAH basins and non-SAH basins?

Because of the small sample size and the unbalanced design of data collection, no statistical comparisons could be made between components measured in SAH versus non-SAH stands. Also, because SAH was sampled only in clearcuts and these occurred only in one district, Tillamook, comparisons between SAH and non-SAH are made with data collected in this district only. There is a wide range of on-the-ground RMA data collected on trees, snags, down wood, and buffer widths for each of our streams measured – all data available in attached appendices. Presented here is just one summary statistic of each resource to highlight the available data. A total of seven units in our study were in SAH. There were 11 plots on five Perennial N streams and 26 plots on 21 Seasonal Type N streams.

Trees: On average, the RMAs of SAH streams had more trees than non-SAH in the clearcut stands for both stream types. On Perennial Type N streams, the number of trees in SAH was also greater than those in partial cut stands, but less than the number on Seasonal Type N streams (Figure 11).

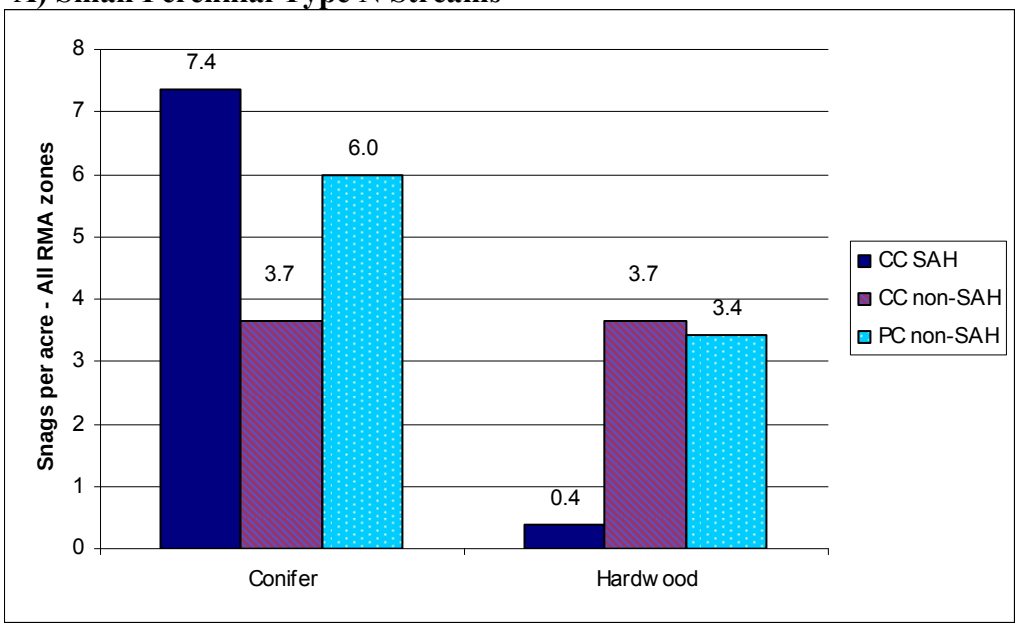
Figure 11. Conifer and hardwood TPA >6" in all RMA zones of Small Perennial Type N and Other Small Seasonal Type N streams in clearcuts and partial cuts sampled in Tillamook. Values stratified by harvest type and salmon anchor habitat.



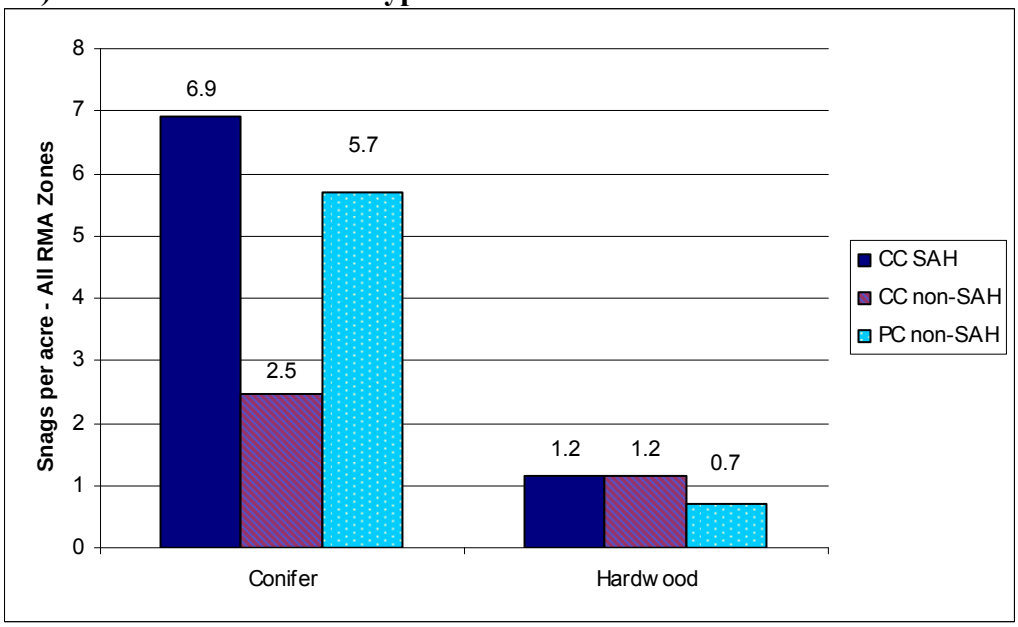
Snags: There were more conifer snags per acre in SAH than non-SAH RMAs in both harvest types and stream types across the sampled stands in Tillamook (Figure 12). There were fewer (Perennial Type N streams) or an equal (Seasonal Type N streams) number of hardwood snags in SAH than non-SAH. Overall, there was a greater number of conifer snags than hardwood snags in the RMAs of Perennial Type N and Seasonal Type N streams

Figure 12. Snags per acre 6"+ in all RMA zones of **A)** Small Perennial Type N streams and **B)** Other Small Seasonal Type N streams in clearcuts and partial cuts sampled in Tillamook. Values stratified by harvest type and salmon anchor habitat.

A) Small Perennial Type N Streams



B) Other Small Seasonal Type N Streams



Down wood: In the RMAs of Perennial Type N streams, the volume of down wood (all decay classes) across all zones was slightly less in SAH than in non-SAH of partial cut and clearcut stands. In the RMAs of Seasonal Type N streams, the volume of down wood (all decay classes) across all zones was greater in SAH than non-SAH in clearcut stands, but slightly less than non-SAH in partial cut stands (Table 24).

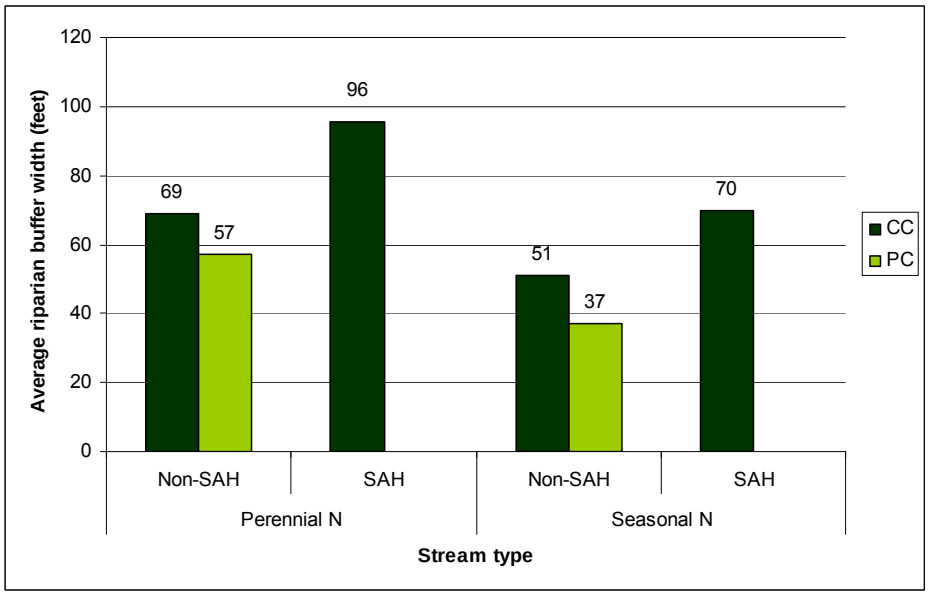
Table 24. Down wood volumes (all decay classes) in the RMAs of Small Perennial Type N and Other Small Seasonal Type N streams in Tillamook.

Class 1-5 Down Wood (ft^3/acre)			
	Per. N Clearcuts		**Per. N Partial cuts**
	SAH	non-SAH	non-SAH
Streambank	15,861	10,661	9,451
Inner	3,111	9,447	5,847
Outer	3,311	3,514	31,821

Class 1-5 Down Wood (ft^3/acre)			
	Seas. N Clearcuts		**Seas. N Partial cuts**
	SAH	non-SAH	non-SAH
Streambank	13,325	3,466	3,359
Inner	8,261	4,051	14,495
Outer	5,899	7,368	6,289

Buffer widths: Average buffer widths in Perennial Type N and Seasonal Type N streams were greater in SAH basins (96' and 70', respectively) than in non-SAH basins in both partial cuts and clearcuts across the Tillamook district.

Figure 13. Average buffer widths of posted RMA's of Small Perennial Type N and Other Small Seasonal Type N streams in Tillamook.



CONCLUSIONS

Implementation monitoring seeks to determine if the objectives, standards, guidelines, and management practices specified in FMPs are being accomplished. Field measurements of the upland and riparian areas in the 55 stands were successful in helping to determine what physical and structural components met or exceeded defined FMP targets and also what structure components were minimal or lacking.

Contract Administrative Review (CAR)

The CAR assessments provided clear evidence that managers intended to implement unit-level prescriptions to the best of their ability to meet the objectives and standards in the Forest Management Plans. The on-the-ground measurement showed that this is still a young forest and Mature Forest Conditions are still developing. Many variables fell short of the targets defined in the FMP because these desired conditions have not yet developed.

Upland Data

Across the landscape however (which for the purposes of this study are the 55 sampled stands) it is expected that minimum targets for green trees, downwood, and snags should be met. Overall, the upland areas of clearcut and partial cut stands exceeded the minimum targets for down wood volumes, snags, and residual green trees. There were deficiencies in some individual units, however the average values across all measured stands reflect a broad compliance with the requirements of the Landscape Management Strategies of the FMP. Field operations thus appear to be successfully meeting or exceeding these targets.

RMA Overview

With few exceptions, the RMA data suggests that retention, ground disturbance, stream channel integrity and other variables controlled by managers are being met.

Stand components needed to meet the definition of Mature Forest Condition were not always available. The data has shown there to be difficulty in managing for Mature Forest Conditions in alder dominated areas because there are not enough conifers to meet established targets. In some cases more conifer could be retained in the outer zones of riparian areas to make up this deficit, however conversion to conifer may be the only way to achieve these targets for Mature Forest Conditions.

This is the first time in the history of ODF that such extensive data has been collected and summarized from riparian zones of State Forest streams. The rules and standards set by Appendix J of the FMP for management of RMAs are complex and until now managers have been implementing these rules with little guidance or knowledge of whether or not prescriptions and operations are able to produce the desired on-the-ground resource targets.

REFERENCES

ODF (2001a) Northwest Oregon State Forests Management Plan. Oregon Department of Forestry.

ODF (2001b) Southwest Oregon Forest Management Plan. Oregon Department of Forestry.

ODF (2003) Salmon Anchor Habitat Strategy for Northwest Oregon State Forests. Oregon Department of Forestry.

DRAFT RECOMMENDATIONS
From The Implementation Monitoring Workgroup

Future Implementation Monitoring Projects

- The small sample of streams in SAH doesn't allow for more than general comparisons between non SAH and SAH streams. It is recommended that a larger sample size and perhaps a separate, independent monitoring project is needed to develop statistically sound data for analysis of salmon anchors and/or other aquatic and riparian concerns.
- Uplands were sampled more intensely than RMAs. Future Project designers should consider increasing the sampling intensity in RMAs to increase the precision of key variables. Currently downwood has high standard errors for all decay classes and Fish and Medium Type N streams could use more focus to increase certainty of the sampling population.
- Results from the CAR assessment supported the on-the-ground measurements of the upland areas. In many cases though it was apparent that the CAR questions were unnecessary, as the answers provided no further information regarding compliance with LMS than what was assessed in the field. For example, the question regarding recruitment of down wood and snags in partial cuts (q. 24 – *Where snags and down wood were deficient or minimum, were additional green trees retained for future recruitment?*) had responses of 'N/A' in 16 of the sampled units, because it was felt there would rarely ever be a deficiency in a partial cut stand – nor was it known what the actual amount of down wood and snags/ac was to begin with. This and several other questions failed to provide meaningful results and a revised list of CAR questions is proposed for future Implementation Monitoring efforts in Appendix A of this report.
- To improve communication meet with district contract administrators/unit foresters before starting IM sampling to determine if there are any special circumstances that might affect sampling or data interpretation. It was determined that many residual green trees were left out of this sampling cycle due to lack of communication between monitoring and district staff.
- Meet with district contract administrators/unit foresters after data collection and analysis to determine if there are any special circumstances that need to be considered in data interpretation, to conduct the contract administrator review portion of the IM protocol, and to ensure timely feedback to the district. After completing sampling on Fish streams there was difficulty for monitoring staff to explain why some targets were not achieved. Having feedback about other resource and operational considerations as to why targets were not met improves the ability of monitoring staff to write an effective monitoring report.
- This sampling cycle included a fairly small sample of 55 units. This represents only a small fraction of sales in a given AOP year. To improve confidence in future samples we should consider increasing the number of sampled units depending on availability of funding and personnel.
- Analysis of downwood data in RMAs has shown very high standard errors so reevaluating the sampling design to account for the high variability in distribution of downed wood is recommended.

- Results from upland samples were shown to have a higher degree of statistical confidence. We should consider sampling fewer upland sites in exchange for sampling more RMAs at a higher sampling density and consider biasing the sample towards an increased plot density in Fish streams.
- Were the ARSs for Small Perennial and Seasonal Type N's applied to 75% of reach and 500' upstream from Type F streams? A 100% sample would have to occur for us to answer with certainty whether or not the prescription was applied to at least 75% of the stream reach. Any other method of sampling can only describe results at the plot level. Recommendation is to improve monitoring sample to account for this target.
- After sampling was completed we discovered there were green tree retention areas outside of sampled sale boundary areas that were unintentionally ignored due to lack of communication between monitoring staff and district representatives. There were approximately 13,750 feet and 20 acres of Fish and Medium N stream RMAs outside of sale boundaries that were not sampled and could possibly sway the results of the fish stream RMA analysis. These streams account for 20% of the total Fish and Medium N streams which is significant enough to alter the outcome. Also there were 33 acres of RMA green tree retention areas that were sampled by the RMA protocol but were intended to contribute to upland tree retention. These areas were not included in the upland green tree calculations and therefore could have influenced the outcome of seven different sale areas. In the future we need to establish clear communication with districts to account for GTRs outside of sale boundaries.

Changes to Forest Management Plan Definitions and/or Guidance

A few additional comments about the upland and riparian sampling regard the interpretation of the rules in the FMP and especially Appendix J. The rules can initially seem very explicit, but oftentimes key definitions of terms, or critical values of desired resources were left out. In researching the definitions and intent of landscape targets and Appendix J terminology, the following assumptions were made in the design of the sampling protocol and these assumptions are our recommendations for future implementation monitoring or for FMP strategy improvement:

- The FMP does not state a minimum diameter for green tree retention in clearcuts. A clear statement of this metric is needed.
- Currently there is no minimum length defined in the FMP for large hard downed wood. The downwood summaries in this report used a minimum length of 6' but there needs to be an established piece size described prior to the next monitoring project.
- Need to standardize how to manage hardwood dominated and mixed conifer/hardwood riparian stands (see MFC), including consideration of alternate vegetation treatment plans.
- The definition for "Ground Disturbance" was assumed to be exposed soil from ground logging equipment, one-end suspension cable yarding, and/or landslides.
- No clear definition of "conifer dominated" or "hardwood dominated" RMAs exists in the FMP. By applying the current SLI stand typing procedure, "conifer dominated" RMAs was defined as >80% of the total Inner RMA basal area/ac is comprised of conifers. All trees ≥ 6" were included in this calculation to determine conifer dominance for Fish and

Medium Type N stream Inner RMAs. Currently it is possible for an RMA to meet layered or older forest structure and still not meet the mature forest condition criteria. Describing definition of Mature Forest Condition in RMAs with the same stand descriptions used for upland stands (e.g. older forest structure, layered) may better meet functional goals for riparian areas and would create consistency with the rest of the FMP.

- Vegetative disturbance was assumed to mean the linear opening in the stand crowns created from cable yarding corridors in RMA buffers. Thinning or clearcut openings did not constitute vegetative disturbance. Vegetation disturbance needs to be defined clearly.
- The requirement for Fish and Large and Medium Type N streams in the Inner zone for TPA is 50 with a 25% SDI. The minimum tree diameter preference is not stated but should be, so to be consistent with the diameter minimum in footnote 1 of Appendix J, the inclusive tree diameters were >11" in the sampling protocol.
- Meeting RMA targets on Fish and Medium Type N streams can only be assured with an RMA inventory prior to operations. Such an inventory could describe the frequency and size classes of conifers per zone and stream length. The results of an inventory would then assist foresters in the selection of additional conifers to retain or individual trees to be harvested to meet FMP targets. Another approach to increase conifer TPA could be an alternative vegetation plan where hardwoods are the dominant species.
- For most stream types the Outer Zone has a specific retention requirement for conifer trees and snags. The preference for conifer or hardwood snags is not stated. The Landscape Management Strategies also do not state preference, so all snag species were included in the calculation. The FMP needs to clearly state if hardwoods count towards retention targets.
- Field measurement of live green trees per acre indicated we are above the 5 TPA target from the FMP. This is complicated by strategies to meet down woody material targets as well as by riparian buffer requirements on some operations. Assess our GTR strategies and provide guidance on meeting these targets.

Furthermore, not all components as described in the ARS and Appendix J were able to be measured through our sampling design. Some things that did not get measured or assessed included:

- Page 9 of the *Salmon Anchor Habitats Strategy for Northwest Oregon State Forests* (ODF 2003) states, "Avoid harvest on debris torrent fans". If a debris flow hadn't recently occurred we had no way to know during the sampling whether there was the presence of an old debris fan and how large it was. This question was not asked directly in the field but the intent is to avoid harvest on debris torrent fans by implementing the ARSs. Appendix J covers this rule so the recommendation is to remove it from SAH strategies.

- Was all down wood retained in the Inner and Outer stream zones? Currently there is no effective way to track whether a particular piece of downwood was retained in a harvest unit. The task of ensuring pre-existing downwood is retained falls on the timber sale

contract administrator. No recommendation is needed but monitoring cannot provide an answer to this question.

- Were all safe snags retained in the inner and outer stream zones? There is no way to assess whether a snag that was cut, was safe. No recommendation is needed but monitoring cannot provide an answer to this question.

- Was a 25' no harvest zone extended for a minimum of 100' upstream and downstream, on each stream, where two or more small Type N perennial streams intersect? A 25' no harvest rule is already described in Appendix J for small perennial Type N streams so this standard is repetitive. Recommendation is to remove this standard.

- If source areas of Perennial streams existed, were they protected for 100 feet above initiation point? The answer to this question was not recorded in the field. Elaboration is needed to describe what "protection" means above the initiation point. Does this standard apply only to clearcuts? Recommendation is to remove this standard.

- Is at least 25% of the GTR required to meet the landscape standard located in riparian areas or outside of the riparian areas? Although buffer width was measured whenever present, length of streams was not. Without length we cannot calculate an RMA acreage to determine leave trees in the RMA. Also, the upland sample occurred on a grid system inclusive of riparian areas. We cannot distinguish upland from riparian area with the current upland protocol. Recommendation is to improve the rule language to something to the effect: At least 25% of the leave trees required to meet the landscape standard are required to be left in upland areas. Another option could be:
  At least 25% of leave trees are required to be in the upland (do we need to define). There is flexibility for distribution of remaining 75%. Trees in the Streambank (This is new) and Inner Zones needed to meet RMA retention targets cannot be counted towards landscape leave tree targets. If landscape trees are designated in RMAs, attempts should be made to select trees in outer edges of RMAs.