CMER (Cooperative Monitoring, Evaluation and Research) Committee
Final Report on the Desired Future Condition (DFC) "Alternative 3" request from the Washington State Forest Practices Board

3 August 2009

To: The Washington Forest Practices Board.
From: Chris Mendoza and Terry Jackson, CMER Committee Co-chairs
Subject: Report on the forest management implications associated with adopting the Desired Future Condition (DFC) Rule proposal "Alternative 3" as compared with "Alternative 1" in response to the CMER DFC Validation Study.

Executive Summary

On May 20, 2009 the Washington Forest Practices Board (Board) issued a request to the Cooperative Monitoring, Evaluation and Research (CMER) committee *to estimate the degree to which implementing Alternative 3 (…allowing the 20 trees per acre to be counted toward 325 square feet basal area requirement) will affect the ability of riparian stands to achieve desired future condition at age 140...*

In order to fulfill the Board's request, 250 randomly selected Forest Practices Applications (FPAs) were analyzed (all of which met the basal area requirements under the current rule) to determine how many would be eligible for Option 2 timber harvest (leaving trees closest to the water, WAC 222-30-021) under Alternatives 1 and 3. The change in the riparian management zone (RMZ) no-harvest buffer width, as a result of including the 20 trees per acre (tpa) in the basal area per acre (BAPA) calculation, was also determined.

The table below breaks down the 250 FPAs showing those meeting 325 BAPA, those eligible for Option 2 (<325 BAPA<), and the number of FPAs (110) that would have increased timber harvest opportunity by including the 20 tpa in the BAPA calculation. The change (decrease) in the RMZ no-harvest buffer width resulting from the additional 20 tpa ranged from 0.1 to <4 feet (one exception of 8 feet) and averaged less than 3 feet across all Site Classes and Stream Sizes.

Number FPAs	Percent FPAs	Description of FPAs
250	100%	Randomly selected FPA's
215	86%	FPAs that meet DFC at 325 sq. ft. BAPA
193	77%	FPAs eligible for Option 2 (trees closest to water)
170	68%	FPAs that meet DFC at 325 sq. ft. BAPA and eligible for Option 2 (trees closest to water)
110	44%	FPAs with increased harvest due to counting the 20 tpa in the DFC basal area calculations

Our analysis revealed that some of the FPAs would accrue excess basal area within the minimum "floors" under Option 2 as a result of including the Inner Zone 20 tpa from the outer part of the Inner Zone. Under Option 2, landowners are allowed to exchange some of the "excess" basal area within the floors by harvesting additional trees within the Outer Zone. Since Alternative 3 counts more basal area towards the riparian stand condition, there is a small increase (< 1 tpa) in the number of trees that can be harvested from the Outer Zone (Table 3).

CMER did not attempt to explore the potential for change in riparian functions in the RMZ no-harvest buffer widths between Alternatives 1 and 3 as it was not part of the Board's request. However, given the relatively small differences in RMZ no-harvest buffer widths between Alternatives (0.1 to 4 ft.), any potential change in riparian functions would be difficult to detect.

Introduction

On May 20, 2009 the Washington Forest Practices Board (Board) issued a request to the Cooperative Monitoring, Evaluation and Research (CMER) committee to explore the forest management implications of adopting rulemaking "Alternative 3" as compared with "Alternative 1". Alternative 1 responds to the CMER Desired Future Conditions (DFC) Validation Study (Schuett-Hames et al. 2005) by simply increasing the DFC stand age 140 basal area per acre (BAPA) threshold for Inner Zone Management to 325 ft^2/acre. Alternative 3 also increases the DFC BAPA threshold to 325 ft^2/acre, but additionally allows the 20 trees per acre required to be left in the outer part of the Inner Zone (Option 2, leaving trees closest to the water) to be included in the basal area calculation.

The DNR staff recommendation was adopted by the Board as:

2. "*Staff recommends that the Board directs CMER to estimate the degree to which implementing Alternative 3 (in other words, allowing the 20 trees per acre to be counted toward 325 square feet basal area requirement) will affect the ability of riparian stands to achieve desired future condition at age 140 and provide the Board with a written report at least 1 week prior to its August 12, 2009 meeting.*"

CMER determined that the Board's directive, as received from the meeting minutes, is somewhat unclear. However, CMER understands that based on the issue itself, and from follow-up conversations with Board staff (Chuck Turley and Lenny Young, personal communication), that the underlying question is how counting the 20 trees per acre (tpa) required to be left in the "outer part of the inner zone" would affect timber harvest opportunities and resulting riparian buffer configurations.

The forest practices rule element that CMER was asked to address is:

Under the current rule for RMZ harvest management "Option 2" (leaving trees closest to the water – WAC 222-30-021), Forest Practice Applications (FPAs) that meet the current DFC rule targets must comply with several harvest constraints including "*A minimum of 20 conifers per*

acre, with a minimum 12 –inch dbh, will be retained in any portion of the inner zone where harvest occurs. These riparian leave trees will not be counted or considered towards meeting applicable stand requirements nor can the number be reduced below 20 for any reason." (Emphasis added).

CMER determined that the most appropriate response to the Board's request was to develop a set of objectives (see below) that would discriminate differences in outcomes of each rule alternative (1 and 3). CMER then analyzed the data available from two random samples of FPAs to develop an unbiased approximation of expected outcomes of the two rule alternatives.

Objectives

1. Determine the proportion (%) of FPAs that would be eligible for Inner Zone timber harvest if the 20 tpa located in the outer part of the inner zone (Option 2) were counted towards the basal area target (Alternative 3), as compared to Alternative 1 for which these trees are excluded from the basal area calculation as per the current rule.

2. Of the FPAs that meet or exceed 325 BAPA by including the 20 tpa from the outer part of the inner zone (result from Objective 1.) and are therefore eligible for inner zone timber harvest (Option 2), to what extent will the number of trees or amount of stand basal area eligible for harvest increase, if these increase at all?

3. What is the effect on RMZ no-harvest buffer widths and inner zone leave tree requirements under riparian management Option 2 (leaving trees closest to the water) for Alternatives 1 and 3?

4. Of those FPAs that have enough basal area in the inner zone (after counting the 20 tpa) to become eligible for inner zone timber harvest, how many would also have enough basal area to be eligible for a credit allowing harvest of trees in the outer zone (on a basal area for basal area credit down to 10 tpa), allowed by the current rule?

5. Display findings by site class, stream size, and a west side average.

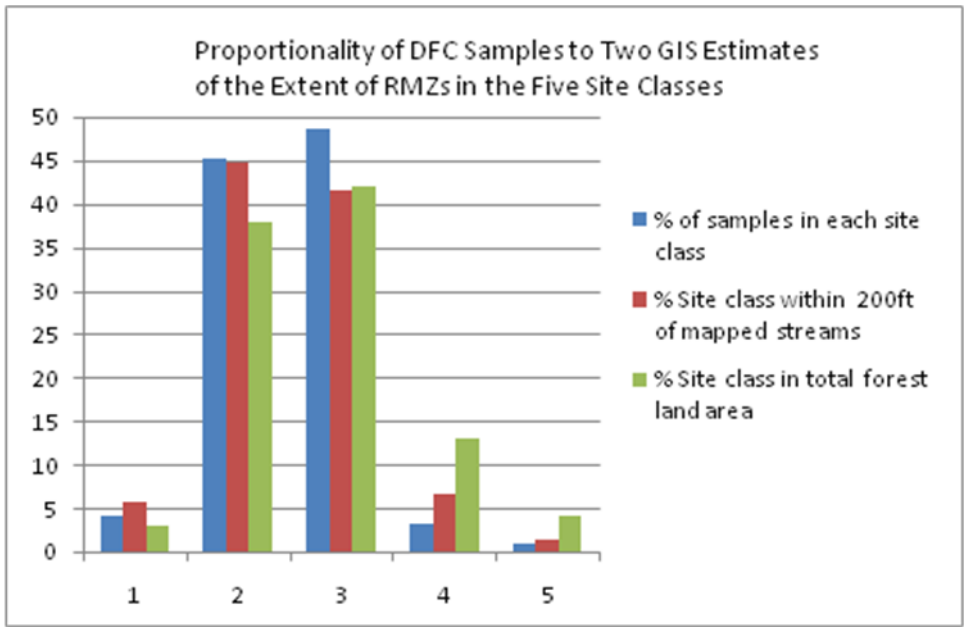
Methods

FPA Sample Selection Process

Two data sets were utilized in this analysis; a one hundred FPA sample (years 2005, 2006) used in DNR's SEPA analysis (DNR 2009), and a one hundred fifty FPA sample (years 2003, 2004) that was used in the CMER FPA Desktop Analysis (McConnell 2007). All FPA's selected would have allowed timber harvest within the RMZ under the existing DFC basal area per acre targets in rule (WAC 222-30-021). Both studies used a similar FPA sample selection process (see Appendix A) so the datasets were combined (250 FPAs) for the purpose of this analysis. Based on a

cursory review of the distribution of FPAs on FFR lands, we believe this sample is reasonably representative of the field distribution of potential FPAs covered under the FF HCP (Figure 1).

Figure 1. Distribution of DFC samples by site class compared against two different GIS metrics developed to estimate the proportion of RMZs by site class. The two GIS analyses are intended to help illustrate the general distribution, but do not directly estimate the proportion of riparian site classes across all FFR lands. The analysis of Site Class within 200 feet of streams is based on using a 1:100,000 scale map layer and thus does not include very small streams, and the analysis based on total proportion of forest land within each site class would include the small streams but also include non-riparian lands.



The input data for the DFC calculations for the SEPA dataset were provided by DNR as hard copy DFC Summary printouts. The input data for the DFC calculations for the Desktop data set were provided by Steve McConnell as an Excel spreadsheet. QA/QC was conducted on all the input data from DNR's SEPA analysis (100 FPAs), and a subsample of the 150 FPAs (15 or 10%) used in the McConnell FPA Desktop Analysis. The 150 FPAs used in the FPA Desktop Analysis had already been through QA/QC in 2007 as part of the Final Report, so selection of a subsample was deemed adequate. See Appendix A for QA/QC details.

DFC Model Provided by DNR

The DFC model runs of 100 FPAs by DNR were completed with a "revised" model that produces stand age-140 core + inner zone BAPA outputs that include the 20 tpa in the outer part of the inner zone. The revised Model uses a "Weyerhaeuser core modeling program with a DNR interface" and was developed (Marc Engel-DNR, personal communication 2009), as part of the SEPA process required under the Board's rule making procedures in order to evaluate outcomes of the different DFC rule change proposals. The revised model was developed by Jeff Welty

(Weyerhaeuser Corporation) and made available to the CMER subgroup by Marc Engel (DNR). The revised DFC Model uses the same stand tables as before, and simply estimates growth to 325 BAPA at stand age 140 years with and without including the 20 tpa from the inner zone. Consistent with the Board's recommendation, CMER specifically focused on reviewing the work conducted on DFC Alternative 1 (change the DFC target to 325 BAPA) and Alternative 3 (change the DFC target to 325 BAPA while allowing for the inner zone 20 tpa to be included in the DFC model calculations). CMER did not review DFC Alternative 2. Both datasets (DNR's 100 FPAs from SEPA analysis, Desktop analysis 150 FPAs) were entered into the dfc_trial_2008 program for DFC Rule Alternatives 1 and 3. Output variables included:

- Basal area at 140 years,
- No-harvest buffer width,
- Credit for basal area in excess of DFC target after hitting minimum floor requirements,
- Number of inner zone leave trees required,
- Number of outer zone leave trees required, and number of outer zone leave trees required after the basal area credit.

Analysis completed included:

- The number of FPA's (from the total 250) from Site Class I, II, and III (small stream only), which are eligible for timber harvest using Option 2 (leave trees closes to the water).
- The number of FPA's in the sample which meet DFC at 325 BAPA.
- The number of FPA's in the sample where Alternative 3 allows for more timber harvest (narrower no-cut buffer) than would be allowed under Alternative 1.
- Comparison of the weighted averages (by stream length) of no-harvest buffer widths for the sample population and broken down by site class and stream size.
- The range of no-cut buffer changes where Alternative 3 allows for more timber harvest.
- Comparison of the number of outer zone leave trees per acre broken down by site class and stream size.

CMER's work focused on the potential implications to changes in riparian no-harvest buffer widths with, and without, the addition of the 20 tpa in the outer part of the inner zone in the basal area calculation under the Option 2 riparian management prescription (leaving trees closest to the water). Only those FPAs with site attributes that allow for timber harvest using Option 2 are included in this analysis; these are stands that are on Site Class I and II ground, and Site Class III ground located along "small" streams. Option 2 is not allowed on Site Class III ground along "large" streams or on Site Class IV and V ground. This approach allowed CMER to determine how many FPAs would have more of the inner zone available for timber harvest as a result of including the 20 tpa in the DFC basal area calculations. In Table 1, we summarize these results using the average and range of no-harvest buffer widths with and without the 20 tpa trees included in the basal area calculation under Option 2.

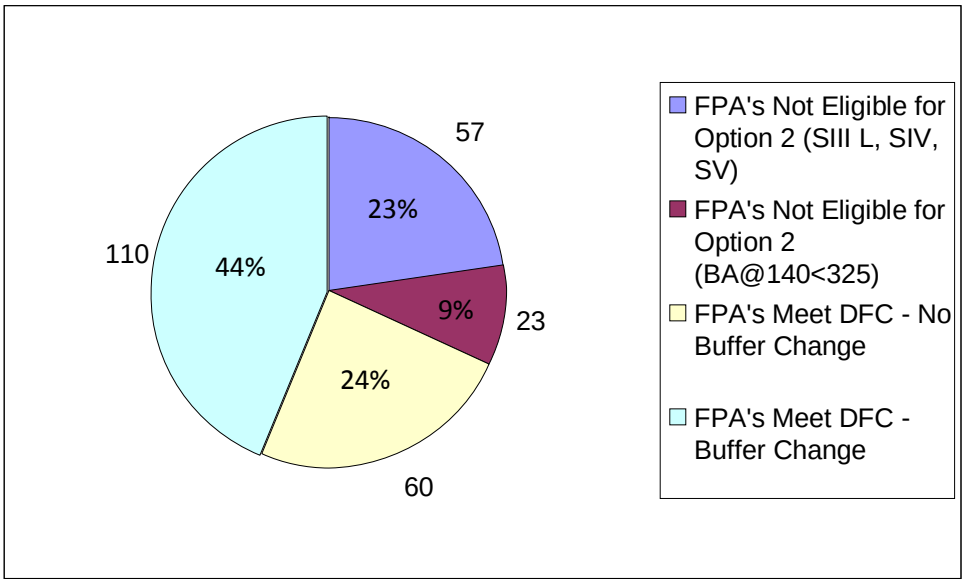
Results

Below is a summary of results related to the Objectives listed above. Data input and output details are available for direct inspection in an electronic version of the Excel spreadsheet, along with the DFC model outputs used to inform the results of this report.

1. *Determine the proportion (%) of FPAs that would be eligible for more Inner Zone timber harvest if the 20 tpa inner zone trees are counted towards the basal area target (Alternative 3), as compared to Alternative 1 (change to 325 BAPA target only).*

Of the 250 FPAs sampled, 193 are from Site Class I, II, and III ("small" stream only) FPAs and therefore eligible for Option 2. Of those 193 Option 2-eligible FPAs, 170 currently meet or exceed the BAPA target of 325, and thus are eligible for inner zone harvest under both Alternatives. The Alternative 3 allowance to count the 20 tpa inner zone trees occurs as the model calculates the harvest opportunity within the inner zone of a stand that meets the BAPA target of 325. Of those 170 FPAs that met or exceeded the 325 BAPA target, 110 would be eligible for additional inner zone timber harvest with the addition of the 20 tpa under Alternative 3. Figure 2 provides a breakdown of the FPAs eligible/not eligible for Option 2 and that meet the DFC target of 325 BAPA with and without changes to the no-harvest buffer width when Alternative 3 is applied.

Figure 2. Pie chart showing the breakdown of all 250 FPAs; the number of FPAs eligible/not eligible for riparian prescription Option 2 (leaving trees closest to the water), and the number of FPAs that meet the DFC target of 325 BAPA with and without a change in the RMZ's no-harvest buffer width.



2. *Of the FPAs that meet or exceed 325 BAPA by including the 20 tpa from the outer part of the inner zone and are therefore eligible for inner zone timber harvest, to what extent will the number of trees or amount of stand basal area eligible for harvest increase, if these increase at all?*

As stated above, in 110 of the 170 Option 2 FPAs that currently meet or exceed the BAPA target of 325, the amount of timber available for harvest within the inner zone would increase with the inclusion of the 20 tpa from the outer part of the inner zone in the DFC basal area calculation. For the remaining 60 Option 2 FPA's, no increase in timber harvest opportunity is created, due to minimum "floor" width requirements in the rules (WAC 222-30-021).

3. *What is the effect on the RMZ's no-harvest buffer width and inner zone leave tree requirements under riparian management Option 2 (leaving trees closest to the water) for Alternatives 1 and 3?*

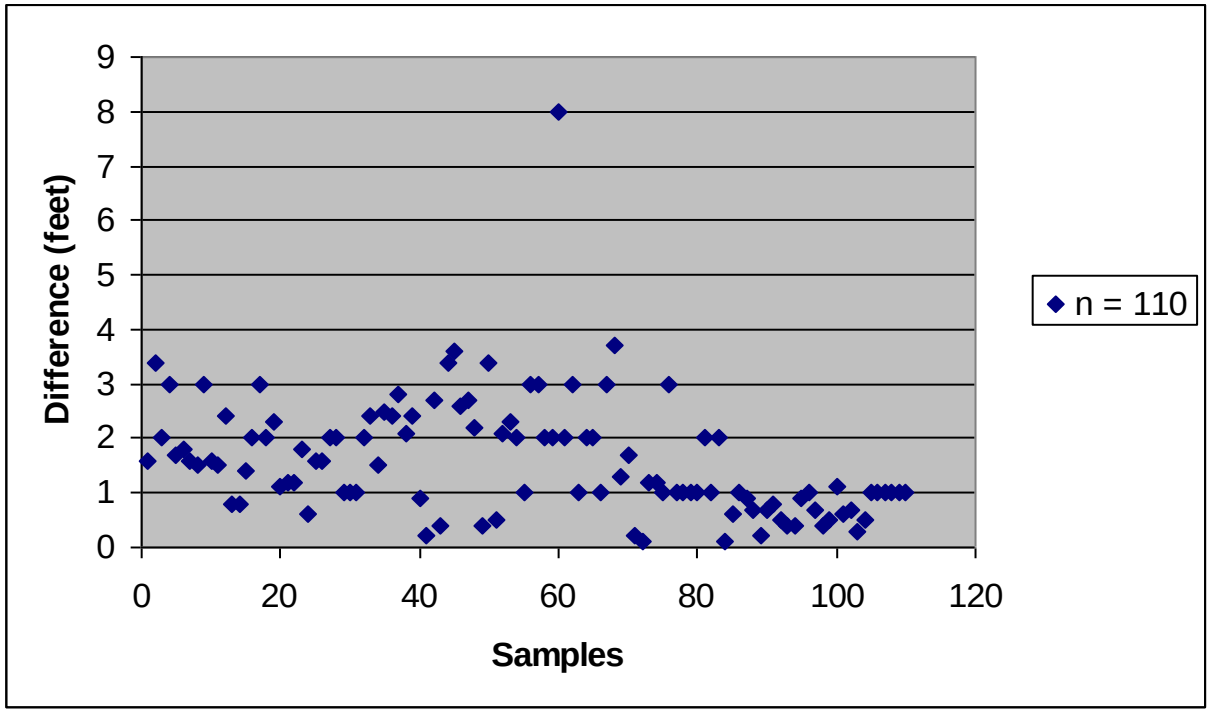
Differences in the average RMZ no-harvest buffer width between Alternative 1 and Alternative 3 were calculated in an Excel Spreadsheet of DFC model outputs that allowed for comparing the weighted averages (by stream length) of the RMZ's no-harvest buffer width by Site Class and stream size. Table 1 shows the differences in average RMZ no-harvest buffer widths by Site Class and stream size for Alternatives 1 and 3.

Table 1. Weighted averages by stream length of no-harvest buffer widths by stream size and Site Class for the proportion of FPAs where there was a difference between Alternatives 1 and 3. Comparison of weighted averages of buffer width by Site Class and stream length showed that there was an overall decrease in buffer widths of between 0.6 feet and 2.7 feet when Alternative 3 was applied. Where S1L = Site Class I, Large stream (> 10 ft. bfw); S1S = Site Class 1, Small stream (< 10 ft. bfw).

Site Class and Stream Size	Alternative 1 No-Harvest Width (feet)	Alternative 3 No-Harvest Width (feet)	Difference (feet)
S1L	117.7	115.1	2.7
S1S	116.6	114.4	2.1
S2L	106.0	104.3	1.6
S2S	99.7	97.9	1.8
S3L	NA	NA	NA
S3S	86.5	85.9	0.6
S4L	NA	NA	NA
S4S	NA	NA	NA
S5L	NA	NA	NA
S4S	NA	NA	NA

Of the 110 FPAs with increased timber harvest opportunities which results from including the 20 tpa trees in the DFC basal area calculation (Alternative 3), individual (site) difference for nearly all of the FPA's ranged from 0.1 to less than 4 feet (Figure 3). The average buffer width change between Alternative 1 and Alternative 3 was less than 3 feet across all Site Classes and Stream Sizes (Table 1).

Figure 3. Distribution of FPA samples where there was a difference in RMZ no-harvest buffer widths between Alternative 1 and Alternative 3.



Of the 250 FPAs, 86% meet DFC under the new threshold (325 BAPA). For the remaining 14% of the FPAs no inner zone timber harvest would be allowed. Counting the number of stands in which inner zone harvest would no longer be permitted as compared to current rules, there is an overall increase in no-cut buffer widths for both Alternative 1 and Alternative 3 when compared to the current rules; however, the magnitude of that increase is different between the alternatives (Table 2). For Site Class III Large Streams, Site Class IV and V, Large and Small Streams, there is no difference between Alternatives 1 and 3 since Option 2 does not apply. The analysis presented in Table 2 includes buffer widths of the entire population of FPA's. The magnitude of the difference between Alternatives 1 and 3 is slightly less when considered across all FPAs than when compared to Table 1 which is based on a subsample of FPAs which meet site attribute criteria for inner zone timber harvest using Option 2.

Table 2. Weighted averages by stream length of no-harvest buffer widths by stream size and Site Class for the entire 250 FPA sample.

Site and Stream Size	Alternative 1 No-Harvest Width (feet)	Alternative 3 No-Harvest Width (feet)	Difference
Total Population	98.9	98.2	0.7
Site 1	120.1	117.9	2.2
Site 2	103.9	102.6	1.2
Site 3	94.1	94.0	0.1
Site 4	80.7	80.7	0.0
Site 5	63.4	63.4	0.0
S1 L	117.7	115.1	2.7
S1S	125.5	124.5	1.0
S2 L	106.8	106.0	0.8
S2 S	100.2	98.5	1.7
S3 L	NA	NA	NA
S3 S	83.6	83.4	0.2
S4 L	NA	NA	NA
S4 S	NA	NA	NA
S5 L	NA	NA	NA
S5 S	NA	NA	NA

4. *Of those FPAs that have enough basal area (after counting the 20 tpa) to become eligible for inner zone timber harvest, how many would also have enough basal area to be eligible for a credit allowing harvest of some trees in the outer zone (on a basal area for basal area credit down to a maximum of 10 tpa) allowed under the current rule?*

Our analysis revealed that some of the FPAs would accrue additional basal area within the minimum floors under Option 2 as a result of including the inner zone 20 tpa from the outer part of the inner zone. Under Option 2, landowners are allowed to exchange some of the "excess" basal area within the floors (not accessible due to the minimum floor management constraint) by harvesting additional trees within the Outer Zone. This exchange is allowed on a basal area for basal area credit and cannot reduce the Outer Zone trees to below 10 tpa. Since Alternative 3 counts more basal area towards the riparian stand condition, there is a small increase in the number of trees that can be harvested from the Outer Zone (Table 3).

Table 3. Outer Zone leave trees per acre by stream size and Site Class for the entire 250 FPA sample.

Site and Stream Size	Alternative 1 Outer Zone Leave Trees (tpa)	Alternative 3 Outer Zone Leave Trees (tpa)	Difference
Total Population	18.2	17.7	0.5
Site 1	24.1	24.1	0.0
Site 2	20.4	19.8	0.6
Site 3	15.6	15.1	0.5
S1 L	27.3	27.3	0.0
S1S	20.9	20.9	0.0
S2 L	20.7	19.9	0.8
S2 S	20.1	19.7	0.4
S3 L	NA	NA	NA
S3 S	16.4	15.5	0.9
S4 L	NA	NA	NA
S4 S	NA	NA	NA
S5 L	NA	NA	NA
S5 S	NA	NA	NA

Assumptions and Limitations

All calculations were done using the DFC model required by DNR. There are substantial issues concerning the accuracy of the existing DFC model that have yet to be addressed. The attached addendum includes information about the assumptions involved in using the model, along with information on the DFC model testing that was included with the McConnell Model and Manual Report to CMER (2007).

CMER did not attempt to explore the ecological implications or potential for change in riparian functions in the RMZ no-harvest buffer widths between Alternatives 1 and 3, as it was not part of the Board's request. However, given the relatively small differences in RMZ no-harvest buffer widths (weighted average decrease between 0.6 and 2.7 ft.) between Alternatives 1 and 3 (Table 2), any potential change in riparian functions would be difficult to detect.

CMER Subgroup Participants

Chris Mendoza (Conservation Caucus), Adrian Miller (WFPA), Terry Jackson (WDFW) Mark Hicks (WA Dept. of Ecology), Nancy Sturhan (NWIFC), Steve McConnell (UCUT), Joe Murray (Merrill Ring), Darin Cramer (DNR), and Ash Roorbach (CMER staff).

APPENDIX A

FPA Sample Selection from FPA Desktop Analysis (McConnell 2007)

Overview

One-hundred and fifty approved FPAs reporting inner zone timber harvest in west-side forests along Type F streams were randomly selected, using the Forest Practices Application Review System (FPARS) available on the WDNR website. The DFC Worksheet data included in these FPAs were entered into the DFC Model, the Model run, and outputs from these Model runs analyzed. Seventy-five FPAs were selected for each of 2003 and 2004. FPAs encountered that did not use one of the standard prescriptions, did not meet DFC, had data entry problems or lacked needed data, were rejected and the next FPA from the randomized list was selected.

Data acquisition and data entry

All FPAs with inner zone timber harvest in west-side forests along Type F streams that were approved by the DNR in both 2003 and 2004, were identified using FPARS. These FPAs were randomized by year, and 75 FPAs from each year selected for analysis. The selected FPAs, available as .pdf files, were accessed electronically using the public domain "Adobe Reader" program. Reading each FPA from front to back, the first DFC Worksheet encountered (some FPAs had multiple stream segments in a given FPA, each with a different Worksheet), was selected and data from this Worksheet entered into the DFC Model and saved as a .dcf file with a unique name for each stand. Data from .pdf files cannot be transferred electronically to spreadsheets and .dcf files were not available from landowners, so .dcf files used in this analysis were re-created by re-entering data manually.

FPA Sample Selection from DNR's SEPA Analysis (DNR 2009)

1. Population was selected from all FPAs turned in between January 1, 2005 and December 31, 2006 that included harvest within an RMZ. This equaled 2,137 FPAs. The sample population included:
    - Alternate Plans
    - No inner zone management
    - Option 1 or Option 2 (Inner Zone Harvest options)
    - Hardwood conversions
    - Other Options provided by the current rules
2. Using an online sample size calculator from Creative research Systems, www.surveysystem.com/sscale.htm, to reach a confidence level of 95% and a confidence interval of 10 from a population of 2,137 a sample size of 92 was needed. A sample size of 100 was chosen resulting in a confidence interval of 95.7.
3. The sample population was randomized using a computer generated program.
4. FPAs were selected starting from the top of the randomized list that included only Option 1 and Option 2 and included a DFC data run that was legible (due to scanning of DFC runs some FPAs were not legible). If the FPA contained more than one DFC run, then only the first stream segment or stream DFC run that met the Option 1 or 2 category was used. Using only one DFC run per FPA assured that a broader selection of stand characteristics, locations and landowners. A total of 621 FPAs were examined before reaching the target of 100 usable DFC runs.
5. All data was entered into the WEYCO core program using the DNR DFC interface.

QA/QC for FPA Sample Selection and Data Entry Process

The input data for the DFC calculations for the SEPA dataset were provided by DNR as hard copy DFC Summary printouts. The input data for the DFC calculations for the Desktop Analysis data set were provided by Steve McConnell as an Excel spreadsheet. QA/QC was conducted on all the input data from DNR's SEPA analysis (100 FPAs), and a subsample of the 150 FPAs (15 or 10%) used in the McConnell FPA Desktop Analysis. The 150 FPAs used in the FPA Desktop Analysis had already been through QA/QC in 2007 as part of the Final Report, so selection of a subsample was deemed adequate.

No discrepancies were found in the data input process, and corresponding DFC model runs, of the 15 FPAs from the Desktop Analysis (Chris Mendoza and Adrian Miller 2009). Of the 100 DNR FPAs used in the SEPA analysis, 4 FPAs had data input discrepancies associated with them when cross referenced with the hard copy DFC Summary printouts provided by DNR (Chris Mendoza and Adrian Miller 2009). However, these discrepancies were minor and did not substantially change the results of the DFC Alternative 3 and Alternative 1 analysis.

DNR FPA Discrepancies from Hard Copy FPA Summary Sheets

FPA Name	Discrepancy	Hard Copy FPA Summary	Excel Spreadsheet
7463	RMZ Length	1200 ft.	1015 ft.
7763	RMZ Length	1050 ft.	1200 ft.
7837	Major Species	Douglas Fir	Hemlock
4906	Major Species	Douglas Fir	Hemlock

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